

# **Building a Successful Student Experiential Learning Program**

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**Director, Environmental Science Academic Programs  
Associate Professor of Environmental Science  
University of Texas at San Antonio**

# What We Are. TREE Program

Established in 2008

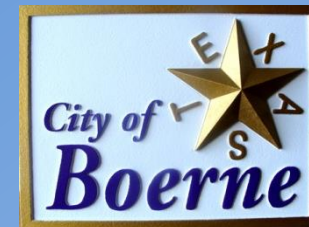
**T**EACHING AND  
**R**ESearch IN  
**E**NVIRONMENTAL  
**E**COLOGY



# Our Mission

To educate and assist students of diverse background to become leaders in natural resources and conservation in order to protect our natural resources and promote sustainability.

# Participants



# About Bexar County

- Largest City – San Antonio
- Population in 2013 –  
~ 1.8 million
- 59.1% Hispanic or Latino
- Median household income  
- \$49,141
- 17.8% persons below the  
poverty level



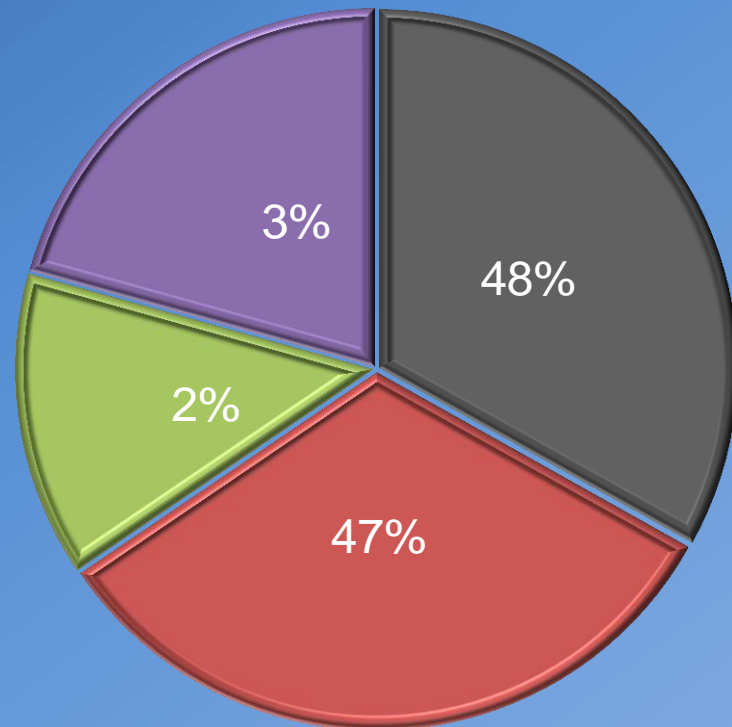
# About UT San Antonio



- Relatively young University within the UT System – Established in 1969
- Current enrollment – 30,300
- 65 bachelor's, 49 master's, and 21 doctoral degrees

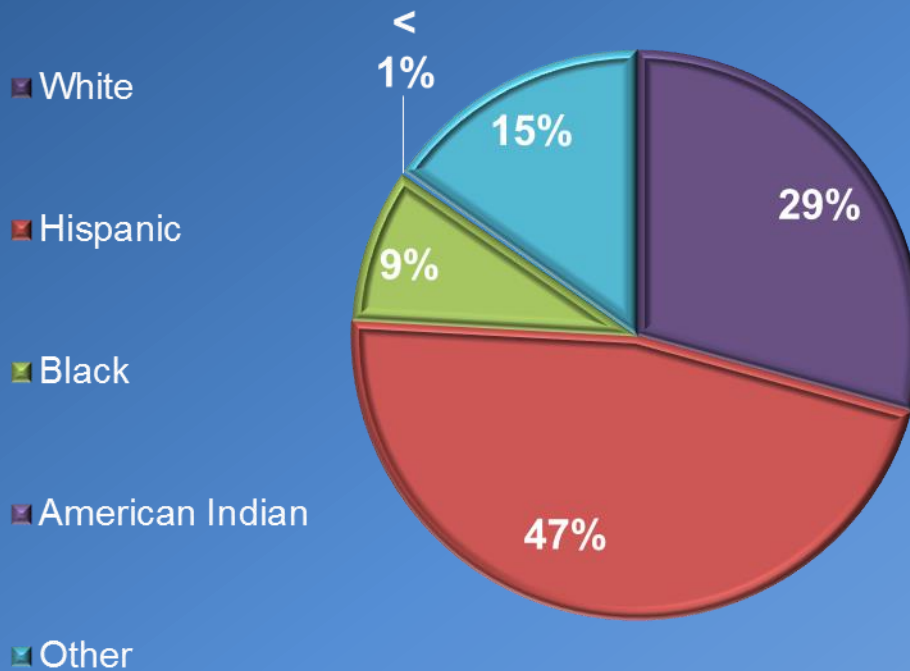
# About UT San Antonio

- Bexar County
- Other Texas counties
- Out-of-State
- International



# About UT San Antonio

## Ethnicity of Student Body





# About UT San Antonio

- **UT San Antonio ranks No. 7 in the nation for the number of undergraduate degrees awarded to Hispanic students\***
- **No. 10 nationally in the number of master's degrees awarded to Hispanics.**



\*Hispanic Outlook in Higher Education magazine rankings.

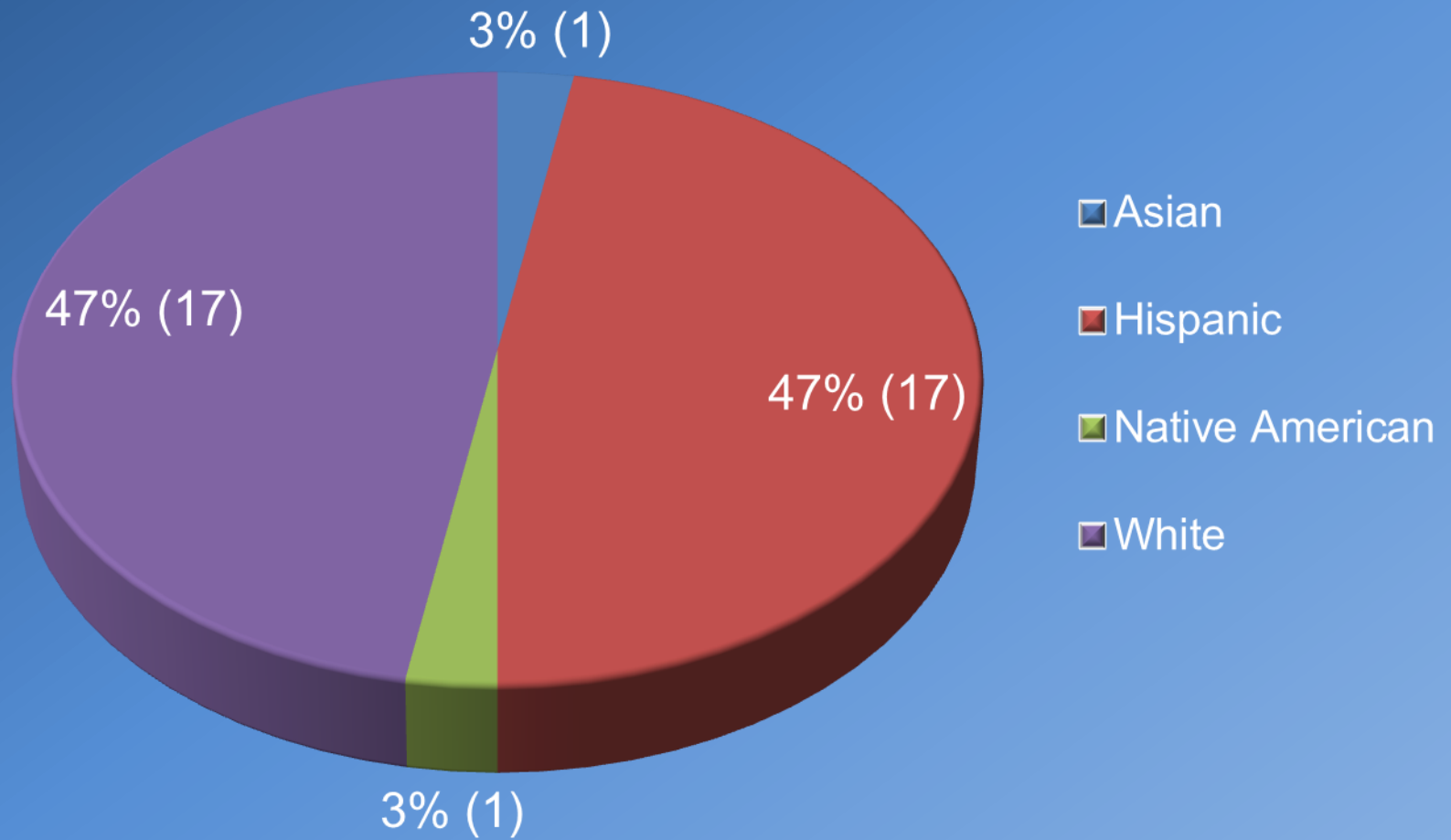
# About UT San Antonio



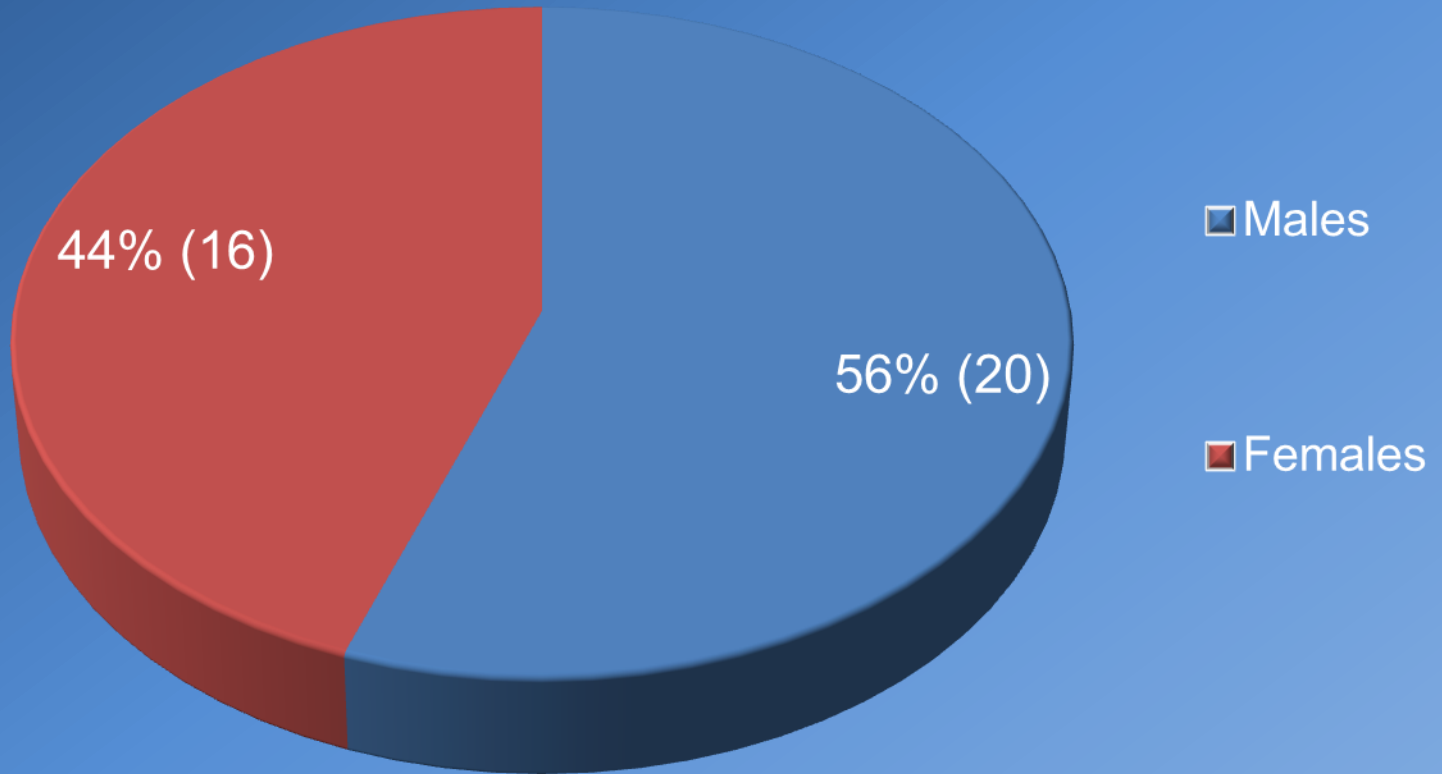
# Demographics of Students in TREE Program



# Ethnicity



# Gender



# What We Do Recruit

## Fishing for your Future?



FELLOWSHIP IN CONSERVATION AND NATURAL  
RESOURCES

To apply, go to

<http://www.utsa.edu/ecology/hsi/app.htm>

**TREE Program**

TEACHING AND RESEARCH IN ENVIRONMENTAL ECOLOGY



JANIS K. BUSH, DIRECTOR  
[janis.bush@utsa.edu](mailto:janis.bush@utsa.edu)

## Want to be a Forest Ranger?



**Fellowship in Conservation and  
Natural Resources**

To Apply, go to

<http://www.utsa.edu/ecology/his.app.htm>

**TREE Program**

TEACHING AND RESEARCH IN ENVIRONMENTAL ECOLOGY



## Looking for your Future?



FELLOWSHIP IN CONSERVATION AND NATURAL  
RESOURCES

To apply, go to

<http://www.utsa.edu/ecology/hsi/app.htm>

**TREE Program**

TEACHING AND RESEARCH IN ENVIRONMENTAL ECOLOGY



JANIS K. BUSH, DIRECTOR  
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## Fellowships Available!!

Funding is now available  
for a limited number of  
UTSA students interested  
in careers in conservation  
and natural resources!

**Apply NOW!**

**UTSA**

The University of Texas at San Antonio



# Workshops

- **Study Skills**
  - Time management
  - Motivation and Procrastination
  - Note Taking
  - Communicating with professors

# Workshops

## Research Boot Camp





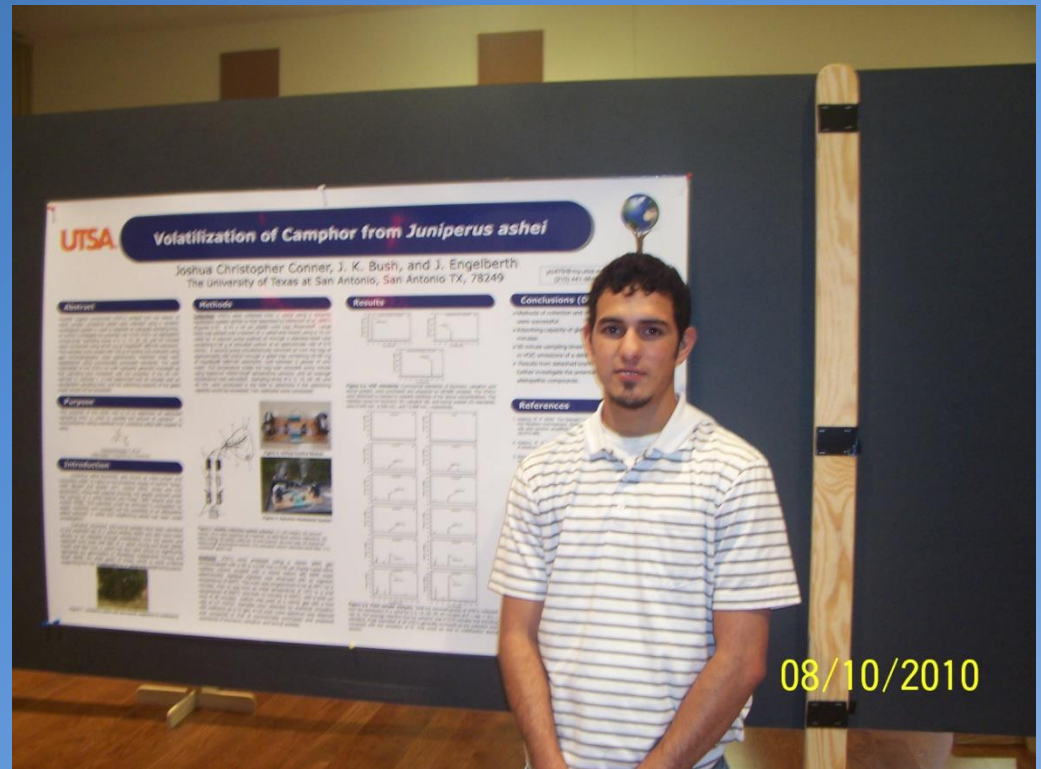
# Workshops

- **Scientific Writing**
  - General science writing
  - Use of reference management software



# Workshops

- Research Skills
  - Preparing poster presentations
  - Preparing oral presentations



# Workshops

<i>Timing</i>	<b>Guide to Effective Grant Writing</b>
<i>Focus</i>	
<i>Research</i>	
<i>Budget</i>	
<i>Clarity</i>	
<i>Goals</i>	<i>How to Write an Effective NIH Grant Application</i>
<i>Objectivity</i>	
<i>Strategy</i>	
<i>Approval</i>	<b>OTTO O. YANG</b>

# Workshops

## Media Training



# Role-Model Seminars

- Research Scientists from across the country
- Local, State and National Conservation/Natural Resource Employees
  - City of San Antonio Conservation Biologists
  - Texas Parks and Wildlife Biologists
  - US Forest Service Biologists

# Role-Model Seminars

Francisco Ayala, Ph. D.  
University of California –Irvine  
Awarded 2001 National Medal  
Of Science and 2010  
Templeton Prize.  
Member: National Academy of  
Sciences



# Role-Model Seminars

Adam Sepulveda, Ph. D.  
University of Montana

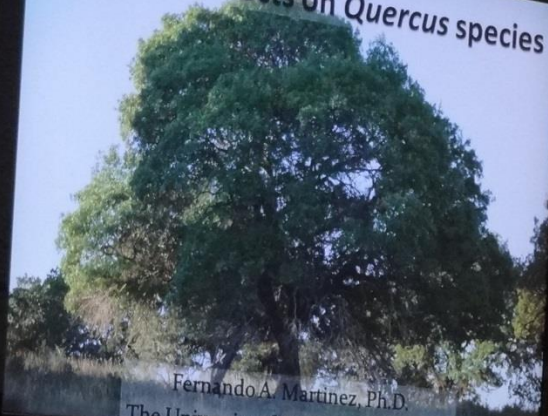


# Local and National Research Conferences





# Herbivory Effects on *Quercus* species



Fernando A. Martinez, Ph.D.  
The University of Texas at San Antonio




UTSA POSTER  
RP7

### UTSA An Analysis of Nitrogen Content in Central Texas Quercus Species as a Function of Herbivory

Jewell Lee M. Cozart, Fernando A. Martinez and Janis K. Bush  
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**Abstract**  
Quercus species are a dominant and ecologically important component of the Central Texas landscape. The effects of herbivory on the nitrogen content of these species are not well understood. This study examined the effects of simulated herbivory on the nitrogen content of three Quercus species: Q. agrifolia, Q. muhlenbergii, and Q. macrocarpa. The results show that simulated herbivory significantly increased the nitrogen content of all three species, with the greatest increase observed in Q. agrifolia. These findings suggest that herbivory may play a role in the nitrogen cycling of these species and could have implications for the health of the Central Texas landscape.

**Methods**  
Three Quercus species (Q. agrifolia, Q. muhlenbergii, and Q. macrocarpa) were grown in a greenhouse under controlled conditions. The plants were divided into three groups: Control, 20% Simulated Herbivory, and 40% Simulated Herbivory. Simulated herbivory was achieved by clipping the plants to a height of 10 cm and applying a herbivore-induced plant volatiles (HIPV) extract to the wounds. The plants were then grown for 12 weeks. At the end of the experiment, the nitrogen content of the leaves was determined using a nitrogen analyzer.

**Results**  
**Quercus agrifolia var. brevifolia**  

Group	Control	20% Simulated Herbivory	40% Simulated Herbivory
Nitrogen Content	~0.0015	~0.0025	~0.0035

  
**Quercus buckleyi**  

Group	Control	20% Simulated Herbivory	40% Simulated Herbivory
Nitrogen Content	~0.0010	~0.0015	~0.0020

  
**Quercus fusiformis**  

Group	Control	20% Simulated Herbivory	40% Simulated Herbivory
Nitrogen Content	~0.0012	~0.0018	~0.0025

**Results - con't**  
Figure 1 shows the mean nitrogen content of the leaves for each species under the three different herbivory treatments. The letters C, H, and N represent Control, Herbivory, and Nitrogen, respectively. Error bars represent standard error of the mean.

**Discussion**  
The results of this study show that simulated herbivory significantly increased the nitrogen content of all three Quercus species. This increase in nitrogen content may be due to the fact that herbivory stimulates the production of secondary metabolites, which can increase the nitrogen content of the plant. The increase in nitrogen content may also be due to the fact that herbivory increases the rate of photosynthesis, which can increase the nitrogen content of the plant. These findings suggest that herbivory may play a role in the nitrogen cycling of these species and could have implications for the health of the Central Texas landscape.

**References**  
1. Cozart, J. L., Martinez, F. A., & Bush, J. K. (2012). The effects of simulated herbivory on the nitrogen content of three Quercus species. *Journal of Environmental Science and Technology*, 46(12), 3456-3462.  
2. Martinez, F. A., Cozart, J. L., & Bush, J. K. (2013). The effects of simulated herbivory on the nitrogen content of three Quercus species. *Journal of Environmental Science and Technology*, 47(1), 123-130.

**Acknowledgements**  
This research was supported by the University of Texas at San Antonio. We thank the following individuals for their assistance: [Names]

Soil Nitrogen Content and the Availability of that Nitrogen to Plants

This poster discusses the relationship between soil nitrogen content and the availability of that nitrogen to plants. It includes a bar chart showing the nitrogen content of soil under different conditions and a line graph showing the nitrogen content of plants under different conditions.



UTSA

# Volatilization of Camphor from *Juniperus ashei*

Joshua Christopher Conner, J. K. Bush, and J. Engelberth  
The University of Texas at San Antonio, San Antonio TX, 78249



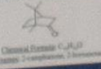
SPOTLIGHT ON THE ARTS & SCIENCES TREE

### Abstract

Volatile organic compounds (VOCs) emitted from the leaves of Ashe Juniper (*Juniperus ashei*) were collected using a dynamic headspace system in order to establish an adequate sampling time, to further investigate the potential role of the VOCs as allelopathic compounds. Sampling times of 0, 5, 10, 20, 30, and 40 minutes were conducted using 20-50 mg of Haystack® DMF100 adsorbent. The samples were eluted with 150  $\mu$ l of hexane and analyzed using gas chromatography/mass spectrometry. Retention times were established using commercially purchased standards. The peak intensities of the VOCs for both replicates generally increased as the sampling time increased, with the exception of the 20 min sample in replicate 1. It was determined that 30 minutes was an acceptable sampling time, and the adsorbing capacity of the glass traps would not be exceeded.

### Purpose

The purpose of this study was to try to determine an adequate sampling time, in order to quantify the amount of camphor, a monoterpane, being volatilized from *Juniperus ashei* with respect to time.



### Introduction

*Juniperus ashei* Buchholz, also known as Ashe Juniper and mountain cedar, is native to the limestone slopes of Central Texas, USA (Bryant and Shaffer 1977; Adams 2004). Growth and seed production, along with species diversity, are greatly reduced under the canopy of *J. ashei* (Schott and Piqueur 1988; Wayne and Van Gulke 2005). This reduction could be attributed to competition for water, nutrients, and sunlight, but the possibility of an allelopathic effect between *J. ashei* and neighboring plants has been under investigation.

Camphor, bornane, and bornyl acetate have been identified in the essential oils of *J. ashei* (Adams 2004) and also have been shown to be released through volatilization from the leaves and twigs from fresh leaf litter of *J. ashei* (Young and Bush 2000). Twigs from fresh leaf litter from *J. ashei* have also been shown to significantly decrease the germination of *Decasium complanatum* (Young and Bush 2000), the vernal grass of Texas, which is more evidence supporting the role of allelopathy in *J. ashei* and neighboring plants.



Figure 1. *Juniperus ashei* with increased vegetation in understory

### Methods

**Collection:** VOCs were collected from *J. ashei* using a dynamic headspace system similar to that described by Matarini et al. (2007) (Figure 2A). A 60 x 60 cm glass jar, bag (Haystack®) glass jar) was placed over a branch of *J. ashei* and closed using a 10 cm cable tie. A vacuum pump pushed air through a desiccation vessel containing 150 g of activated carbon at an approximate rate of 200 ml/min. A second pump continuously removed air from the bag at approximately 200 ml/min through a glass trap containing 20-50 mg of Haystack® DMF100 adsorbent, with between 2 plates of adsorbent. The temperature inside the bag was recorded every minute using Spectrum Master-Dyn® temperature sensors, and an average temperature was calculated. Sampling times of 0, 5, 10, 20, 30, and 40 min were conducted in the field to determine if the adsorbing capacity would be exceeded. Two replicates were conducted.

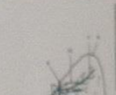


Figure 3. Static collection system similar to that of Matarini et al. (2007)

Figure 2. Dynamic headspace system similar to that of Matarini et al. (2007)

**Analysis:** VOCs were analyzed using a Varian 6800 GC gas chromatograph with a 30 m x 0.25 mm x 0.25  $\mu$ m Dgmsi Super 1000 capillary column equipped with a Varian Station MS 2000 mass spectrometer. Sample injection was performed with an injection syringe. The oven was programmed to be at 50°C for 2 minutes, then to rise from an initial temperature of 50°C to a final temperature of 200°C, and then to increase to 250°C, with a hold for 20 minutes. Helium was used as a carrier gas with a flow rate of 20 ml/min. Samples were detected by electron ionization mass spectrometry. A full scan mass spectrum was obtained with retention as a GC gas. A full scan mass spectrum was compared with retention of GC gas. A full scan mass spectrum was compared with retention of GC gas. A full scan mass spectrum was compared with retention of GC gas.

### Results



Figure 4. Temperature (°C) over time (min) for three different sampling times: 0 min, 5 min, and 20 min.

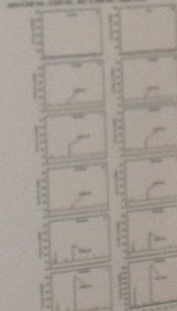


Figure 5. Peak intensity (AU) over time (min) for three different sampling times: 0 min, 5 min, and 20 min.

### Conclusions (Disc. or Summary)

Volatilization of camphor and other VOCs from *J. ashei* were collected. Adsorbing capacity of glass traps was not exceeded at 30 minutes. VOCs which adsorbing time will be used in another study. A VOC adsorbent of a modified nature in the laboratory. A results from desiccation vessel will be used to further investigate the potential role of VOCs as allelopathic compounds.

### References

- Adams, J. L. 2004. The Ecology and Evolution of *Juniperus ashei* in Central Texas. M.S. Thesis, The University of Texas at San Antonio.
- Bryant, J. P., and Shaffer, G. R. 1977. The Ecology of *Juniperus ashei* in Central Texas. M.S. Thesis, The University of Texas at San Antonio.
- Young, J. K., and Bush, J. K. 2000. Volatilization of Camphor and Bornane from *Juniperus ashei* in Central Texas. M.S. Thesis, The University of Texas at San Antonio.
- Matarini, J. C., et al. 2007. Volatilization of Camphor and Bornane from *Juniperus ashei* in Central Texas. M.S. Thesis, The University of Texas at San Antonio.

### Acknowledgements

- Funding in part by a grant awarded to J. K. Bush by the President's Research Office.
- Funding in part by a grant awarded to J. K. Bush by the Texas State Department of Agriculture (TSDA).
- Special thanks to Maria Salazar for her assistance in sample collection.

### In vivo analysis of the Tomato Golden Mosaic virus AL2 promoter

Jennifer Guzman, Jun Yu, and Garry Surratt  
University of Texas at San Antonio, San Antonio, TX 78249

**Abstract:** The AL2 promoter of the Tomato Golden Mosaic Virus (TGMV) is known to be highly active in tomato plants. In this study, we investigated the in vivo activity of the AL2 promoter in tomato plants. We used a reporter gene system to analyze the activity of the AL2 promoter in tomato plants. The results show that the AL2 promoter is highly active in tomato plants, and that the activity is dependent on the concentration of the promoter. These results suggest that the AL2 promoter is a strong promoter in tomato plants, and that it can be used to drive the expression of genes in tomato plants.

**Keywords:** Tomato Golden Mosaic Virus, AL2 promoter, in vivo analysis, reporter gene system.

**Introduction:** The AL2 promoter of the Tomato Golden Mosaic Virus (TGMV) is known to be highly active in tomato plants. In this study, we investigated the in vivo activity of the AL2 promoter in tomato plants. We used a reporter gene system to analyze the activity of the AL2 promoter in tomato plants. The results show that the AL2 promoter is highly active in tomato plants, and that the activity is dependent on the concentration of the promoter. These results suggest that the AL2 promoter is a strong promoter in tomato plants, and that it can be used to drive the expression of genes in tomato plants.

**Methods:** We used a reporter gene system to analyze the activity of the AL2 promoter in tomato plants. The reporter gene system consisted of the AL2 promoter, a reporter gene, and a selectable marker. The reporter gene system was transformed into tomato plants, and the activity of the AL2 promoter was analyzed in the transformed plants. The results show that the AL2 promoter is highly active in tomato plants, and that the activity is dependent on the concentration of the promoter.

**Results:** The results show that the AL2 promoter is highly active in tomato plants, and that the activity is dependent on the concentration of the promoter. The activity of the AL2 promoter was measured in tomato plants transformed with the reporter gene system, and the results show that the activity is dependent on the concentration of the promoter.

**Conclusions:** The results suggest that the AL2 promoter is a strong promoter in tomato plants, and that it can be used to drive the expression of genes in tomato plants. These results suggest that the AL2 promoter is a strong promoter in tomato plants, and that it can be used to drive the expression of genes in tomato plants.

**References:** Guzman, J., Yu, J., and Surratt, G. 2007. In vivo analysis of the Tomato Golden Mosaic virus AL2 promoter. M.S. Thesis, The University of Texas at San Antonio.



# In vivo analysis of the Tomato Golden Mosaic virus AL2 promoter



Jennifer Guerrero, Jun Tu, and Garry Sunter  
University of Texas at San Antonio, San Antonio, TX 78249

## Abstract

*Tomato Golden Mosaic virus* (TGMV) is a member of the *Geminiviridae* family of single stranded (ss) DNA viruses plant viruses. TGMV belongs to the genus *Begomovirus* with two genome components, named A and B. DNA component A directs expression of the AL2 and AL3 genes, while DNA B directs expression of genes required for the movement of the virus in plants. AL2 directs coat protein expression and AL3 is a replication enhancing protein. Promoters for transcripts initiating at nucleotides 1935 and 1629 regulate expression of AL2 and AL3, as determined using promoter:β-D-glucuronidase (GUS) fusions in transient leaf assays. We have generated transgenic *N. benthamiana* plants harboring the AL1935 and AL1629 promoter::GUS fusions to determine tissue specificity of each promoter. Plants will be analyzed using histochemical staining to determine whether each promoter is expressed in mesophyll cells and/or phloem cells.

## Purpose

New resistance strategies to plant pathogens requires increased knowledge of molecular mechanisms that regulate expression of genes involved in plant pathogenesis. The purpose of this project is to understand how the geminivirus promoters are regulated. Interfering with these promoters to express coat protein and other viral proteins could provide resistance to this virus.

## Introduction

The *Geminiviridae* family of viruses is transmitted by insect vectors such as treehoppers. Taxonomy: *Geminivirus* is a member of the family *Mastreviridae*. *Topocuvirus* is a member of the *Geminiviridae* family. TGMV, which has a broad host range, causes some of the most serious diseases of agricultural and ornamental plants and is a major constraint to crop production in many developing countries (Figure 1). The geographical ranges of TGMV are

## Introduction

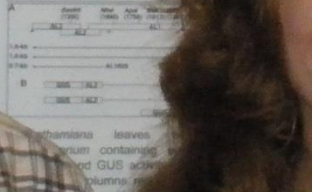
Genomic organization of TGMV. The genome consists of two complementary DNA strands, A and B, which are packaged into a double-stranded DNA genome. The A strand contains the AL1, AL2, and AL3 genes, while the B strand contains the B1 and B2 genes. The AL1 gene encodes a replication enhancing protein (REP), while the AL2 and AL3 genes encode coat protein (CP) and replication enhancing protein (REP), respectively. The B1 and B2 genes encode movement proteins (MP1 and MP2), which are involved in the movement of the virus within the plant.

Figure 2. Genomic organization of TGMV. The A and B strands are shown. The AL1, AL2, and AL3 genes are indicated by arrows. The B1 and B2 genes are indicated by arrows. The origin of plus and minus strands is indicated by the '+' and '-' signs. The AL1935 and AL1629 promoters are indicated by the '+' and '-' signs.

## Results (cont)

2) Activity of the TGMV AL1629 and AL1935 promoters. To define sequences necessary and sufficient for AL1629 and AL1935 promoter activity, a series of 5'-truncated promoters linked to the GUS reporter in a translational fusion, were constructed (Figure 4B). AL1629 promoter deletions were made that contained either 650bp (AL1629Eco::AL2/GUS) or 200bp (AL1629Cla::AL2/GUS) of TGMV sequence upstream of an AL2/GUS fusion. An AL1935 promoter construct was generated containing 326bp of TGMV sequence upstream of GUS (AL1935::GUS).

Figure 4. Transcription map of TGMV. (A) mRNA (arrows) are shown relative to the origin of plus (IR+) and minus (IR-) strands. ORFs (open boxes), TATA boxes (filled boxes), and polyadenylation signals (shaded boxes) are shown. Restriction sites are shown with respect to the origin of plus (IR+) and minus (IR-) strands. (B) Promoter-reporter constructs used for in vivo analysis and generation of transgenic plants.



## Future Work

1) DNA binding studies using electrophoretic mobility shift assays (EMSA) will be performed to confirm binding of ERF protein to the AL1629 promoter. We are currently expressing his-ERF in both *E. coli* and Sf9 insect cells. Co-immunoprecipitation will be performed with transgenic plants containing the AL1629 promoter::GUS fusion to confirm in vivo binding of ERF. Transgenic plants containing the AL1629 promoter::GUS fusion will be used to analyze the effect of ERF on GUS expression. The effect of ERF on GUS expression will be analyzed in transgenic plants containing the AL1629 promoter::GUS fusion. The effect of ERF on GUS expression will be analyzed in transgenic plants containing the AL1629 promoter::GUS fusion.

# K-12 Outreach





Northside  
Independent  
School District















**girl scouts**  
of southwest texas







# Research Experiences









# The City of Grey Forest

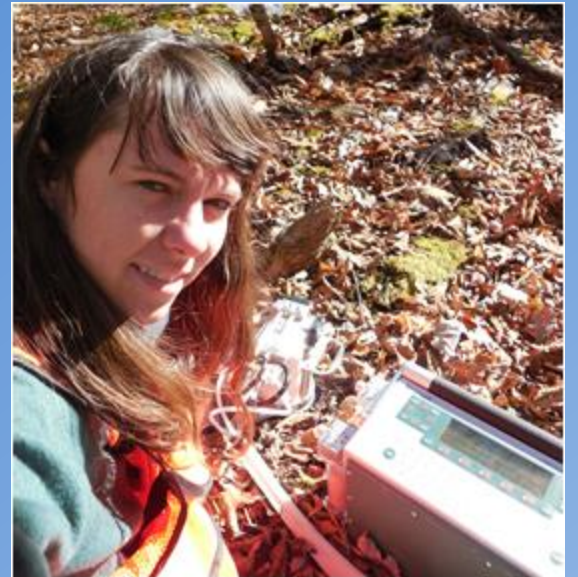
A Senior Playground













**LTLT**

*Land Trust for the Little Tennessee*







Bent Creek  
Experimental Forest

SOUTHERN  
RESEARCH STATION

U.S. DEPARTMENT OF AGRICULTURE

















# What We Have Found.

- Qualitative Case Study
- Three focus groups
  - After one, two, and three years
- Semi-structure interview
  - Open-ended questions
- Used coding to identify common themes

# Why the Students Wanted to Participate

- 1) Sense of Identity
- 2) They get to do research
- 3) They get to do organized community service
- 3) Having a faculty mentor
- 4) Financial support



# What was most helpful

Most: Resume building, travel to scientific meetings, routine group meetings, media training, role-model seminars, conducting their own research

Least: Study skills

# Resume Building

Not an exercise in how to build a resume, but rather exposing them to activities they can add to their resumes.

# Travel to Scientific Meetings

- Travel to new places
- Calibrate their level of experience and knowledge to students from other areas
- Interacting with others of similar interest
- Creating a sense of empowerment

# Group Meetings

- Creating the sense of identity
- Sharing their experiences and learning from others to help manage their college experience
- Educate and motivate for obtaining advanced degrees

# Role Model Seminars

- Opened their eyes to career options

# Research Experience

- Opened their eyes to the possibilities
- Experience 'hooked' them on doing research

# Quotes from the External Reviewer

Dr. Richard McGee,

Associate Dean for Faculty Recruitment and Professional  
Development

“To be candid, I have been working with students and student programs, and serving as external evaluator, for more than 20 years.”

“I can honestly say the students in the TREE are the most uniformly positive, appreciative, and committed to their program I have ever seen”



# Quotes from the External Reviewer

“ . . . the opportunities provided to them are life-changing.”

“ . . . most feel they would have been severely challenged to find their way in their field at UTSA without TREE.”

# Quotes from the External Reviewer

“Most striking are the bonds and commitment to helping each other, and their very strong desire to engage in the community”

“I have never seen a group of students, particularly this mixture of undergraduates through graduate students, so eager to do more even though they are all stretched thin with school and life activities.”

# Final Thoughts

- Importance of the acronym.
- Problems when establishing the program.
- Establishing relationship with governmental or non-governmental agency to over support.

