American Crossroads

Digitizing the Vascular Flora of the South-Central United States
Texas Oklahoma Regional Consortium of Herbaria
(TORCH TCN)

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ADBC Summit – September 24th, 2020

South-Central US

- Oklahoma & Texas:

  876,859 km^2

  11% of contiguous US

- "Crossroads" of North American ecological and biological diversity (edges of many plant species distributions)

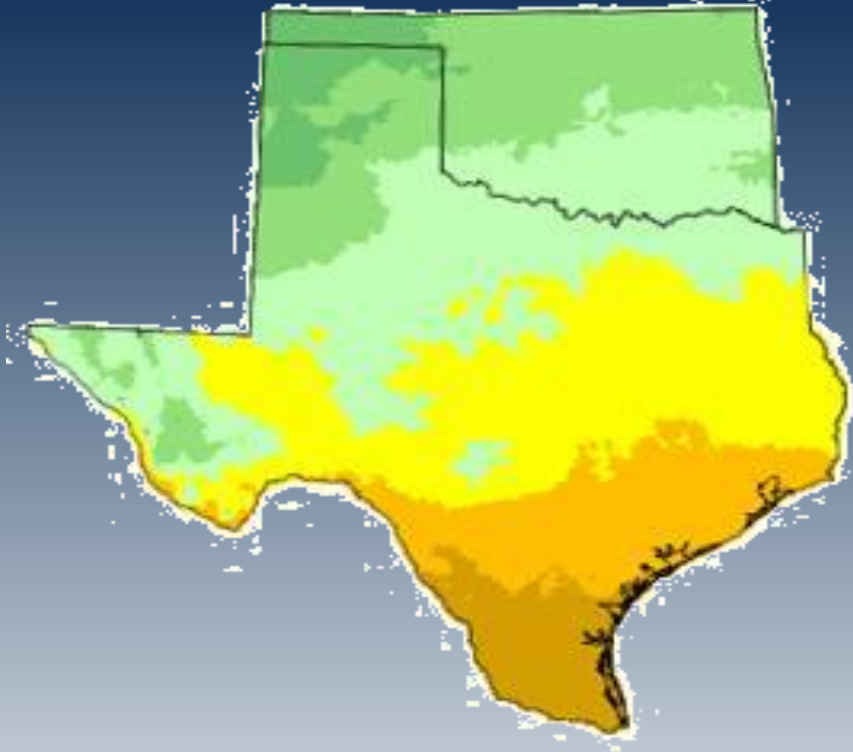- Key to understanding continent-wide patterns of biome evolution

106.6˚ W   93.5˚ W

37˚ N

25.8˚ N

©GoogleEarth
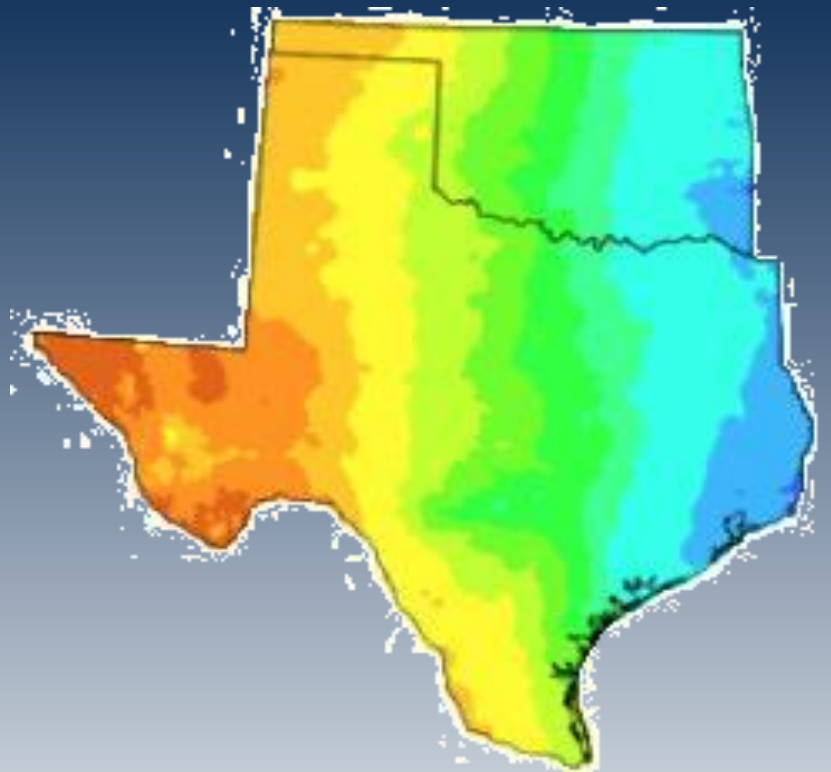
Environmental Gradients

North-to-South: mean January temp 0 °C to 18°C, through 5 plant hardiness zones

West-to-East: mean annual precipitation <12.5 cm to >150 cm (1 cm / 10 km), with abrupt peaks in west Texas and the Ozarks

©National Center for Atmospheric Research

https://climatedataguide.ucar.edu/climate-data/prism-high-resolution-spatial-climate-data-united-states-maxmin-temp-dewpoint
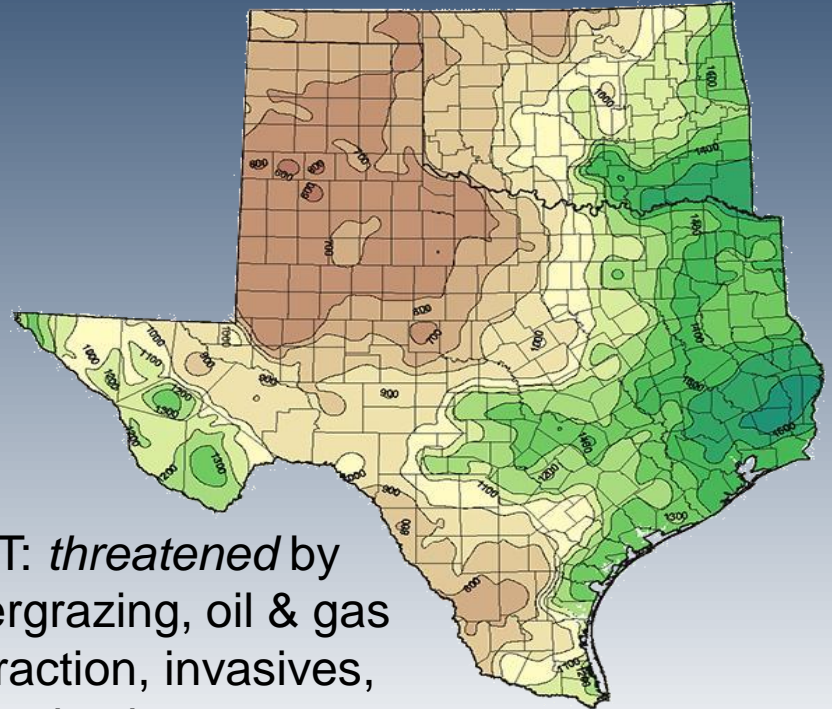
Ecological diversity

4 EPA Level-I Ecoregions: Great Plains, Eastern Temperate Forests, North American Desert, Temperate Sierras.
17 Level-III Ecoregions
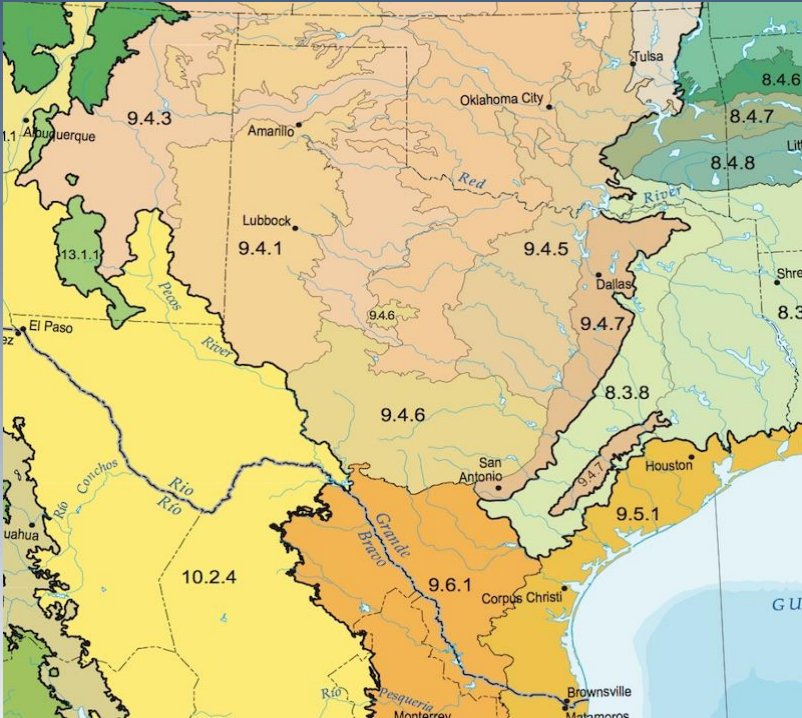
©Commission for Environmental Cooperation
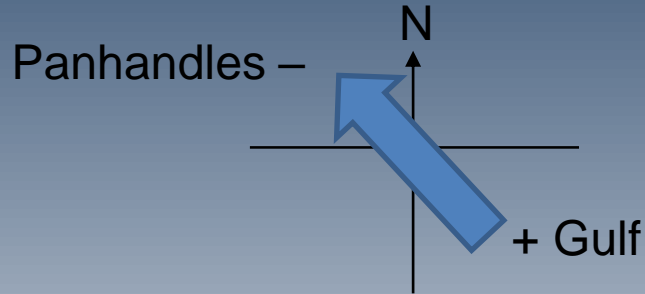
Plant diversity

- 4945 native vascular plant species, 31% of all native species in the US & Canada

- Texas is 2nd in species richness among US states, with 325 endemics

BUT: *threatened* by overgrazing, oil & gas extraction, invasives, urbanization, etc.

www.bonap.org

Research Hypotheses

- Geographic patterns in <u>phylogenetic</u> diversity:
  - Diversity will decline with latitude as tropical lineages drop out
  - Diversity will decline with precipitation

Panhandles –   N

+ Gulf

- Vegetation responses to climate change will be large and species-specific

- Species distribution (niche) models will be improved with substrate data (rather than relying only on climate data)

TORCH TCN: Documenting the plant diversity of Texas & Oklahoma
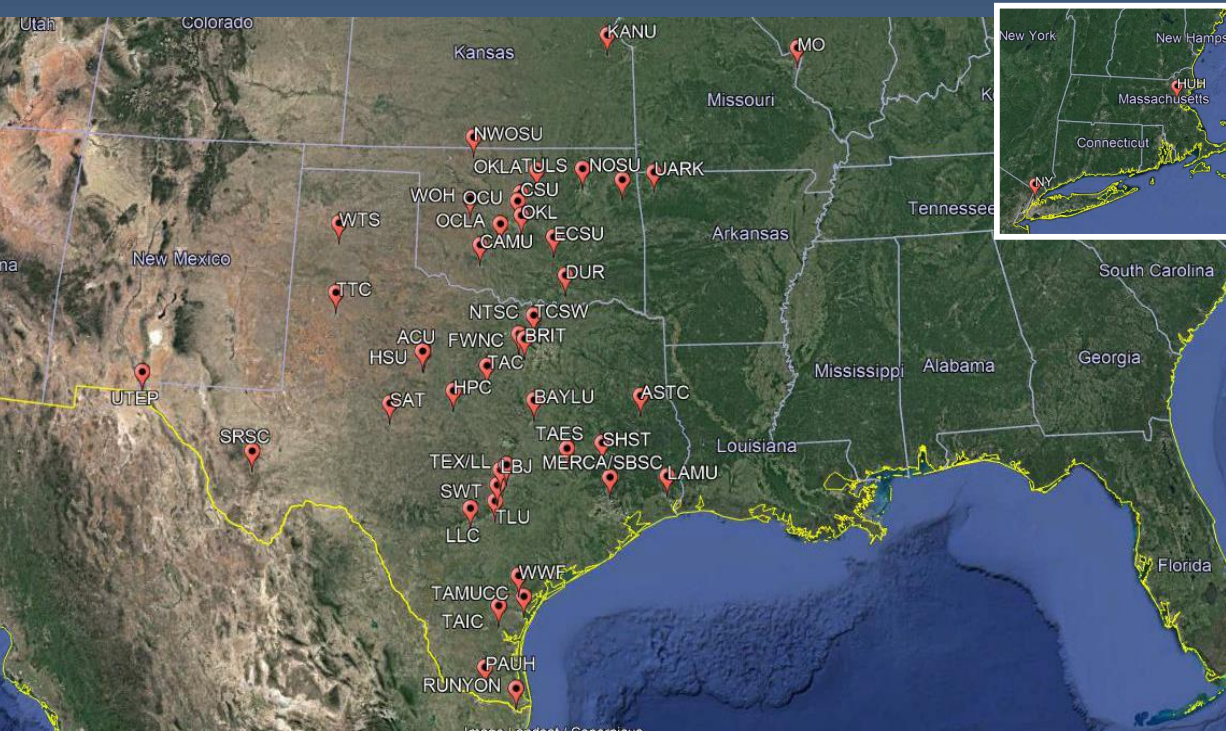
©GoogleEarth

- 4-year grant to digitize almost 2 million specimens collected within these 2 states.

- 1.7 million of these from 41 TORCH herbaria (small, medium, large), and 0.3 million from 5 herbaria outside OK & TX (plus U.S. National Herbarium).

- 5 collaborative leads, 10 subawards, 31 providers

Objectives

- To disseminate the digitized data through our Symbiota portal http://portal.torcherbaria.org

- Develop, implement, and share innovative strategies to increase workflow efficiency (emphasis on automation)

- To recruit and engage students and citizen scientists in project-based broader-impact activities
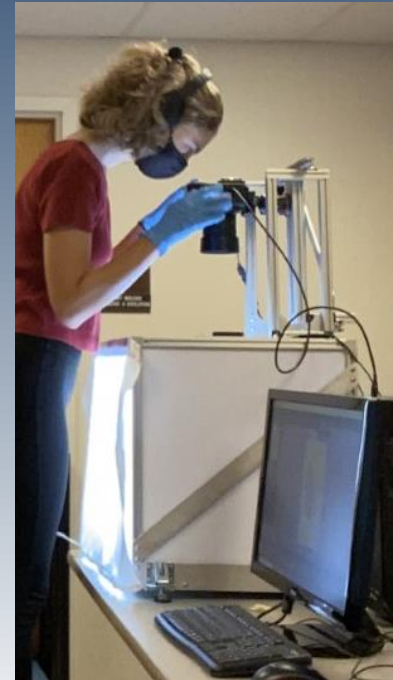
TORCH Web Portal

TORCH Innovations – Imaging Station

- Custom LED lightbox and camera stand developed by Jason Best, TORCH Technological Innovator.
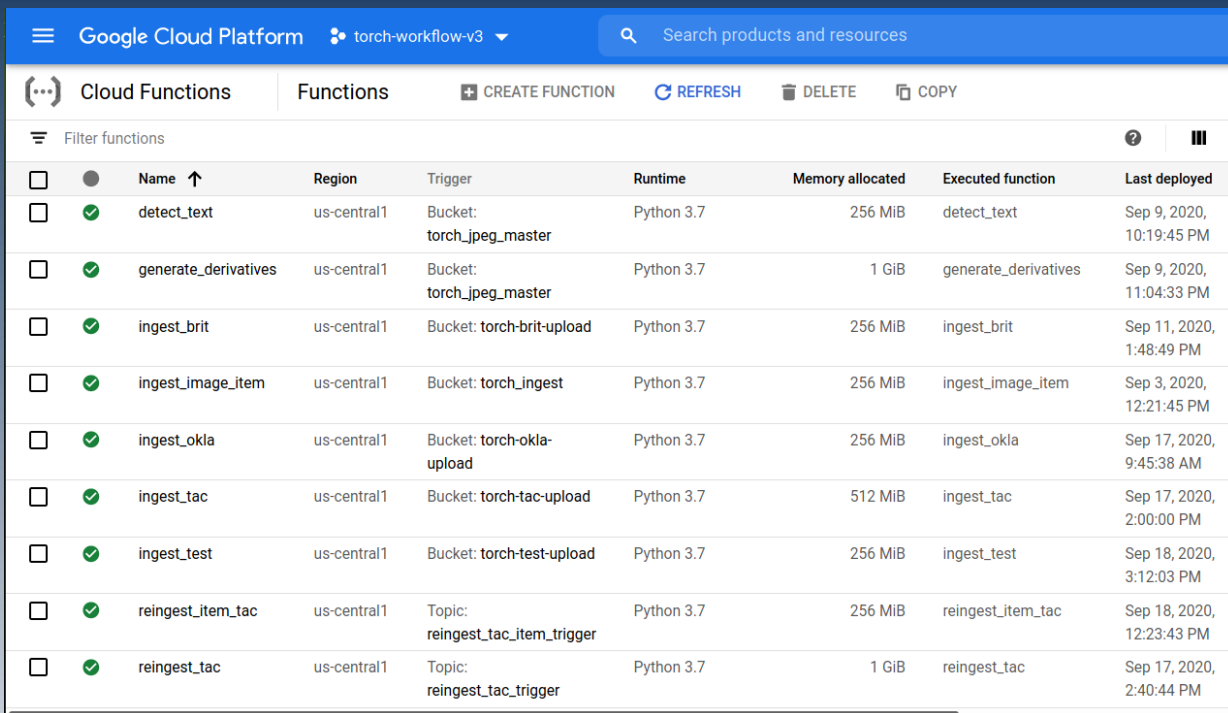
- 2 stations were delivered; 4 more in preparation.

J. Best and D. Rivas assembling lightbox at BRIT

Lightbox in use by S. Hubbard at OKLA

TORCH Innovations – Image Processing

Developed by Jason Best at BRIT; now in production use with images from Tarleton University (TAC), a TORCH data provider.

After user uploads archival JPEGs/DNGs with Filezilla Pro, GCP:

1) Scans barcodes and renames files

2) Generates web derivatives and URLs

3) Performs OCR

4) Ingests and sorts into TACC storage at TEX

TORCH Innovations – Computer Vision for object detection and data extraction (linking legacy databases)
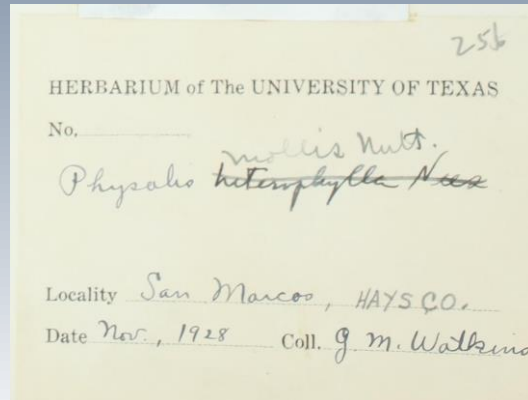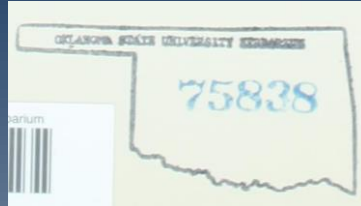
- Tensorflow Model trained on ~50 images per herbarium stamp

- Finds Accession Stamp and Number, barcode, Main Label, Annotation Labels

- OVPD: 380k records; TAES: 233k records

Developed by TORCH Data Manager Clay Barrett at OKLA

TORCH collaboration and Community Engagement

Symbiota Sandbox

Home | Search | Images | Arizona Flora | Vouchered Inventory Example | Interactive Tools | Crowdsourcing Tools

Home >> Collection Search Page >> University of Texas collab with BRIT Details

University of Texas collab with BRIT (TEX4BRIT)

Data Editor Control Panel
- Add New Occurrence Record
- Create New Records Using Image
- Add Skeletal Records
- Edit Existing Occurrence Records
- Add Batch Determinations/Nomenclatural Adjustments
- Print Specimen Labels
- Print Annotations Labels
- Occurrence Trait Coding Tools
- Batch Georeference Specimens
- Loan Management

Administration Control Panel
- View Posted Comments
- Edit Metadata and Contact Information

Notes from Nature
Transcribe museum records!

PROJECT CATEGORY

All | Plants | Bugs | Butterflies | Labs | Magnified

Marine Invertebrates

Active Projects

- 28 TEX students transcribed 27,000 BRIT records, as part of a collaboration between the two institutions during COVID-19 closures. (George Yatskievych & Amber Horning)

- 23 Weekly #TranscriptionThursdays #ArmchairBotanist sessions since WeDigBio Lite in April (Tiana Rehman & Jessica Lane)

- 728 volunteers completed 7,500 record transcriptions in 8 Notes from Nature expeditions (7 BRIT, 1 OKLA)

Broader Impacts: Community Engagement

- Engaging statewide organizations: Master Naturalists, Master Gardeners, and native plant societies, who have an inherent interest in native plants.

- Members are incentivized by: volunteer hours being required for certification; direct interaction with researchers and institutions; individual and group acknowledgment by the community; digital achievement badges; and opportunities for remote work and participation (especially during COVID-19).

- Better accuracy in data transcription, and valuable "boots-on-the ground" experience (beneficial to georeferencing efforts)

Student training opportunities

- 10-week Digitization Internships for 20 undergraduate students (postponed due to COVID-19)

- Projects to be taxon-based or delimited by geographic area, and presented at TORCH meetings each August

- 14 graduate students supported

During Year 1...

- 88 people across 15 different institutions contributed at least 1 person-month's worth of work to the TORCH TCN.

- 80,000 specimens barcoded

- 105,000 specimens imaged (COVID-19 highlighted advantages of first imaging specimens)

- 240,000 new specimen records

- 119,000 records georeferenced

- 18 of 46 participating institutions have a presence on the TORCH Symbiota Portal, contributing a total of 2.37 million records (72% with images, 30% with geocoordinates), including 722,000 from Texas and Oklahoma.

Thanks to:

 National Science Foundation

Integrated Digitized Biocollections

Lead and Subaward PIs

Staff and Student Digitizers

Volunteers

Ed Gilbert (Symbiota help)