

Continued Statewide Delivery of the Lone Star Healthy Streams Program



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Texas State Soil and Water Conservation Board

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List of Acronyms and Abbreviations

Ac – acre	GLCI – Grazing Lands Conservation Initiative
AgriLife – Texas A&M AgriLife	Ha – hectare
ALEC – Department of Agricultural Leadership Education and Communication	Hvy – Heavy
ARS – Agricultural Research Service	LSHS – Lone Star Healthy Streams
AU – Animal Unit, 1000 pounds live weight	Max. – Maximum
AUD – Animal Unit Day	Min. – Minimum
AUM – Animal Unit Month	mL – milliliter
AUY – Animal Unit Year	Mod. – Moderate
BCSC – Beef Cattle Systems Center	mos. – months
BMP – Best Management Practice	NRCS – USDA Natural Resources Conservation Service
BST – Bacterial Source Tracking	PI – Principal Investigator
CEU – Continuing Education Unit	Q1 – First Quartile (25 th percentile)
CFU – Colony Forming Units, measure of fecal bacteria present in samples	Q3 – Third Quartile (75 th percentile)
CIG – Conservation Innovation Grant	QPR – Quarterly Progress Report
Conc. – Concentration	RTD – Rapid Transfer Device
CWA – Clean Water Act	SR – Stocking Rate in acres per animal unit
<i>E. coli</i> – <i>Escherichia coli</i>	Std. Dev. – Standard Deviation
EMC – Event Mean Concentration	SWCD – Soil and Water Conservation District
EPA – Environmental Protection Agency	TCEQ – Texas Commission on Environmental Quality
EQIP – Environmental Quality Incentives Program	TDA – Texas Department of Agriculture
Extension – Texas A&M AgriLife Extension Service	TMDL – Total Maximum Daily Load
FSA – Farm Services Agency	TSSWCB – Texas State Soil and Water Conservation Board
FY – Fiscal Year	TWRI – Texas Water Resources Institute
Geo Mean – Geometric Mean	USDA – United States Department of Agriculture
GI – gastrointestinal	WPP – Watershed Protection Plan

Introduction

Problem/Need Statement

Excessive levels of fecal indicator bacteria (e.g. *E. coli*) remain a major cause of water quality impairment throughout Texas. According to the 2012 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d), a total of 568 impairments are included in Category 5 with impairments due to elevated bacteria representing the highest percentage (45%). Total Maximum Daily Loads (TMDLs), TMDL Implementation Plans (I-Plans), and watershed protection plans (WPPs) continue to be developed to address these impairments.

Fecal indicator bacteria are common inhabitants of the intestines of all warm-blooded animals, including livestock. Although watersheds can be affected by microbial pollution from a wide variety of sources, livestock are increasingly under scrutiny. For example, bacterial source tracking (BST) results in the Lampasas River Watershed revealed livestock (cattle, avian livestock, and other non-avian livestock) accounted for a total of 22% of the *E. coli* identified while in the Leon River Watershed, livestock accounted for a total of 19%. One mechanism for reducing bacterial contamination from livestock species is to promote greater adoption, implementation, and maintenance of best management practices (BMPs) by livestock producers and landowners across the state. However, to accomplish this, significant resources are needed to educate and inform livestock producers and landowners about bacteria impairments, their causes, and most importantly, BMPs that can be implemented to help reduce bacterial contamination.

Surface water contamination by bacteria is not isolated to one watershed or region, but is instead a significant statewide issue. Consequently, through the joint vision of the TSSWCB and Extension, the LSHS program was developed and pilot tested through TSSWCB project 09-06 entitled, *Development of a Synergistic, Comprehensive Statewide Lone Star Healthy Streams Program*. This piloting period provided an opportunity to refine the program materials and components in preparation for statewide implementation of the program. Through TSSWCB project 12-08, *Statewide Delivery of the Beef Cattle, Dairy Cattle, Poultry and Horse Components of the Lone Star Healthy Streams Program*, over 30 education and training events have been conducted to date reaching over 50 counties and nearly 1,600 citizens with demand for the program increasing. Through both of these projects, presentations were developed, manuals were published, and other resources made available for online delivery. It is estimated that for every \$1 spent on water-related conservation programs in Texas, \$4-\$7 are saved, yielding a potential economic impact of the Lone Star Healthy Streams program to be \$1.26 to \$2.2 million.

Another component of TSSWCB project 12-08 was a statewide evaluation targeting beef cattle producers in Texas. The goal of this effort was to evaluate potential barriers to the adoption and implementation of water quality BMPs. Results of the evaluation have been analyzed and submitted for publication in appropriate journals. An executive summary is being developed and will enable conservation program managers to better understand BMP adoption behavior by livestock producers in the state. Consequently, it is imperative these results be shared with state water quality and natural resource agencies to improve design practices and programs that encourage and secure participation,

facilitate sustained adoption of practices, and meet water quality goals in the most cost-effective manner. Extension, with the help of the TSSWCB, will facilitate meetings with state water quality and natural resource agencies to disseminate the results so identified barriers to BMP adoption can be addressed.

The LSHS program is an important water quality education initiative in Texas. To help meet increasing demands for the program, this project provided continued statewide implementation to support and enhance current and future watershed protection efforts in Texas and provide a basis for gaining landowner participation and adoption of BMPs.

The LSHS program is an important water quality education initiative in Texas. This project has provided implementation of the LSHS program to support and enhance current and future watershed protection efforts in Texas.

General Project Description

This project delivered the Lone Star Healthy Streams program through local and distance education events in targeted watersheds across Texas.

Local Watershed and Distance Education. Extension worked with Extension Regional Program Leaders, County Extension Agents, and Extension Specialists around the state to deliver this program in bacteria impaired watersheds through local or distance education which uses WebEx, Centra Symposium or Lync software. The delivery took place in conjunction with County Extension Agents and their program planning committees; continued use of the LSHS website, and additional written materials as needed. The LSHS website and resource manuals continued to be used for program implementation.

Locations for training programs were selected in concert with the TSSWCB and targeted bacteria impaired watersheds where livestock and poultry have been identified as potential contributors, as well as those watersheds currently undergoing development and/or implementation of a WPP, TMDL, or I-Plan. Training programs were conducted at field days, conferences, and other county extension events. LSHS was incorporated into other events to enhance various state projects and maximize contact with producers

Both local and distance education programs varied in length and topic depending on the audience or location of the program. Distance education events were delivered using software such as WebEx, Centra Symposium, and/or Lync. These software programs allowed a presenter to load materials onto a platform while interested participants logged in from a remote site to listen and view the presentation live. Presentations were recorded so that participants who missed the live presentation could log on at a later time to listen to the presentation and view the presentation materials. A minimum of 10 local events and 3 distance education events were conducted each year. Curriculum and training materials have been developed to address topics and BMPs related to beef cattle, dairy cattle, poultry, and horses. As part of each training program, participants will learn about water quality law and policy, sources of bacteria in Texas waterways, bacteria fate and transport, benefits of voluntary conservation practices, sources of financial and technical assistance, and livestock- specific BMPs that are designed to reduce bacterial contamination of runoff.

Evaluation and Assessment. The impacts and effectiveness of the LSHS program were assessed using a multi- stage evaluation approach. The first stage used a pre-test/post-test evaluation strategy which was utilized at the beginning and end of both watershed and computer-based training programs. The pre-test asked knowledge-based questions that included a combination of multiple choice and true/false questions. The post-test measured the same knowledge-based questions to determine the knowledge change of participants. In addition, the post-test included 'satisfaction' questions and 'intentions to adopt' questions. The 'intentions to adopt' questions focused on BMPs that participants should adopt based on what they have learned and the practice's ability to reduce bacterial contamination.

Communication of Evaluation Results with State Agencies. Through TSSWCB project 12-08 titled, Statewide Delivery of the Beef Cattle, Dairy Cattle, Poultry and Horse Components of the Lone Star Healthy Streams Program, Extension developed and implemented a statewide evaluation designed specifically to identify the factors that motivate and barriers that limit producer

adoption/implementation and sustained management of BMPs known to reduce bacterial contamination of waterbodies. Demographic, socioeconomic, policy, and farm characteristics were assessed to identify and better understand the controlling factors and adoption behavior of Texas beef cattle producers. With assistance from the Southern Plains Regional Field Office of the National Agricultural Statistics Service, the evaluation was mailed to a random sample of 1,700 beef cattle producers in Texas. The sample was stratified to obtain representation from producers owning small, medium, and large beef cattle herds. This portion of TSSWCB project 12-08 has been completed and results submitted for publication in appropriate journals. An executive summary is being produced for dissemination to all interested parties interested in barriers to BMP adoption in Texas.

To ensure the results from the evaluation are shared with appropriate agencies and organizations across the state, Extension, with the help of the TSSWCB, facilitated a minimum of two meetings with state water quality and natural resources agencies. The intent of these meetings communicated findings from the evaluation including barriers to participation in conservation programs and BMP implementation, and characteristics of producers most likely to adopt BMPs. The goal of these efforts helped conservation agencies forge a plan of action to remove or minimize programmatic barriers and ultimately, to substantively enhance adoption of water quality BMPs across the state.

Project Goals

The goal of this project was to promote healthy watersheds and improve water quality through continued delivery of the LSHS program by educating Texas livestock producers and landowners. This goal was accomplished by meeting the objectives of:

- 1) Facilitating continued and enhanced statewide implementation of the Lone Star Healthy Streams (LSHS) program through local and distance educational events to help reduce bacterial contamination originating from grazing and dairy cattle, poultry, and horses in Texas surface waters.
- 2) Evaluating program success by measuring changes in producer knowledge and understanding regarding bacteria pollution and BMPs to minimize bacterial contamination as well as intentions to adopt recommended BMPs
- 3) Communicating barriers to BMP adoption identified in the statewide evaluation of agricultural producers conducted for TSSWCB project 12-08 (Statewide Delivery of the Beef Cattle, Dairy Cattle, Poultry and Horse Components of the Lone Star Healthy Streams Program) to federal and state agencies including the NRCS and TSSWCB to enable program modifications, as appropriate, that will increase adoption of water quality BMPs.

Measures of Success

- Delivery of a minimum of 10 LSHS local and 3 distance educational trainings per year.
- Number of livestock producers and landowners participating in educational events delivered locally or through distance education.
- Number of unique visitors to the LSHS project website.
- Number of factsheets, publications, and other educational materials distributed regarding the LSHS program and BMPs to reduce bacterial contamination.

- Increased knowledge and understanding of livestock producers and landowners on bacteria pollution and BMPs to reduce bacteria runoff, increased understanding of the expected adoption of BMPs, increased understanding of the barriers associated with BMP adoption and implementation as measured by surveys and pre/post evaluations
Enhanced coordination among state agencies to address barriers identified in TSSWCB project 12-08 statewide livestock producer evaluation to increase conservation program success and BMP adoption.

Methods and Results

Task 1: Project Administration

Objectives: Administer, coordinate, and monitor all work performed under the project including technical and financial supervision and preparation of quarterly progress and final reports.

Subtask 1.1: Preparation of Quarterly Reports

Extension prepared QPRs for submission to the TSSWCB. QPRs documented all activities performed within a quarter and were then submitted by the 15th of January, April, July and October to the TSSWCB. QPRs were also distributed to all project partners.

Subtask 1.2: Perform Accounting Functions

Extension performed accounting functions for project funds and submitted appropriate reimbursement Forms to TSSWCB at least quarterly. These forms are routed through Texas A&M Sponsored Research Services and then submitted to TSSWCB.

Subtask 1.3: Coordination of Project Meetings

Extension hosted coordination meetings or conference calls, at least quarterly, with project partners to discuss project activities, project schedule, communication needs, deliverables, and other requirements. Extension developed lists of action items needed following each project coordination meeting and distributed to project personnel. Numerous meetings and phone calls were held each quarter throughout the project time period.

Subtask 1.4: Participation of Final Report

Extension, with assistance from project partners, developed the final report assessing the effectiveness of the LSHS program, including the local and distance education events.

Task 2: Coordinate and Deliver LSHS

Objective: Continue delivery of a statewide educational program that provides livestock producers and landowners applicable information on water quality law and policy, sources of bacteria in Texas waterways, bacteria fate and transport, benefits of voluntary conservation practices, sources of technical assistance and financial incentives, and livestock-specific BMPs that are designed to reduce bacterial contamination of runoff. Extension will work in cooperation with the TSSWCB and other agencies and organizations as appropriate to guide program delivery and selection of training locations.

Subtask 2.1: Employ a Program Specialist

Extension employed a Program Specialist who will serve under the leadership of the Extension State Forage Specialist as the full-time LSHS Program Coordinator and will be responsible for promoting, coordinating, and delivering local and distance education LSHS training events. Extension hired Matthew Brown to serve in this role effective January of 2015.

Subtask 2.2: Educational Program Location Selection

Extension worked in concert with TSSWCB and state and local organizations to select locations for the LSHS training events. Extension coordinated efforts with state agencies, county extension agents, and organizations already involved in WPP/TMDL processes in specific watersheds.

Subtask 2.3: LSHS Marketing

Extension actively marketed the LSHS programs through news releases (AgriLife News and local media outlets), internet postings, newsletter announcements, public/conference presentations, flyers, etc., to enhance awareness and utilization. TSSWCB was provided all promotional materials for review and approval prior to distribution.

Subtask 2.4: LSHS Program Coordination and Planning

Extension coordinated with Extension Regional Program Leaders, County Extension Agents, local SWCDs, NRCS, TSSWCB, and others to deliver the LSHS educational program to bacteria-impaired or threatened watersheds throughout the state. Trainings included the standardized presentation developed in Subtask 3.3 of TSSWCB project 09-06 Development of a Synergistic, Comprehensive Statewide Lone Star Healthy Streams Program. Livestock production characteristics of each watershed dictated LSHS components were discussed along with the mode of delivery (local or distance) for each program.

During the project time period, over 42 LSHS programs were held, 31 being face to face and 9 being distance programs. As the project progressed, word spread about the usefulness of the information being presented and in many cases county extension agents outside of targeted watersheds were asking for the program or portions of the program to be brought to their county. LSHS was delivered in numerous watersheds including but not limited to: the Lampasas River, Mill Creek, Leon River, Navasota River, Alligator and Geronimo Creek, Plum Creek, Lavaca River, Upper Llano River, Double Bayou, Attoyac Bayou, Carters Creek, Copano Bay, North Bosque River, Trinity River, Little River, San Antonio River, Oso Bay, and Oso Creek.

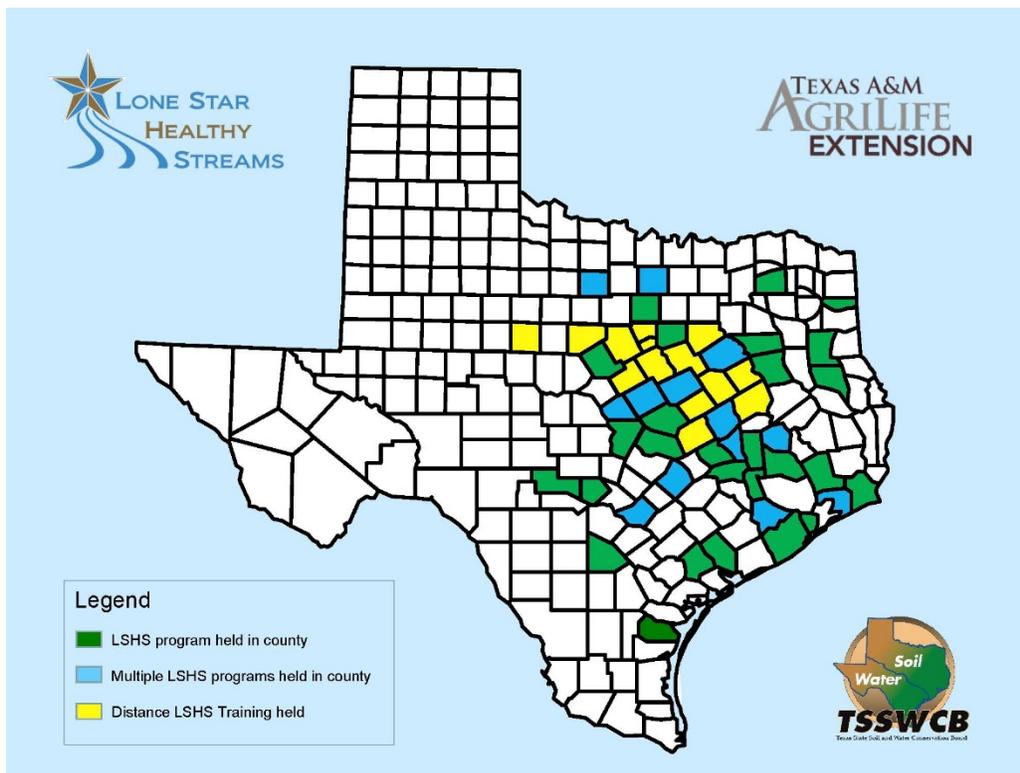


Figure 1: Map of LSHS program locations

Subtask 2.5: Meeting Participation

Extension participated in meetings as appropriate in order to efficiently and effectively achieve project goals and summarize activities and achievements made throughout the course of this project. Such meetings included, but were not limited to, local soil and water conservation districts (SWCDs), TSSWCB board meetings, Texas Watershed Coordinator Roundtables, the TSSWCB Regional Watershed Coordination Steering Committee, the annual meetings of Texas Soil and Water Conservation District Directors, Extension regional planning meetings, the American Society of Agronomy annual meetings, and the Society for Range Management annual meeting.

Subtask 2.6: LSHS Website

Extension, with assistance from TWRI, continued to host and maintain a LSHS program website (<http://lshs.tamu.edu/>) to serve as a public clearinghouse for all project related information. All workshop information, the LSHS BMP manuals, as well as other material have been available at this website. The number of unique visitors to the website and the distribution of Lone Star Healthy Streams educational materials was tracked to assess its impact and reported each quarter. Throughout the course of this project the LSHS website was visited 3,516 times by 2,097 unique visitors.

Task 3: LSHS Effectiveness

Objective: To measure both knowledge and behavior changes of individuals participating in the LSHS program using a staged evaluation approach.

Subtask 3.1: LSHS Program Evaluation

With assistance from the department of Agricultural Leadership Education and Communication (ALEC), developed and conducted pre-test/post-test evaluations (for both local and distance education events) that measured changes in knowledge of participants regarding water quality law and policy, sources of bacteria in Texas waterways, bacteria fate and transport, benefits of voluntary conservation practices, sources of financial and technical assistance, and livestock-specific BMPs that were designed to reduce bacterial contamination of runoff; evaluated participant satisfaction with the program; and evaluated participant's intentions to change their behavior as a result of the program.

Overall satisfaction of the LSHS program by over 6,000 participants to date was 98% mostly to completely satisfied. 78% of program participants indicated that their understanding of the topics discussed improved and 99% would recommend the LSHS program to others. Of the program participants that answered the evaluation question, 62% indicated that they were likely to adopt one or more BMPs. The LSHS program reached producers operating on over 45,000 acres and based on attendee feedback had an economic impact of over \$2,475,000.

Subtask 3.2: BMP Evaluation Mailout

With assistance from ALEC, develop and deliver stage 2 mailout evaluation specifically designed to assess the barriers and factors related to the adoption and implementation of BMPs known to reduce bacterial contamination of water bodies. Results from this mailout were compiled and can be found in the manuscript *Factors Influencing the Adoption of Water Quality Best Management Practices by Texas Beef Cattle Producers*.

Subtask 3.3: Analyze Evaluation Results

With assistance from ALEC, analyze demographic, socioeconomic, policy, and farm characteristics data to better understand the factors involved in producer adoption of BMPs. Results were used to periodically evaluate and modify LSHS education program materials. Adoption rates were lowest for erosion and sediment control practices and highest for grazing management practices. The highest adopted practice overall was watering facilities with over 80% of producers indicating as having adopted this practice. The lowest adopted practice overall was filter strips with a 15.6% adoption rate.

This effort also showed the adoption of BMPs by Texas beef cattle producers is influenced by variables related to capacity, attitudes, environmental awareness, and farm characteristics. This evaluation also suggested that the number of visits with county extension agents and extension personnel to be the most significant factor influencing conservation practice adoption. In addition to that, the number of visits with NRCS was the most significant factor reducing the probability of adopting several BMPs. All of the results were compiled and can be found in the manuscript *Factors Influencing the Adoption of Water Quality Best Management Practices by Texas Beef Cattle Producers*.

Task 4: Coordinate meetings with state agencies to discuss evaluation results from TSSWCB project 12-08

Objective: To facilitate meetings with state water quality and natural resource agencies to disseminate and discuss findings from the evaluation, identify specific barriers to BMP implementation, characterize producers most likely to adopt BMPs, and forge a plan of action to minimize or eliminate barriers to adoption of water quality BMPs.

Subtask 4.1: Evaluation Discussion Meetings

Extension, with assistance from the TSSWCB, coordinated two meetings with state water quality and natural resource agencies (i.e., NRCS, FSA, etc.) approximately six months apart. The first meeting involved sharing the results of the statewide evaluation. The second meeting focused on incorporating evaluation results into development of a targeted plan of action that specifically addressed barriers to conservation practice implementation in an effort to increase statewide adoption of water quality BMPs. These meetings were held at multiple locations and attendees included representatives from TSSWCB, TCEQ, Extension, AgriLife Research, NRCS, FSA, TPWD, and more.

Subtask 4.2: Summary Report

Extension, with assistance from the TSSWCB, developed a report summarizing information discussed in the meetings used as a guide for applicable state water quality and natural resource agencies. The information presented at these meetings were compiled and can be found in the manuscript *Factors Influencing the Adoption of Water Quality Best Management Practices by Texas Beef Cattle Producers*.

Conclusion

The goal of this project was to promote healthy watersheds and improve water quality through delivery of the Lone Star Healthy Streams program, using both local and distance education in targeted watersheds across the state. This was accomplished through the education of Texas livestock and poultry producers and landowners on how to best protect Texas waterways from bacterial contributions associated with the production of livestock and poultry utilizing best management practices. In addition, this project also aimed to better understand the barriers and factors associated with the adoption and implementation of BMPs known to reduce bacterial contamination in waterways and develop recommendations for enhanced landowner participation.

The LSHS program or portions of this program were delivered to audiences at over 40 events throughout the state, reaching over a total of 6,000 participants and impacting over 45,000 acres since it began. LSHS has also shown to have an economic benefit of over \$2,450,000 to the state of Texas. Landowners and livestock producers were eager to come to an extension managed program and adaptation of practices were as high as 80% depending on the particular practice. Attendees were not only interested in how to improve the efficiency of their land but had great interest in land stewardship and the contribution their land has to water quality. In addition, unique visitors to the LSHS website exceeded 2,000. This highly beneficial program will continue to be carried out throughout the state in coordination with the TSSWCB, Extension, and other project partners.