**Annual Meeting Report**

**SERA-IEG 25 Turf**

**(Ft. Lauderdale, Florida, 2018)**

**Project/Activity Number: SERA25**

**Project/Activity Title:**

**Period Covered: 2017-2018**

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**Summary of 2018 annual meeting minutes:**

A two-day joint meeting between the SERA-IEG 25 multi-state group and the WERA-IEG 10 multi-state group was held at the University of Florida, Institute of Food and Agricultural Science Research and Education Center in Ft. Lauderdale, FL on July 11-13, 2018. During the meeting, a multitude of topics were discussed among attendees, with particular focus on common trends and needs between the turfgrass industries in the Southeastern U.S. (SERA-IEG 25) and the Western U.S. (WERA-IEG 10). This discussion was facilitated through the presentation of state reports from each state representative who attended the meeting. Following the state report presentations and discussions, SERA and WERA groups held separate working group business meetings to develop priorities and a working plan for the next annual meeting and future of the SERA-IEG 25 working group. The remaining one and a half days of this working group meeting focused on discussion among all attendees about important or emerging issues relevant to the turfgrass industries represented. Discussion topics ranged from water conservation, to nutrient management, to breeding efforts, and pest management.

State reports were given by a subset of SERA and WERA working group official member states depending on who could attend the meeting. From the SERA-IEG 25 group, representatives from Arkansas, Florida, Georgia, Mississippi, Oklahoma, Tennessee, and Texas gave updates on the turfgrass industry and university faculty since the 2016 meeting. From the WERA-IEG 10 goup, representatives from Guam, Arizona, California, Colorado, Iowa, Nebraska, New Mexico, and Utah gave updates on their respective turfgrass industry and university faculty accomplishments over the past year.

During discussion sessions focused on urgent or emerging issues relevant to the turfgrass industry and turfgrass science, attendees discussed a wide range of topics. Of particular importance and focus were the similarities and dissimilarities between the southeastern U.S. and western U.S. These comparisons helped attendees develop working plans to collaborate and address important issues through research and/or extension efforts, thereby increasing partnerships and the overarching impact of research and extension efforts associated with this working group meeting.

Water conservation and the effects of drought on turfgrasses was the focus of the first discussion and led by Dr. Leinauer (NMSU) and Dr. Moss (OKSU). The primary research focus of turfgrass scientists in the western U.S. is water conservation since there is very little annual precipitation (6-9 inches annually in New Mexico). Researchers in the West are evaluating native grasses as drought tolerant lawn options. Scientists from both regional working groups are working with the National Turfgrass Evaluation Program (NTEP) to evaluate cool season grass species and genotypes for drought tolerance. Others have been investigating new irrigation technologies or strategies to reduce evapotranspiration and increase the efficiency of turfgrass irrigation. Research on irrigation strategies includes subsurface drip irrigation and a new Texas A&M-patented system that attempts to recycle stormwater and irrigation runoff into an irrigation system. UF/IFAS research (Dr. Michael Dukes) has developed an irrigation technology that irrigates a lawn based on soil moisture sensor readings and has been able to maintain turf quality. Others are investigating if plant growth regulators (PGRs) or wetting agents can reduce irrigation needs and increase drought tolerance and water use efficiency. Discussion on water conservation wrapped up by focusing on how we can effectively educate and train consumers and end-users to reduce water consumption. Ideas included: gaining a better understanding of human behavior and perception to drive change – turfgrass SCRI project surveys have indicated that consumers will pay more for drought-tolerant turfgrasses and that drought tolerance ranks highly on desirable lawn criteria. Session ended with discussion that U.S. government should implement policies that require soil moisture sensors and rain-out sensors in all irrigation systems to reduce water consumption.

The second discussion session focused on turfgrass nutrient management and was led by Dr. Bryan Unruh (UF). The primary concerns associated with turfgrass nutrient management and fertilization center around groundwater pollution and the non-point source pollution of waterways. This discussion is primarily a southeastern U.S. issue. Thus far, in Florida there are 127 fertilizer ordinances among 67 state counties that regulate when professionals can apply fertilizers to lawns. However, UF/IFAS research has found that when following fertilization recommendations, little to no nitrogen leaches from turfgrass lawns. UF/IFAS (Dr. Travis Shaddox) has been most active in this arena in Florida recently. There is much debate on what criteria should inform fertilization recommendations based on plant tissue and soil testing results. New research is focused on more clearly and objectively identifying what we are basing our soil test results on to inform cultural management practices (e.g., reference ranges commonly used in medical fields).

Drs. Fontanier (OKSU) and Wiecko (UG) led the next discussion session, which focused on turfgrass shade tolerance. Drivers of these research and extension efforts centers around the multitude of structures in urban and residential landscapes (trees, buildings) that create shade and thus areas that are not conducive to the growth of most turfgrass species and cultivars. Recent work has found that applying plant growth regulators (PGRs) can be an effective method for mitigating the negative effects of shade on turfgrass quality. Shade is frequently a challenge on athletic fields where stadiums block sunlight at the beginning the end of the day, reducing day length for the turfgrasses. Ways to mitigate these effects were discussed and included using stadium grow lighting in high-maintenance athletic fields. Future work will focus on determining ideal day length periods for different turf types.

Next, Dr. Kenworthy (UF) and Dr. Fei (ISU) provided an update and discussion of turfgrass breeding efforts underway throughout the western and southeastern U.S. Western U.S. breeding efforts are primarily focuses on developing superior genotypes of buffalograss, saltgrass, zoysiagrass, bluegrass, and fine fescues. There are also efforts underway in the West to use cool season grasses as perennial ground covers in corn cropping systems. In the Southeastern U.S., there are a multitude of breeding efforts underway to develop superior warm season turfgrass genotypes. Several breeders at multiple universities (Texas A&M, UF, OKSU, MSU, NCSU, and UGA) have or are currently releasing advanced cultivars of St. Augustinegrass, zoysiagrass, bermudagrass, paspalum, and creeping bentgrass.

Dr. Kai Umeda (UAZ) led a discussion of turfgrass weed management updates and challenges, primarily in the western U.S. Primary challenges are purple nutsedge, liverseed, khakiweed, and goosegrass. There are currently multiple efforts underway to evaluate herbicides for their efficacy at controlling these weeds in turfgrasses. Folks from the southeastern U.S. brought up that doveweed has increased dramatically in FL warm season lawns over the past several years.

Next, Drs. Adam Dale (UF) and Ricardo Ramirez (USU) led a discussion of the most pressing issues regarding insect and mite pest management in turfgrasses. In the western U.S. the major insect pests of focus are billbugs. Research is currently underway and has recently developed degree day models to inform management programs. Ramirez has developed a Utah traps website that allows growers to determine degree day accumulations based on their geographic location, which facilitates insecticide application timing. One focus of research in the West and South is reducing the reliance of the pest control industry on preventive insecticide applications. Both regions are working on developing alternative pest management strategies, like conservation biological control. Future work will and needs to focus on the effects of our changing climate (drought, temperature) affects insect pests and their impact on turfgrasses. The southern region has more abundant and diverse insect and mite pests than the west. The biggest recent pests are southern chinch bug, tropical sod webworm, bermudagrass mite, invasive mole crickets, and Tuttle mealybug. Research efforts have focused on short term (insecticide efficacy trials) and longer term (cultural practices, biological control) pest control strategies in residential lawns and on golf courses. Recent research and extension efforts have worked towards combining conservation efforts with pest control efforts and public engagement.

The next discussion topic centered around turfgrass pathology and was led by Dr. Qian (CSU) and Dr. Harmon (UF). The biggest pathogen pests of turfgrasses in the western U.S. are necrotic ring spot, snow molds, anthracnose, fairy ring, and ascochyte leaf blight. The number one pathogen in Colorado is necrotic ring spot. In the southern U.S., Pythium is the most commonly diagnosed turfgrass pathogen. The most recent and challenging pathogen of southern turfgrasses is lethal necrosis of St. Augustinegrass, which attacks and kills ‘Floratam’ St. Augustinegrass. This virus is a complex of sugarcane mosaic virus and a latent panicovirus, which was recently identified for the first time. Ongoing research is focused on developing pathogen resistance in new warm season turfgrass lines.

The final discussion session focused on the removal of turfgrasses in urban and residential landscapes and initiatives to replace turfgrasses with alternative landscaping designs or plants. There was discussion of programs in the western and southern U.S. that incentivize homeowners to replace turfgrass with alternative landscaping. To-date, attendees were only aware of such programs in Alachua County, Florida (none in SC, NC, GA, MS, LA, TX). UF/IFAS is currently pursuing a project to evaluate the effects of replacing turfgrass with alternative landscapes on the ecosystems services turfgrasses provide (e.g., water filtration, cooling, carbon sequestration, arthropod habitat). Dr. Jim Baird (UCR) is working on developing new varieties of bermudagrass and kikuyugrass that are more drought tolerant and appropriate for CA. Also evaluating Kurapia as an alternative ground cover to turfgrass that may be more drought tolerant.

The meeting was concluded with discussion of developing a new SERA-IEG 25 5-year plan and what should be done to adjust our working group’s current objectives and goals. The new 5-year plan will incorporate more S.M.A.R.T. Objectives and give more explicit numbers and measurable evaluations in terms outcomes and impacts. There was also discussion of using partnerships and program overlap discovered during the SERA-IEG 25 meetings to develop USDA-NIFA-SCRI and other USDA grant program proposals.

**Accomplishments:**

SERA-IEG 25 faculty have demonstrated many noteworthy accomplishments during the past year addressing the objectives of the group. Many of these accomplishments have been collaborative, multi-state, and multi-university activities, which were fostered largely through identification and discussion of key issues at previous SERA meetings. The collaborative efforts are highlighted in the accomplishments described below. The following represent some of the more noteworthy accomplishments of the group for the past year, organized by the different focus areas outlined in our 5-year plan:

**1. Water Conservation/ Drought/ Turfgrass Water Use.**The most prevalent theme expressed by members SERA and WERA groups during this year’s meeting was water conservation. Recurring discussions during the 2018 meeting focused on some aspect of water management and the reduction of irrigation and water inputs into turfgrass systems. Across the entire southeastern region of the United States, water conservation through the development of turfgrass best management practices, drought tolerant turfgrass genotypes, novel irrigation technologies, and consumer education and training programs are widespread and making great progress. There was also discussion of consumer-based or environmental activist-led efforts to remove turfgrass from residential landscapes to reduce irrigation. Florida and Texas are among the most active programs conducting research and developing strategies to conserve water and maintain beneficial turfgrass lawns, and addressing social challenges associated with this issue.

The team of faculty representing five SERA25 universities across the southeast (Texas A&M University, University of Florida, Oklahoma State University, University of Georgia, and North Carolina State University) continue to conduct research and extension efforts for the $4.5 million USDA-SCRI research project aimed at developing warm season turfgrass cultivars with improved drought and salinity tolerance for the southern United States. These efforts are leading to the development of several promising drought-tolerant turfgrass species and cultivars, two of which have been released (‘TifTuf’ bermudagrass and ‘TamStar’ St. Augustinegrass).

The Texas Tech Turfgrass Research program, led by Dr. Joey Young, has been heavily focused on water conservation in turfgrass management. Much of the research completed or currently in progress inovlves golf course management. Dr. Young has obtained some funding from the USGA for projects related to water conservation and quality issues that are common on the Southern High Plains of Texas. Additionally, he has interest in opportunities to demonstrate the benefits of turfgrass in the urban landscape. Based on some surveys conducted by Dr. Young, there has not been a substantial switch to hardscape landscapes in residential areas, but there is a perception that more drought-tolerant or low maintenance landscapes should contain less turf and more rocks. The big question that goes unanswered in these situations is how much more energy would it take to cool the home during high temperatures as there is limited evaporational cooling with xeriscapes. Research efforts may move toward understanding the optimum landscape design that would conserve water while still providing other necessary ecosystem services.

The Texas A&M Turfgrass Research Program, led by Drs. Wherley and White, maintains strong collaborations with Engineering, Water Quality, Breeding, and Soil Physics faculty across the University. Wherley has received a third multi-year (2-yr) Texas Research, Engineering, and Extension Water Seed Grant Project which involves faculty from Texas A&M AgriLife Research and Texas Engineering Experiment Station (TEES). The current phase of the project involves improvements to the patented LIRMS through development of an autonomous irrigation control system which delivers improved soil wetting efficiency, reduced runoff, and corresponds to local municipal water restrictions. We have worked closely with SAWS (Karen Guz) and City of College Station (Jennifer Nations) in determining best use of the system for meeting needs of water purveyors. Co-PI’s on current project are Dr. Allen Berthold (TWRI), Dr. Kelly Brumbelow (TEES), Dr. Jorge Alvarado (TEES), Dr. Richard White (SCSC), and Dr. Fouad Jaber (Texas AgriLife Dallas Ag. and Biological Engineering). The team was the first of all Waterseed funded projects to be issued a patent, which was issued May 1, 2017. We have been approached by a number of potential licensing parties within the irrigation industry, and with whom we continue to discuss possibility for licensing of the LIRMS technology as a residential/commercial irrigation system add-on.

Funding from Turfgrass Producers International (TPI) is supporting a six-state cooperative

research effort at the University of Tennessee, Utah State University, the University of Minnesota, Texas A&M University, the University of Connecticut and the University of California to document water use for turfgrasses in the U.S., with an emphasis on water conservation in residential turfgrasses.

Researchers at the University of Florida are also actively conducting research and extension programming efforts to address water conservation in turfgrass landscapes. Turfgrass breeder, Dr. Kevin Kenworthy, is currently working closely with the Turfgrass Producers of Florida (TPF) to develop drought tolerant cultivars of St. Augustinegrass and zoysiagrass. In collaboration with Dr. Bryan Unruh, he is also actively evaluating new genotypes of bahiagrass and bermudagrass, the two best species for drought tolerance, to identify more aesthetically pleasing and easy to maintain lines. Dr. Michael Dukes has developed an irrigation technology that irrigates a lawn based on soil moisture sensor readings and has been able to maintain turf quality. Several faculty at UF are continuing work to develop improved drought tolerant turfgrasses, irrigation technologies, and new strategies for producing, planting, and maintaining turfgrass lawns with reduced irrigation inputs.

**2. Turfgrass Fertility, Disease, Insect, and Weed Management**Turfgrass management in the southeastern U.S. is difficult and requires a balance of maintenance inputs including cultural practices (mowing, fertilization, irrigation) and pest management (diseases, insects, and weeds). To maximize the ecosystem services that turfgrass lawns provide, the plants that make up a lawn must be healthy and actively growing. However, diseases and insects frequently attack and kill turfgrass plants, which requires pesticide inputs, supplemental irrigation or fertilization, or plant replacement to restore those benefits. This reliance on pesticides, natural resources, and plant replacement results in high costs and environmental inputs, which presents several risks for consumers, businesses, and the environment. Therefore, multiple SERA25 faculty are actively conducting research to develop new, more environmentally and economically sustainable strategies to prevent and manage turfgrass pests.

Cultural and chemical turfgrass weed management strategies and the resistance of select turfgrass species to herbicides continue to be a major research and extension focus. U.S. Golf Association funding supported a cooperative effort between the University of Arkansas and the University of Tennessee to investigate the use of fraze mowing and herbicides to eradicate bermudagrass (*Cynodon dactylon*) in putting greens or sod production fields. Funding from the U.S. Golf Association is also facilitating the development of methods to diagnose herbicide resistance in goosegrass (*Eluesine indica*). In addition, funding from the U.S. Golf Course Superintendents Association- Environmental Institute for Golf is supporting a survey to evaluate existing herbicide resistance in annual bluegrass (*Poa annua*) populations of golf course turf throughout Tennessee.

MSU collaborated with the Mid-South Sod Council on a research project to investigate the effects of different herbicide programs applied at bermudagrass sprigging on fall sod strength. The results of this study will provide producers with information on the performance of these programs and allow them to make informed decisions on weed control options.

In 2017, research was conducted to determine the influence of fungicide treatment and application target site on the severity of large patch (*Rhizoctonia solani*) disease severity on Japanese lawngrass (*Zoysia japonica*).

Research efforts in turfgrass pathology have identified a novel complex of ectotrophic root-infecting (ERI) fungi associated with bermudagrass decline and take-all root rot. Currently spatial analysis of this ERI complex is underway on two putting greens at MSU Golf Course.

The most recent and challenging pathogen of southern turfgrasses is lethal necrosis of St. Augustinegrass, which attacks and kills ‘Floratam’ St. Augustinegrass, the most common lawn turfgrass in Florida. This virus is a complex of sugarcane mosaic virus and a latent panicovirus, which was identified for the first time in 2017. Ongoing research is focused on developing pathogen resistance in new warm season turfgrass lines.

Dr. Adam Dale at University of Florida is conducting several research projects investigating new strategies for managing insects in turfgrasses. From 2016-2018, Dr. Dale’s program generated over $500,000 in university, federal, and industry grant funding to support turfgrass entomology research with the effort of developing more sustainable management tactics for turfgrasses on golf courses, sod farms, and residential lawns. Insect research at the University of Florida is focused on developing more sustainable chemical and cultural management strategies for the southern chinch bug, southern and tawny mole cricket, bermudagrass mite, fall armyworm, and tropical sod webworm. This work has developed immediately effective insecticide recommendations including application rate, volume, timing, and insecticide class for specific insect pests. In addition, longer-term research has identified ecological strategies to promote turfgrass plant health and the abundance or diversity of beneficial arthropods. More specifically, Dr. Dale’s program has developing guidelines and recommendations for golf course superintendents to create wildflower habitats in golf course out-of-play areas. UF research has demonstrated that providing wildflower habitats can increase biological control of turfgrass caterpillar pests in adjacent golf course fairways by up to 50%, thereby reducing pests and associated management inputs.

**3. Development of Improved Turfgrass Varieties for the Southern Region.**Turfgrass breeding is one of the main strengths of the SERA25 faculty. Several internationally-respected researchers are dedicating their efforts to developing and identifying turfgrass genotypes that exhibit superior traits compared to current commercially available cultivars. Of primary importance are aesthetics, drought tolerance, disease resistance, insect resistance, and shade tolerance.

This working group focus area is particularly strong given that a team of faculty representing five SERA25 universities across the southeast (Texas A&M University, University of Florida, Oklahoma State University, University of Georgia, and North Carolina State University) were awarded $4.5 million through the USDA-SCRI program. This project also closely collaborates with industry advisors from National Turfgrass Evaluation Program (Kevin Morris), United States Golf Association (Mike Kenna), Turfgrass Producers of Texas (John Cosper), Water Managers including San Antonio Water System (Karen Guz) and Masaun Consulting (Whitney Milberger-Laird), and Texas Builders Association (V.P. Ned Munoz). This multidisciplinary project involves breeders, physiologists, extension, and economists. The primary objectives of this research project are to develop warm season turfgrass cultivars with improved drought and salinity tolerance for the southern United States. These efforts are leading to the development of several promising drought-tolerant turfgrass species and cultivars, two of which have been released (‘TifTuf’ bermudagrass and ‘TamStar’ St. Augustinegrass).

Texas A&M Turfgrass Breeding Program, led by Dr. Ambika Chandra, continues to focus on development of warm season turfgrasses (primarily zoysiagrass and St. Augustinegrass) with improved drought, salinity, and cold tolerance attributes. Dr. Chandra has received support through a combination of federal (USDA SCRI) and industry (USGA, Scotts Miracle Gro, Turfgrass Producers of Texas) sponsors. Recent releases from the program include ‘TamStar’ St. Augustinegrass, ‘Innovation’ Zoysiagrass, and ‘Chisholm’ zoyisagrass. She is also currently working on development of greens-type zoysiagrasses. Dr. Russell Jessup’s perennial grass breeding program at College Station has recently been focused in part on development of seeded types of St. Augustinegrass, which would have application particularly for lawn patch repair situations. This work is currently being supported in part through the Scotts Miracle Gro Company.

A cooperative research effort between the University of Tennessee and the University of

Georgia used both genotyping-by-sequencing and morphological characterization to evaluate

variations among hybrid bermudagrasses and off-type grasses (*Cynodon dactylon* (L.) Pers. x *C.*

*transvaalensis* Burtt-Davy) on putting greens. In addition, a cooperative research effort between the University of Tennessee and Penn State University was conducted to explore relationships in athletic field surface hardness data collected using different instruments.

The University of Tennessee is cooperating in the 2011 National Kentucky Bluegrass and Kentucky Bluegrass Traffic Tests, 2012 National Tall Fescue Test, and 2013 National Bermudagrass and Bermudagrass Traffic Tests. Data was provided by the University of Tennessee and other Universities supporting registration of ‘KSUZ 0802’ a new line of improved zoysiagrass.

In the last 2 years the MSU Turf team has participated in 8 National Turfgrass Evaluation Program (NTEP) tests. Some have been completed but most are ongoing. They include standard NTEP trials for bermudagrass, tall fescue, St, Augustinegrass, and seashore paspalum. Other special NTEP evaluations include, golf course fairway overseeding, warm season putting greens, warm-season low input and warm-season water use. These tests are highlighted at our field days and make MSU a destination for the observation of these trials. The data from these trials are processed by NTEP and disseminated.

MSU has partnered with Sod Solutions™ in a breeding program to use MSU derived germplasm and proprietary germplasm from Sod Solutions to produce new bermudagrass cultivars. Moreover, MSU has established 5000 ft2 of a proprietary St. Augustine grass as the first phase of a breeder and foundation nursery. This material will be grown to distribute larger quantities of certified stock to sod producers, thus making new turfgrass cultivars more easily transferable to the marketplace.

University of Florida turfgrass breeder, Dr. Kevin Kenworthy, is currently working closely with industry stakeholders and other UF faculty (Drs. Jason Kruse, Phil Harmon, Bryan Unruh, and Adam Dale) to develop improved cultivars of St. Augustinegrass, zoysiagrass, bahiagrass, and bermudagrass. Focus areas include disease resistance (Harmon), insect resistance (Dale), drought tolerance (Unruh), and improved aesthetic and maintenance uniformity (all faculty). Several years of this work has led to the pending and patented release of a new St. Augustinegrass cultivar that exhibits improved shade tolerance, disease resistance, weed resistance, and a unique appearance.

**4. Identifying Strategies to Promote Soil Health**

The underlying factor that affects the quality and benefits provided by turfgrasses, no matter where the location is, are soils. Soils are frequently highly disturbed during residential development or grounds maintenance practices, which may disrupt important processes and affect turfgrass and ecosystem health. Therefore, SERA25 faculty actively conduct research and extension programming efforts to identify better ways to manage soils and promote soil health.

The Texas A&M Turfgrass Team has recently developed an industry partnership with Aspen Beverage, San Antonio, Texas. Aspen is one of the world’s largest cold brew coffee extractors, and generates substantial quantities of spent coffee grounds (nearly 200 cu yds weekly) as a by-product of bottling for major companies including Starbucks, Dunkin Donut, and Coca-Cola. Working with its subsidiary GeoJava, we are working with other SCSC and Horticulture faculty (McInnes, Feagley, and Lombardini) to explore methods of utilizing spent coffee grounds as a topdressing/fertilizer, pre-emergence herbicide, and also as a root zone amendment for sand-based systems. This could have the potential to reduce usage of sphagnum peat moss, a non-renewable resource that is currently in short supply. We have received funding from both the USGA Greens Section, and from GeoJava to support this project. It has received world-wide interest.

From 2016 through 2018, the UF Turf Team (Drs. Adam Dale, Jason Kruse, and Billy Crow) have been investigating the effects of soil compost amendments to determine their effects on turfgrass quality and growth, plant-parasitic nematode abundance and damage, and insect communities. More specifically, the UF Turf Team has been investigating in adding compost into soils or as a top dressing to existing lawns affects pest or beneficial insects and the ecosystem services they provide (i.e., thatch decomposition and biological control of insect pests). This research has translated to management recommendations for plant-parasitic nematode control (Crow) associated with compost top-dressing recommendations. Ongoing research, near completion, by Dale and Kruse will result in management recommendations for incorporating compost into soils after residential development and prior to installation of ornamental plants and turfgrass lawns. The ultimate objective of this work is to identify strategies to make residential lawns more ecologically sustainable from the point of installation to long-term management.

**5. Developing and Conducting Educational, Extension and Outreach Programs Summarizing Research Results and Promoting Technology Transfer of the Previous 1- 4 Focus Areas.**

As Texas continues to urbanize, the area covered by residential development will increase. Residential lawns can contribute bacteria from pet waste and nutrients from improperly applied fertilizers. Homes and pavement increase rainwater runoff flow, which can carry more pollutants to streams and other water bodies. Many [watershed-based plans](https://www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan/watershed-pp.html) call for outreach and education programs to inform the public on how to reduce pollutant inputs and runoff volume. Texas A&M faculty have been delivering Healthy Lawns and Healthy Waters training programs to five watersheds with [watershed-based plans](https://www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan/watershed-pp.html) in Texas; [Cypress Creek](http://www.cypresscreekproject.net/), [Upper Cibolo Creek](http://www.ci.boerne.tx.us/147/Upper-Cibolo-Creek-Watershed), [Plum Creek](http://plumcreek.tamu.edu/), [Geronimo Creek](http://www.geronimocreek.org/Plan.aspx), and [the Upper San Antonio River](http://www.bexarfloodfacts.org/watershed_protection_plan/). The program focuses on rainwater harvesting and proper use of fertilizers for residential homes. Participants also receive a free soil analysis.

Turfgrass field days are also a major event for most turfgrass faculty representing universities that are part of the SERA25 working group. In 2016 and 2017 MSU’s Turfgrass Research Field Day drew over 200 participants to Rodney Foil Plant Science Research Center to learn about the latest advances in turfgrass management and culture. Participants left with an enhanced understanding of turfgrass research as well as some programs that they may be able to use in their management of turf. Supplemental education on native grasses and pesticide application calibration was also provided. In 2016 and 2017, the University of Florida Turf Team hosted 6 turfgrass field days in Ft. Lauderdale, Citra, and Milton, FL, attracting over 1,000 turfgrass industry professionals. At these events, attendees gained hands-on training and exposure to the latest turfgrass research addressing residential landscape, golf course, and sod farm challenges associated with natural resources, pest managements, cultural management practices, and wildlife conservation.

Additionally, the MSU turf team has partnered with Auburn University and the University of Florida to put on the Deep South Turf Expo in Biloxi MS. This successful conference and tradeshow draws over 600 participants per year to hear about relevant topics in turf management.

In addition to field days, SERA25 faculty regularly engage with turfgrass industry stakeholders in small groups to facilitate interaction and more comprehensive learning. In 2016 and 2017, the University of Florida Turf Team hosted four Evidence-based Turfgrass Management short courses, which were offered to turfgrass industry professionals and UF/IFAS county extension faculty. These were two-day, intensive courses that provided hands-on learning activities for nearly 100 attendees to develop more advanced skills on the production, maintenance, and protection of turfgrasses in Florida.

Educational materials are a major component of how SERA25 faculty reach industry stakeholders with the latest research and evidence-based management recommendations. Therefore, SERA25 faculty place a significant emphasis on creating extension publications in the form of field guides, blog posts, management guides, fact sheets, and trade magazine articles. For example, a cooperative effort between Clemson University and the University of Tennessee resulted in development and publication of ‘The Insecticide and Miticide Mode of Action Field Guide’, a resource to assist in managing arthropod pests of turfgrass and ornamental plants.

MSU and LSU partnered with the Louisiana Mississippi Chapter of the Golf Course Superintendents Association (GCSAA) to produce a booklet titled “Nutrient BMPs for Golf Courses in Louisiana and Mississippi”. This booklet serves as guidance to golf course superintendents and will be useful to regulators and legislators.

**Impact Statements**

**1. Water conservation and drought tolerance**

The UF|IFAS Center for Landscape Conservation and Ecology, of which several UF Turf Team faculty are affiliated (Dale, Kruse, Kenworthy, Unruh), have reported 2017-2018 savings of 176.4 million gallons of water based on educational programs delivered, which is enough water to supply the annual indoor water needs of nearly 2,005 households and save nearly $584,000 on utility bills. Ongoing efforts by the UF Turf Team will continue to build on this progress in the 2018-2019 year.

By 2018, researchers should have the data to begin reporting specific impacts resulting from the cooperative multi-state research effort to document water use for turfgrasses in the U.S., with an emphasis on water conservation in residential turfs in the next series of State Reports.

In 2017, 2,496 volunteers enrolled in the Tennessee Extension Master Gardener (TNEMG) Program logged 184,640 service hours and 35,894 education hours regarding best management practices including water conservation methods in residential landscapes, turfs and gardens.

**2. Nutrient management**

To measure both knowledge and behavior changes of individuals participating in the Texas A&M Healthy Lawns and Healthy Waters (HLHW) program, evaluations were developed and implemented. SCSC developed and administered pre-tests and post-tests to evaluate HLHW attendee knowledge gain regarding 1) program principles, and 2) appropriate best management practices and other activities that address rainwater harvesting and proper turf management. In addition, participant satisfaction with the program and participant intention to adopt behavior as a result of the HLHW training were measured. Outcomes for the programs from year 1 are as follows:

Knowledge gained as measured by pre/post-tests administered at the trainings: pre-test scores averaged 45% correct answers, while post-test scores averaged 80% correct. Post-training evaluation: 96.5% of participants were satisfied with the HLHWtraining. The value of participating in the program as estimated by attendees was an average of $856.78 or a total of $124,233 for 2017 participants. Intentions to Adopt Behavior Change: 92% of participants will fertilize based on recommendations from soil test; 83% of participants will install some type of rainwater harvesting system; 79% of participants will improve management of home irrigation system; 86% of participants will select plants/grass based on water conservation. A total of 45 soil samples have been submitted and analyzed.

The Website http://tennesseeturfgrassweeds.org, typically reaches practitioners in 110 countries, 50 U.S. states and 276 Tennessee municipalities annually. To date, the mobile website http://mobileweedmanual.com developed to assist practitioners select herbicides for use in both turfgrasses and ornamentals, and containing weed control efficacy data, and turfgrass and ornamental plant tolerance information for >2,400 species, and labels for >100 different herbicides has been visited by 136,681 individuals in 182 countries, all 50 United States, and 256 municipalities in Tennessee.

Presently, the Website https://www.facebook.com/SoilPlantPestCenter containing pictures and guidelines for identifying insects and diseases of turf and ornamentals active throughout Tennessee has >5,800 followers.

**3. Pest management**

In 2017, the UF/IFAS Turfgrass Entomology Lab (Dr. Adam Dale) organized and hosted eight extension workshops and participated in five others, reaching 485 turfgrass industry professionals with hands-on training about managing insect, pathogen, and weed pests in turfgrass systems. In addition to the direct hands-on training, the UF Turf Entomology Lab reached stakeholders through presentations, email, phone, social media, and online resources shown below:

* Reached approximately 2,050 industry stakeholders through presentations
* Reached approximately 485 industry stakeholders through hands-on workshops and training
* Fielded approximately 50 email consultations
* Fielded approximately 40 phone consultations
* Engaged (number of individuals who clicked on and viewed my posted content) approximately 2,469 industry stakeholders through social media via Twitter and gained 200 followers
* Reached individuals through 1,525 laboratory website visits

The UF/IFAS Turf Entomology Lab (Dr. Adam Dale) has found that creating native wildflower habitats in out-of-play areas on golf courses increases native bee abundance, general pollinator abundance, and predatory and parasitic insect abundance. Areas adjacent to wildflowers experience up to 50% greater biological control of caterpillar pests than areas adjacent to conventionally maintained turfgrass. In addition, planting more diverse wildflower mixtures attracts significantly more native bees and provide significantly greater pest control benefits.

So far, four golf courses in north-central Florida have implemented or begun to implement these habitats (On Top of the World, Adena Golf Club, St. Johns Golf Club). Each club has expressed interest in expanding beyond the small-scale experimental work that UF has conducted. In addition, at least five other superintendents have expressed interest in creating similar habitats on their courses. Thus far, by implementing the minimum of what we recommend, we have taken 40,000 sqft of highly maintained turfgrass and converted it to low-input, drought tolerant habitats that do not need to be fertilized, mowed, or treated with insecticides. In addition, we have demonstrated that these habitats provide 50% greater biological control of caterpillar pests on maintained turfgrass within, but not limited to, a 60-meter distance from the wildflower habitats.

This work has resulted in financial support from the Florida Golf Course Superintendent’s Association, partially supporting a UF master’s student beginning in the Fall 2018 semester. This student will continue to work towards developing IPM strategies that conserve beneficial wildlife and reduce pests and maintenance inputs on golf courses.

**4. Development of Improved Turfgrass Varieties for the Southern Region.**As a direct result of variety performance evaluations conducted at the CAFS under heavy simulated traffic, several bermudagrass varieties including ‘Latitude 36’, ‘Northbridge’ and ‘Riviera’ are now being planted on sports fields rather than the former industry standard variety ‘Tifway’. More than 590 TNEMG interns received training (2½ hr.) focusing on top performing turfgrass varieties and their management as sustainable turfs.

Efforts associated with the USDA-NIFA-SCRI funded working group are leading to the development of several promising drought-tolerant turfgrass species and cultivars, two of which have been released (‘TifTuf’ bermudagrass and ‘TamStar’ St. Augustinegrass). Other recent improved turfgrass releases include ‘Innovation’ Zoysiagrass, and ‘Chisholm’ zoysiagrass. In addition, the University of Tennessee and other Universities have contributed research data supporting registration of ‘KSUZ 0802’ a new line of improved zoysiagrass.

**5. Developing and Conducting Educational, Extension and Outreach Programs Summarizing Research Results and Promoting Technology Transfer of the Previous 1- 4 Focus Areas.**

Dr. Adam Dale and colleagues from UF actively teach landscape pest management training courses at Pest Management University held at the Mid-Florida Research and Education Center in Apopka, FL. These courses are 3-day, hands-on workshops that train landscape industry professionals on plant and pest identification and management. We currently offer two course types in a series: Foundations (beginner level) and Masters (advanced level). Dr. Dale taught 4 courses in 2017, directly training over 80 landscape pest control professionals from over 20 different pest control companies. On average, students show a 39% improvement in landscape pest identification and management knowledge after taking the courses.

The UF/IFAS Turfgrass Entomology Lab (Dr. Adam Dale) published seven extension publications that were accessed 13,623 times. Dr. Dale also published 9 articles in industry trade magazines including PestPro Magazine, PMU Newsletter, Florida Turfgrass Association Turf Digest, and the Turfgrass Producers of Florida newsletter, which are read by thousands of industry professionals throughout the southeastern U.S.

The Nutrient BMP’s for Golf Courses in Louisiana and Mississippi will allow golf course superintends and other personnel to speak with regulators and possibly legislators about ways that their use of fertilizers are not having an adverse environmental impact. The MSU Turfgrass Field Day has become a go to event for turfgrass practitioners in Mississippi. They attend this event to keep current on the latest developments in turfgrass culture. It could be interest in a new cultivar or cultural program but the bottom line is things viewed at field day are used by those that attend.

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