



Decision Support for Nature-Based Solutions

Trinity Floodplain Prioritization Tool

Urban Riparian Symposium

February 2025



TRINITY RIVER IN DALLAS, TEXAS @JUSTIN TERVINE



Justin Kozak, PhD, CFM
Nature-Based Solutions Project Manager

The Nature Conservancy

Founded in 1951, The Nature Conservancy (TNC) is a non-profit conservation organization partnering with communities in more than 70 countries to create a world where people and nature thrive.

Our mission is to protect the lands and waters on which all life depends.

TNC recognizes that **natural infrastructure and nature-based solutions** are important tools for addressing interconnected challenges to benefit people and the environment.



CHRISTMAS BIRD COUNT MAD ISLAND MARSH PRESERVE © KARINE AIGNER

Outline

- A Brief Primer on Nature-Based Solutions (NBS)
- A Very Brief History of NBS and FEMA
- NBS and State and Regional Flood Planning
- Trinity Floodplain Prioritization Tool

A Brief Primer on Nature-Based Solutions

NBS: An umbrella concept

- Best Management Practices
- Green Stormwater Infrastructure
- Complete/Green Streets
- Low Impact Development
- Conservation Development
- Natural and Nature-Based Features/Engineering with Nature



SINGAPORE. [HTTPS://WWW.BIOPHILICCITIES.ORG/SINGAPORE](https://www.biophiliccities.org/singapore)

NBS: A Definition

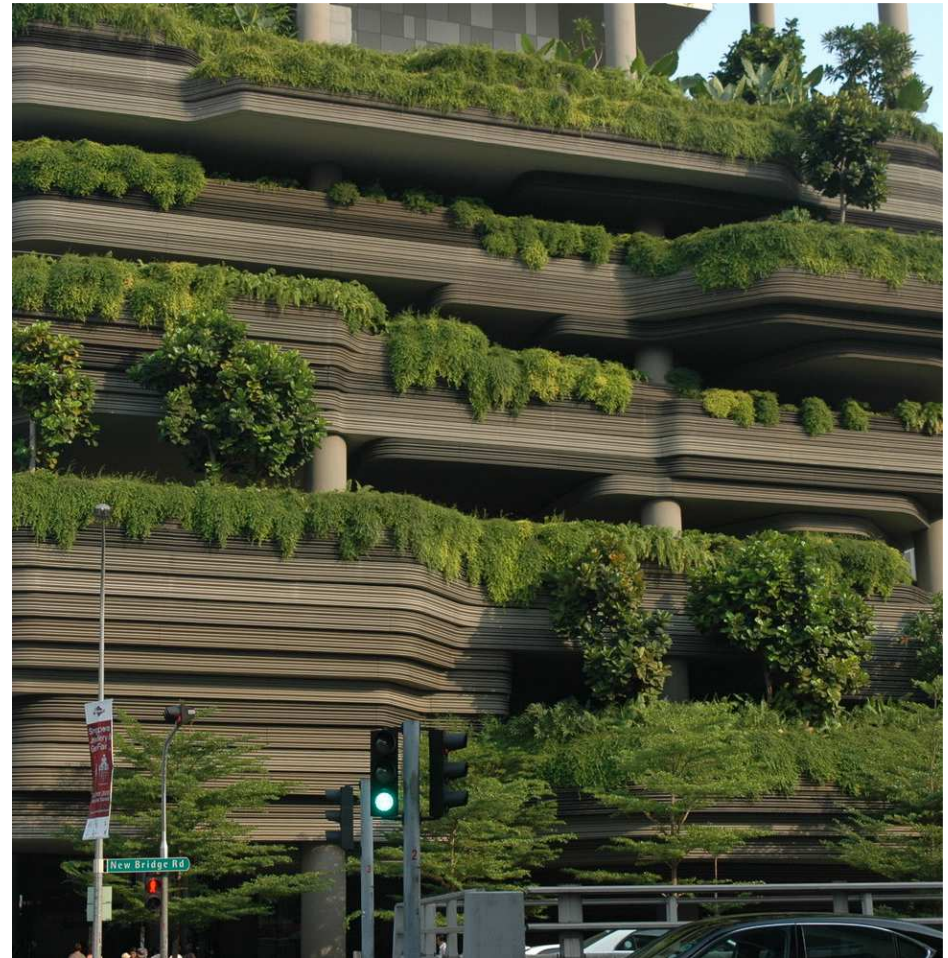
Working Definition: **Nature-Based Solutions for Flood Resilience in Texas Guidance Manual**

Using or imitating natural features or processes to increase resilience while providing sustainable benefits to people and the environment

Using nature to solve problems and help people

What kind of problems?

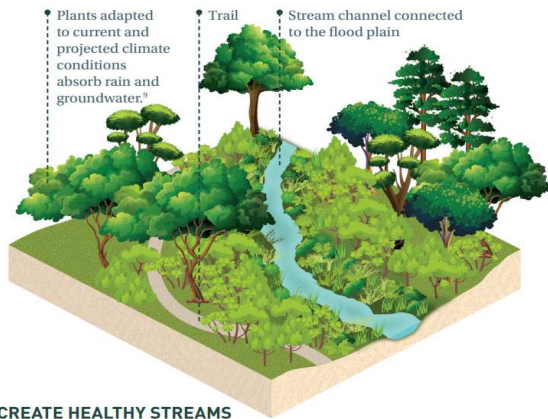
- Urban heat
- Drought
- Water quality
- Water quantity (Supply)
- Water quantity (Flood)
- Air quality
- Physical health
- Mental health



[HTTPS://WWW.BIOPHILICCITIES.ORG/SINGAPORE](https://www.biophiliccities.org/singapore)

NBS Types: FEMA

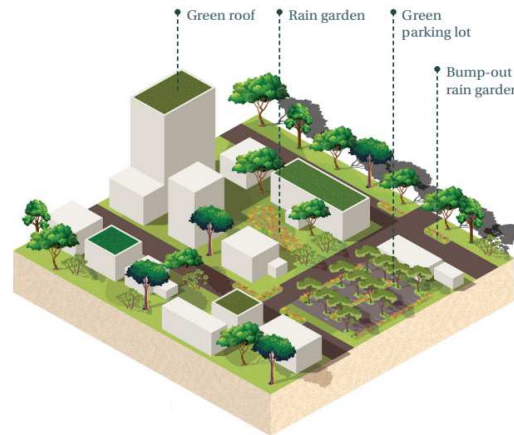
Watershed



Interconnected systems of natural areas and open space

Larger in scale

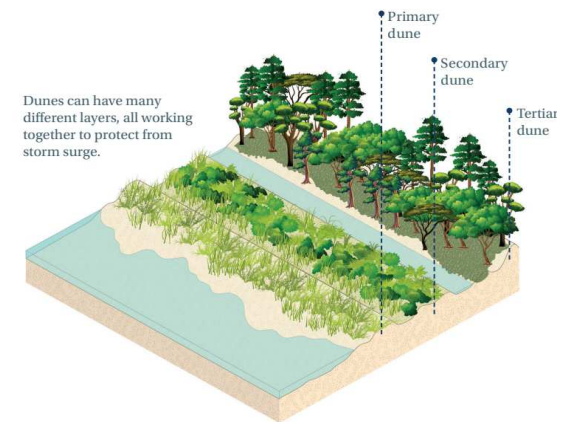
Neighborhood



Manage rain where it falls to reduce stormwater runoff

Often built into a site or neighborhood without extra space

Coastal



Buffers the coast from storm impacts & designed to support coastal resilience

Stabilize shorelines & reduces erosion

Why NBS?

Ability to provide communities with multiple benefits

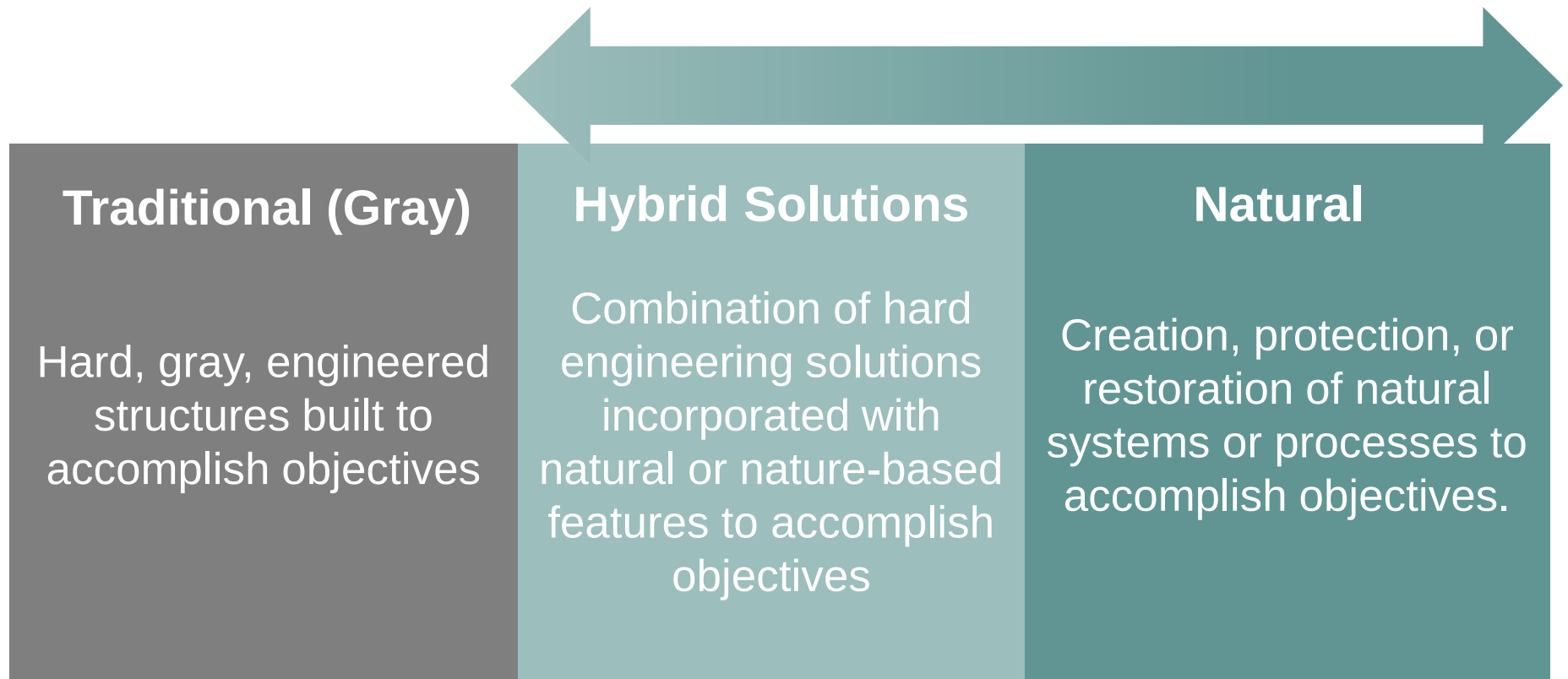
- Air and water quality
- Infiltration
- Mental and physical health
- Recreation
- Habitat and biodiversity
- Flood mitigation/resilience
- Aesthetics/beauty
- Social cohesion

Not an NBS!!!!



Source: Brian van der Brug / Los Angeles Times

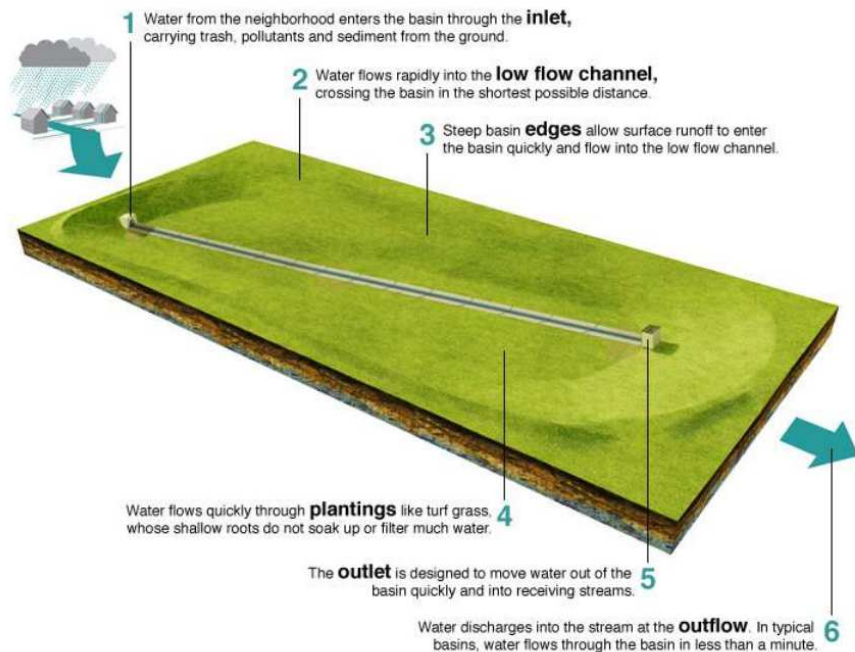
NBS Spectrum



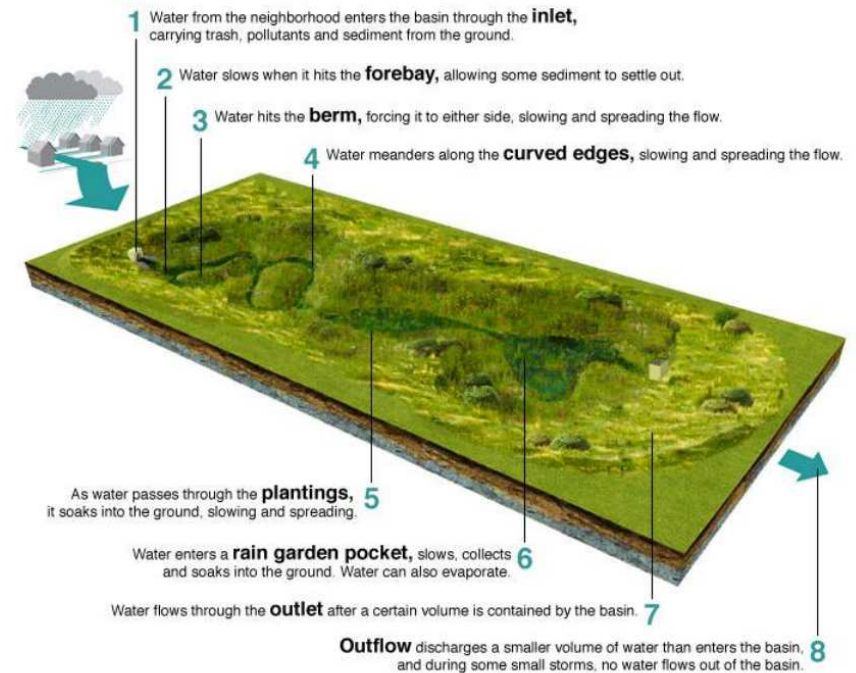
Adapted from the International Guidelines on Natural and Nature Based Features for Flood Risk Management

Hybrid Solution Example

What Happens to Stormwater in a *Typical* Detention Basin?



What Happens to Stormwater in a *Retrofitted* Detention Basin?



A Very Brief History of NBS and FEMA

NBS and FEMA

The valuation of ecosystem services (benefits from nature) has been institutionalized

- 2013 – Issues first “ecosystem services policy”
- 2016 – Expanded policy to new ecosystem types, new eligible mitigation actions
- 2020 – Projects can pass BCA on ecosystem service values alone
- 2022 – Updated ecosystem service values based on land cover type



TRINITY RIVER IN DALLAS, TEXAS @JUSTIN TERVINE

Real Benefits: FEMA BCA Toolkit

Standard Benefits – Ecosystem Services

Total Project Area (acres or sq.ft):

0

Use Acres? ☒ Yes

Enter the percent land use of the project area below:

Urban Green Open Space (%):

Rural Green Open Space (%):

Riparian (%):

Coastal Wetlands (%):

Inland Wetlands (%):

Forests (%):

Coral Reefs (%):

Shellfish Reefs (%):

Beaches and Dunes (%):

Expected Annual Ecosystem Services Benefits (\$):

2022 Proposed Values

Land Cover Category	Value (2021 USD/acre/year)
Forest	12,589
Urban Green Open Space	15,541
Rural Green Open Space	10,632
Riparian	37,199
Coastal Wetland	8,955
Inland Wetland	8,171
n/a*	n/a
Coral Reefs	7,120
Shellfish Reefs	2,757
Beaches and Dunes	300,649

FEMA Ecosystem Service Value Updates

June 2022

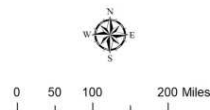
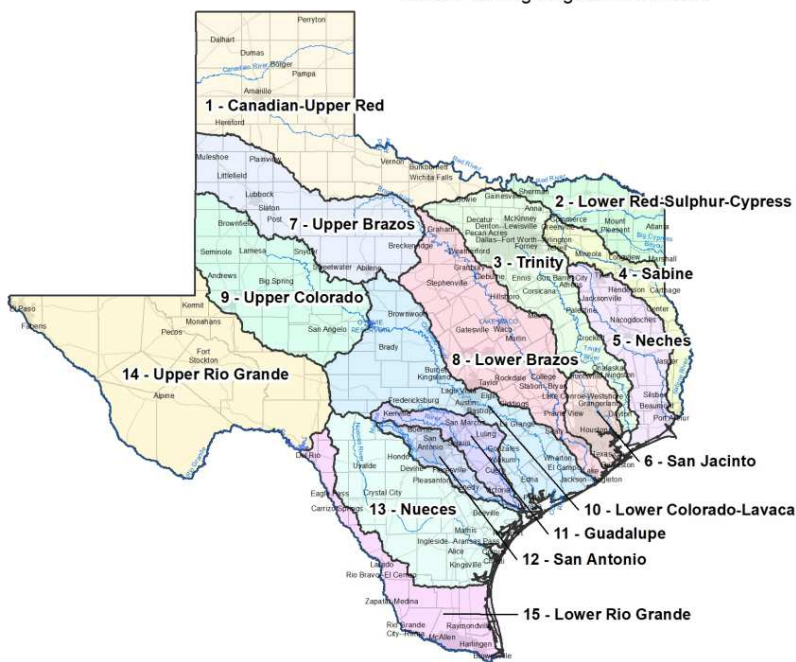
 FEMA

https://www.fema.gov/sites/default/files/documents/fema_ecosystem-service-value-updates_2022.pdf

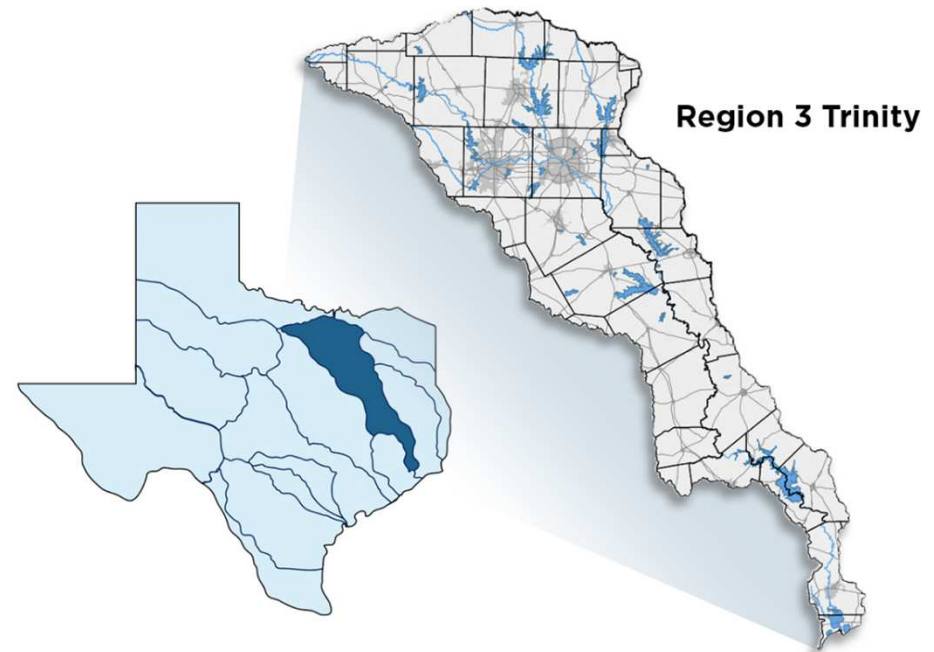
State and Regional Flood Planning

Texas Flood Planning- Flood Infrastructure Investment

Flood Planning Region Boundaries



Texas Water
Development Board



*** A shortage of NBS projects ***

NBS in State Flood Plan and Flood Infrastructure Fund

Flood Mitigation Project (FMP) Ranking Percent Weight relevant to NBS:

- Percent Nature-Based Solutions (by cost):
 - 5%
- Water Supply Benefit (Y/N)
 - 5%
- Multiple Benefits
 - 2.5%
- Environmental Benefits
 - 2.5%

Nature-Based Flood Risk Reduction Solutions in the State Flood Plan:

- FMP: 8 projects
- FME: ~15 projects
- FMS: ~80 projects

Trinity Floodplain Prioritization Tool

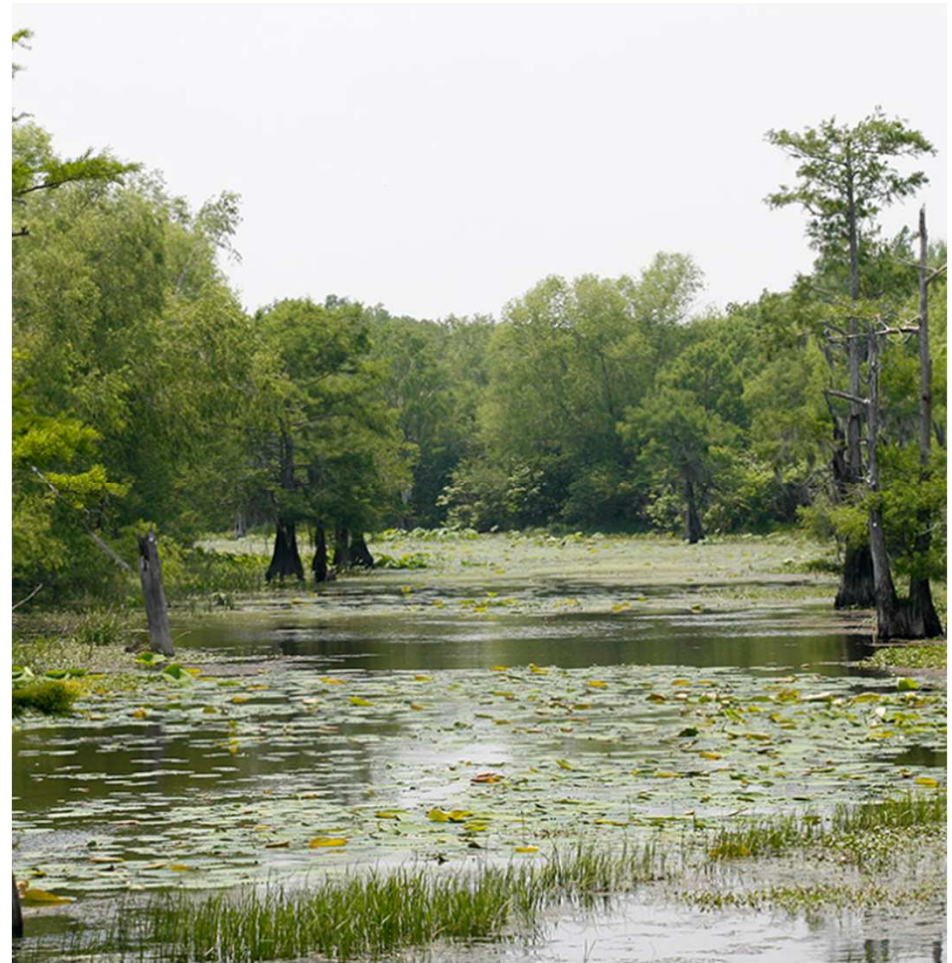
Floodplains for Resilience

“Floodplains are among the most diverse, dynamic, productive and populated but also the most threatened ecosystems on Earth.”

~Schindler et al. *Environmental Evidence*. 2013.

Floodplains provide:

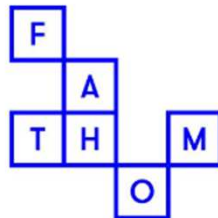
- biodiversity & habitat connectivity
- recreational corridors
- nutrient reduction and filtration
- reduced flood risk
- improved flood storage capacity and infiltration
- delay flows
- “room” for the river



FLOODPLAIN PRIORITIZATION TOOL

The Nature Conservancy developed the new Floodplain Prioritization Tool (FP Tool) to identify critical opportunities for floodplain conservation and restoration in the Mississippi River Basin. Working with data developed by the Conservancy and provided by several partners, the FP Tool is designed to help identify places where these actions would have the greatest impact on the overall health of this iconic river system. This first-of-its-kind tool is interactive, web-based and designed to help decision-makers—like federal, state and local governments, county planners, land trusts, and businesses—optimize their conservation and restoration investments and minimize the impacts of development. For the portfolio of priority sites identified throughout the basin, the Floodplain Prioritization Tool allows stakeholders to identify priorities and assess tradeoffs related to nutrient removal, wildlife habitat, flooding and other goals.

The applicability of this new tool is important because floodplains are incredibly [hard-working ecosystems](#) that can improve water quality, reduce flood impacts, provide critical wildlife habitat and enhance recreational opportunities. But tens of millions of acres of floodplains across the Mississippi River Basin have been developed or converted to agriculture. These changes in land use have degraded water quality, increased flood impacts, and diminished habitat for fish and wildlife, all of which takes a toll on the economy and the quality of life for people.



About the Floodplain Prioritization Tool

Mississippi River Basin Floodplain Tool

[Who is it for?](#)

[Launch the FP Tool \(IE not supported\)](#)

[Fact Sheet](#)

[Feature Story](#)

[Coverage Map](#)

[The Value of Floodplains](#)

[User Training Video](#)

[Technical Specifications & Data Layers](#)

[Email TNC's Kris Johnson](#)

[Media Info](#)

Lower Meramec River Floodplain Tool

[Launch the FP Tool \(IE not supported\)](#)

Western Tennessee Floodplain Tool



SILVER JACKETS

Many Partners, One Team

Silver Jackets are Interagency Teams that Facilitate Collaborative Solutions to State Flood Risk Priorities.

State-led Silver Jackets teams exist in all states and several territories, bringing together multiple state, federal, and sometimes local agencies and Tribes to learn from one another and work together to reduce risk from floods and sometimes other natural hazards. Silver Jackets teams conduct diverse collaborative efforts.

[Silver Jackets Website](#)

[Texas Silver Jackets](#)





ERDC scientists help create man-made ecosystem with "wild" results

By **Jim Frisinger, Fort Worth District** / U.S. ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT

Published Aug. 28, 2013



Lynde Dodd, Research Biologist,
US Army Engineer Research and
Development Center, Lewisville Aquatic
Ecosystem Research Facility



Ecosystem restoration reverses 160 years of habitat decline

Story & photo by Jim Frisinger
USACE, Fort Worth District

Lynde Dodd, a research biologist for the Environmental Laboratory, U.S. Army Engineer Research and Development Center, still recalls her summer bike three years ago. She walked drainages between subdivisions in Frisco, a booming suburb, conducting a pre-construction vegetation survey.

The first settlers to the Peters Colony 160 years ago encountered bison and a vibrant prairie. It spread across rolling hills that overlook rich North Texas riparian bottomlands. This Blackland Prairie "once exploded with a riot of colorful wildflowers and grasses," wrote Matt White, author of *Prairie Time*. "From flowers that bloomed barely above the ground to others 10 feet or more in height, the variety of plant life that existed within just a few feet was remarkable."

Dodd took note that many species once common 160 years ago were missing: blackjack oak, red oak, pecan, bur oak and red mulberries. Their fruits and nuts sustain wildlife in a healthy, diverse ecosystem.

Her team found only small patches of Blackland Prairie species, big and little bluestem, black-eyed Susans, side oats grama and snow on the prairie. Powerful invasive species Johnsongrass, giant ragweed and chestnut had moved into the area as ecological disturbances occurred, replacing many of the Texas natives.

Settlers and ranchers share some of the blame by clearing lands and building log homes.

The Corps of Engineers imposed the Elm Fork to create Lewisville Lake for water supply and to reduce flood risk.

Dodd said the surviving trees were "disturbance specialists," cedar elm, green ash and sugarberry, that can survive lake flooding.

With little quality wetland acreage available, migratory waterbirds were few.

Jim Giovenone of the American Bird Conservancy said habitat loss throughout the Central Flyway hurt bird breeding. But rather than just charting decline, Dodd and her colleagues were the vanguard for a turnaround.

The City of Frisco and USACE, Fort Worth District staged an environmental reveal along more than 200 acres of Stewart and Hackberry creeks in partnership under Section 1133 of the Continuing Authorities Program. The national program helps habitat recover from the impact of Corps of Engineers projects, such as Lewisville Lake.

For George Purcify, Frisco city manager, the project would take a slice of suburban environment back to its past glory.

For the first time, the city could connect to outdoor recreation at Lewisville Lake. It would help achieve Frisco's vision to have a natural greenway cutting across the city from the northeast to the southwest.



Lynde Dodd and her team of biologists assess plant and wildlife along the shoreline before re-introducing missing or scarce native plants.

USACE Environment

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17

- Continuing Authorities Program (CAP)
- USACE partners with Non-Federal Sponsors (NFS - local governments or agencies) in Floodplain Management and Aquatic Ecosystem Restoration (AER)
- Leverage the many co-benefits of NBS while improving ecosystem health

TRINITY RIVER FLOODPLAIN TOOL

Photo Credit: Robert J. Hurt

The Trinity River Basin, with nearly 11 million acres of land and over 715 river miles, is the largest river basin that begins and ends in Texas and the most populous basin in the state. The Trinity – called the Arkikosa by the Caddo peoples – serves as the water source to more than half of all Texans; water from the Trinity Basin drains into the Galveston Bay estuary system, considered one of the most productive ecosystems and commercial fisheries in the nation. The basin includes five major Texas ecoregions, from the Cross-Timbers and Blackland Prairie in the upper portions, through the Post Oak Savannah and Piney Woods in the middle section, to the Coastal Prairies and Marshes along the Gulf coast. Floodplain protection and restoration is an important strategy for supporting the health and resilience of communities and ecosystems in this important basin and the Gulf of Mexico.

The Trinity Floodplain Prioritization Tool is designed to help identify key opportunities for floodplain protection and restoration in the Trinity River Basin. Users are able to specify criteria related to water quality, wildlife habitat, carbon storage, current and future flood risk, and current and projected land use characteristics. The map changes in response to the user selections to identify sites that meet all the selected criteria and help identify the geographies where floodplain conservation is likely to have the greatest positive impact for the conservation and community priorities selected.

About the Floodplain Prioritization Tool

Mississippi River Basin Floodplain Tool

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[Technical Specifications & Data Layers](#)



Since 2020, TNC and the USACE Silver Jackets, Fort Worth District (USACE-SFW) have collaborated with Trinity Basin stakeholders to support the protection and restoration of greenspace in the floodplain.

Goals:

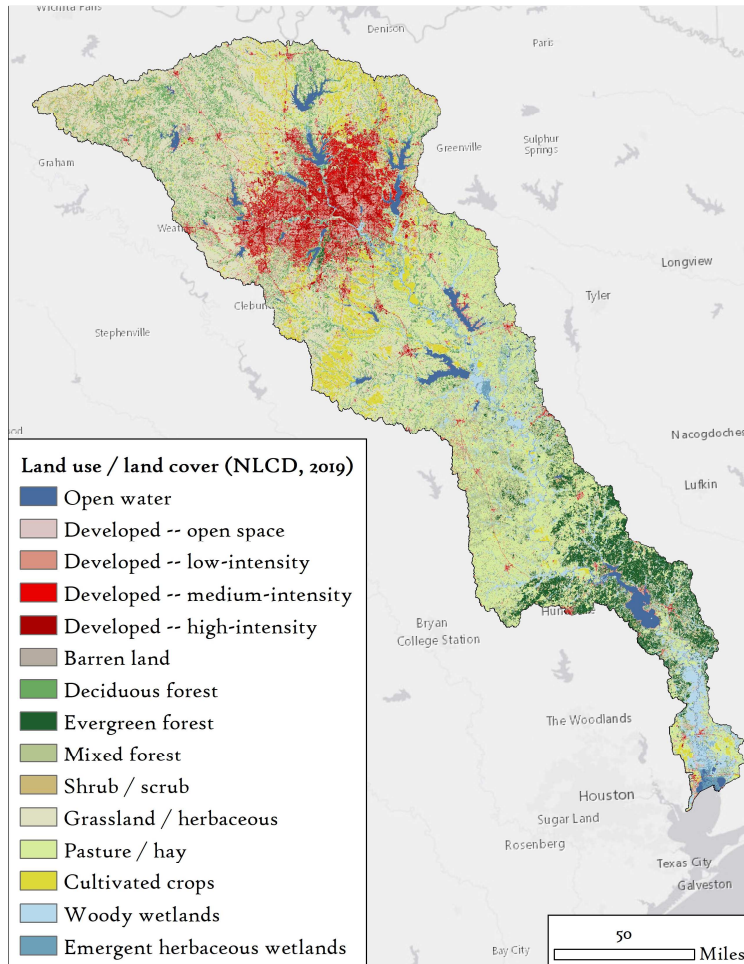
- Identify priority conservation opportunities in the floodplain to reduce flood risk and improve biodiversity, water quality, and additional community benefits.
- Garner largescale investment in floodplain protection and restoration projects and other NBS.



Trinity River Basin

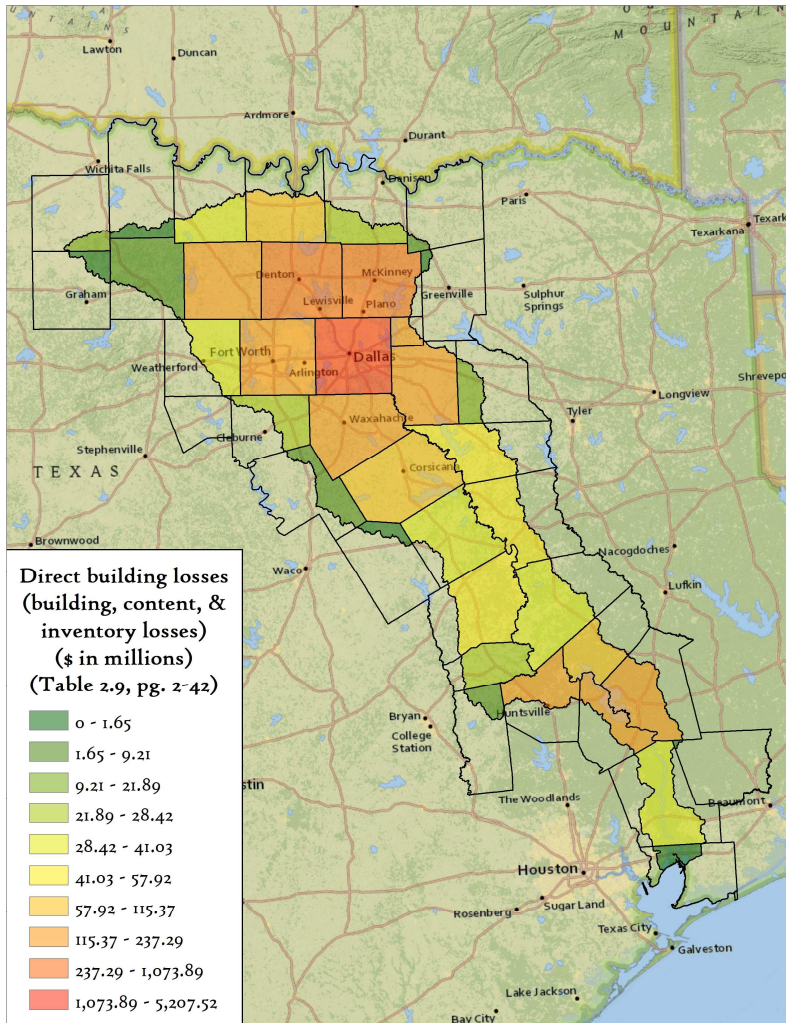


- 715 river miles.
- The largest river basin beginning and ending in the state of Texas.
- It drains more than 18,000 sq. miles from its headwaters in North Texas to Galveston Bay and estuary system—"one of the most productive ecosystems and commercial fisheries in the United States."



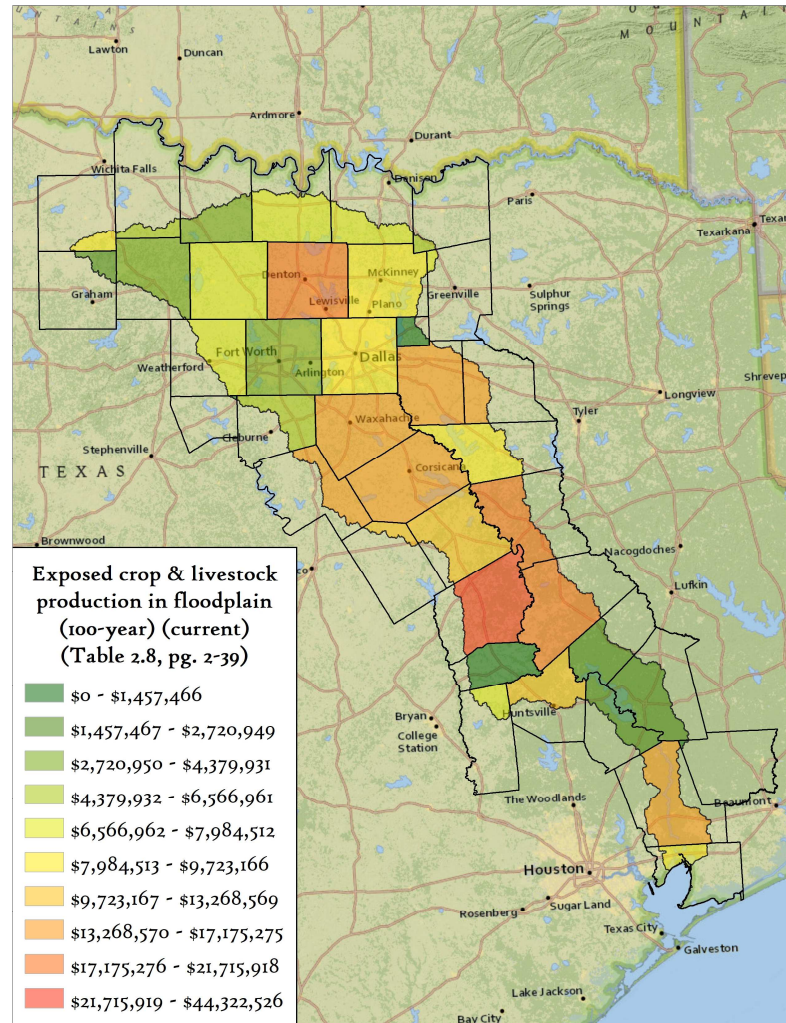
- Is home to the fastest growing metropolitan areas in the U.S.
- Provides drinking water to more than 50 percent of Texans, serving both Dallas-Fort Worth and Houston.

Flood Related Building Losses (\$M)



ADAPTED FROM TWDB DATA

Exposed crop and livestock production in floodplain (\$M)



Experiences
substantial flood
related losses

PHASE 1- TOOL BUILDOUT & REGIONAL FLOOD PLANNING (Fall 2021- Summer 2023)

- Spring 2020/Fall 2021- Convene core partners and fund.
- February- July 2022- Discovery: 11 small focus group sessions with Silver Jackets project partners and other regional stakeholders to inform data and tool development to build out the GIS based tool to support regional goals.
- August 2022- February 2023- Tool buildout
- Summer 2023: Revise tool based on feedback from regional stakeholders
- Winter 2023/24: Tool publicly available on the Freshwater Network

Trinity Floodplain Prioritization Tool



Trinity Floodplain Prioritization Tool

The Trinity Floodplain Prioritization Tool (FPPT) is designed to help identify key opportunities for floodplain protection and restoration in the Trinity River Basin. Use the selector widgets below to specify criteria related to current and future flood risk, current and projected land use characteristics, water quality, wildlife habitat, and carbon storage. The map on the right will change in response to your selections to identify sites that meet all the selected criteria and help identify the geographies where floodplain conservation is likely to have the greatest positive impact for the conservation and community priorities selected.

Identify Floodplain Units

Select Flood Frequency

1-in-5-year

1-in-100-year

1-in-500-year

View Floodplains By Watershed Size

HUC-8

HUC-12

Catchment

Watershed Opacity

Filter Floodplain Units

Download Selected Data

Save and Share

Reset Filters

Available Floodplain Area

☐ Available floodplain area for the currently specified flood frequency

0 to 100,000 acres

☐ Available unprotected floodplain area for the currently specified flood frequency

0 to 100,000 acres

Water Quality & Soils

☐ Nitrogen yield to local

0 to 100

- **Water Quality & Soils** (N, P, Sediment yield, 303d listed segments)
- **Habitat** (Terrestrial, freshwater, resilience, connectivity)
- **Carbon Storage** (above, below ground)
- **Flood Risk- Community** (current/future population exposure, building losses, SVI)
- **Flood Risk- Agriculture** (% floodplain in crop or pasture, in area of high current/future losses)
- **Development pressure** (in floodplain, in watershed)
- **Supporting overlays** (land cover, floodplain, priority conservation areas, development pressure, flood losses, exposure)

**data in parentheses is partial layer list*



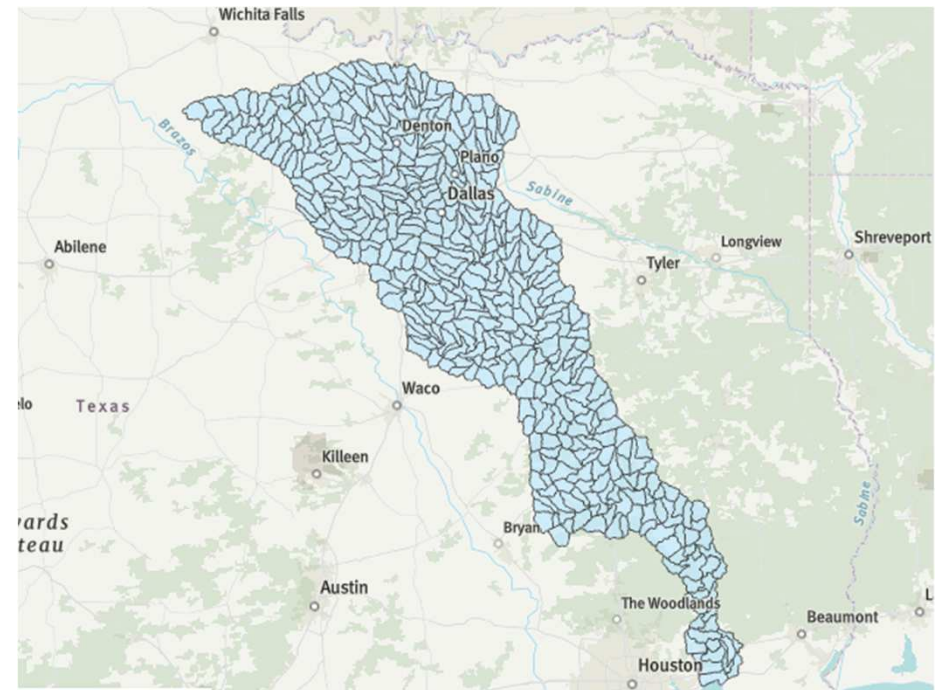


Use Case– Section 1135 Environmental Restoration

Section 1135 – Environmental Restoration - What areas may be available to protect or restore to improve aquatic habitat that could be funded by cost-share in Upper Trinity River Basin?

Criteria:

- *Available unprotected floodplain* within watershed *near protected land* (possibly USACE adjacent) in *5-year flood* frequency that potentially contributes to *sediment loading* to USACE project (reservoir).
 - ☒ 1 in 5 yr.
 - ☒ HUC 12
 - ☐ Available floodplain area, unprotected
 - ☐ Suspended sediment yield
 - ☐ Connectivity
- Possesses community flood risk reduction potential (NFS co-benefits)
 - ☐ Population exposure (current and 2050)
 - ☐ Expected to experience increased developmental pressure
- Supporting Layers
 - ☐ 5-yr
 - ☐ 100-yr
 - ☐ Protected areas



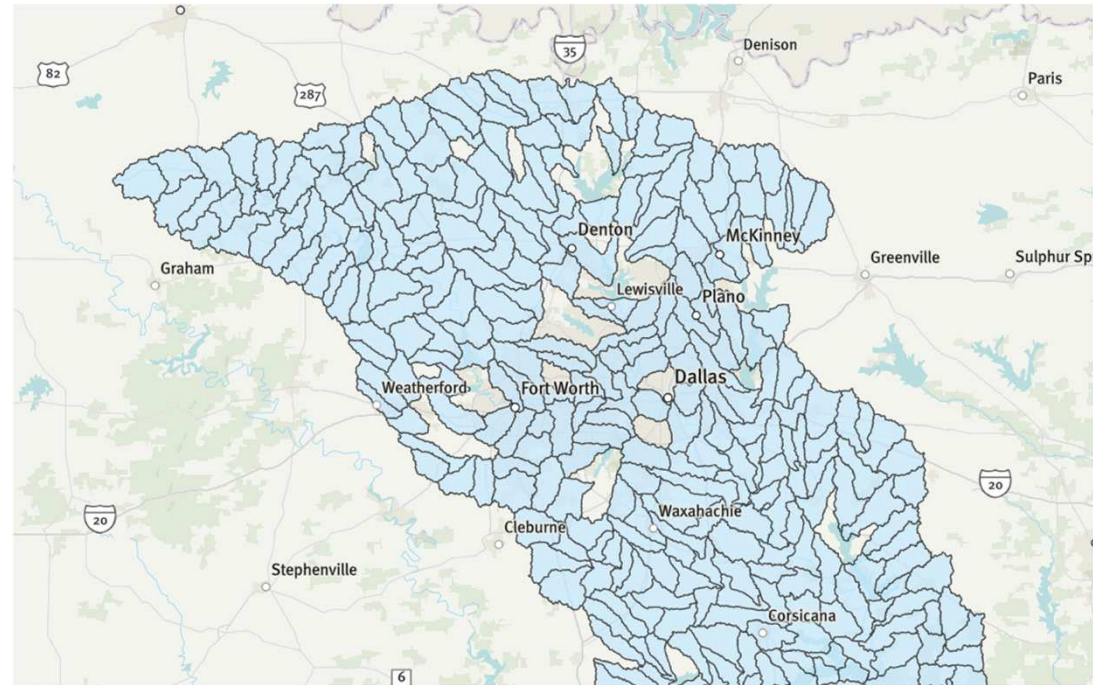


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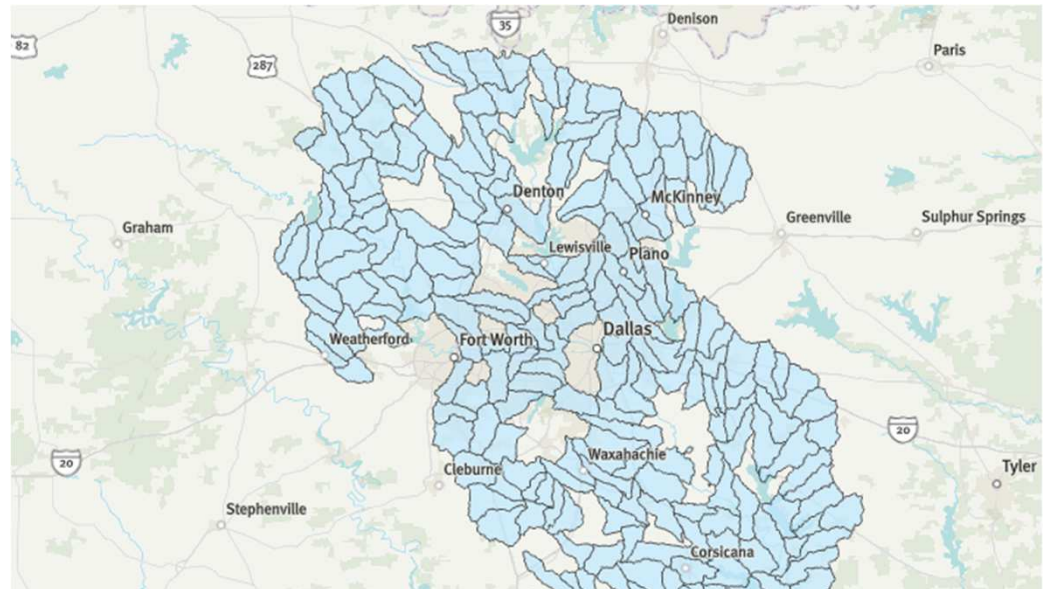


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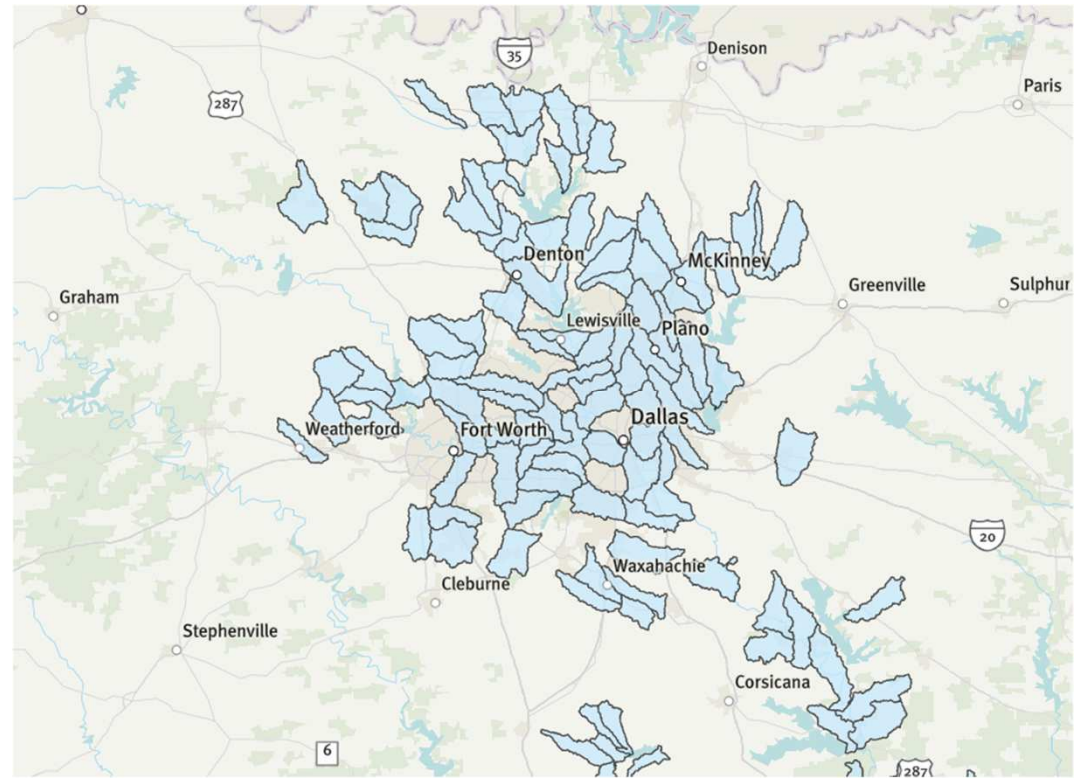


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 - ☒ HUC 12
 - ☒ Available flood plain area, unprotected **>100 acres**
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 - ☒ Connectivity **> 1 acre**
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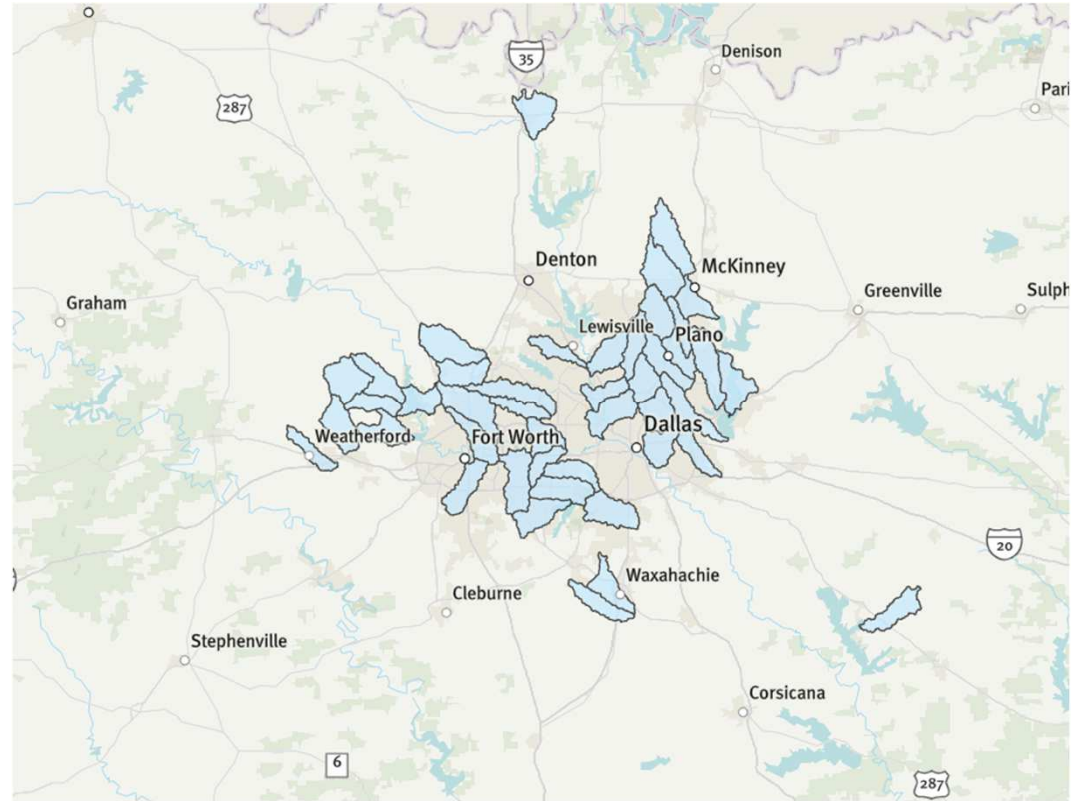


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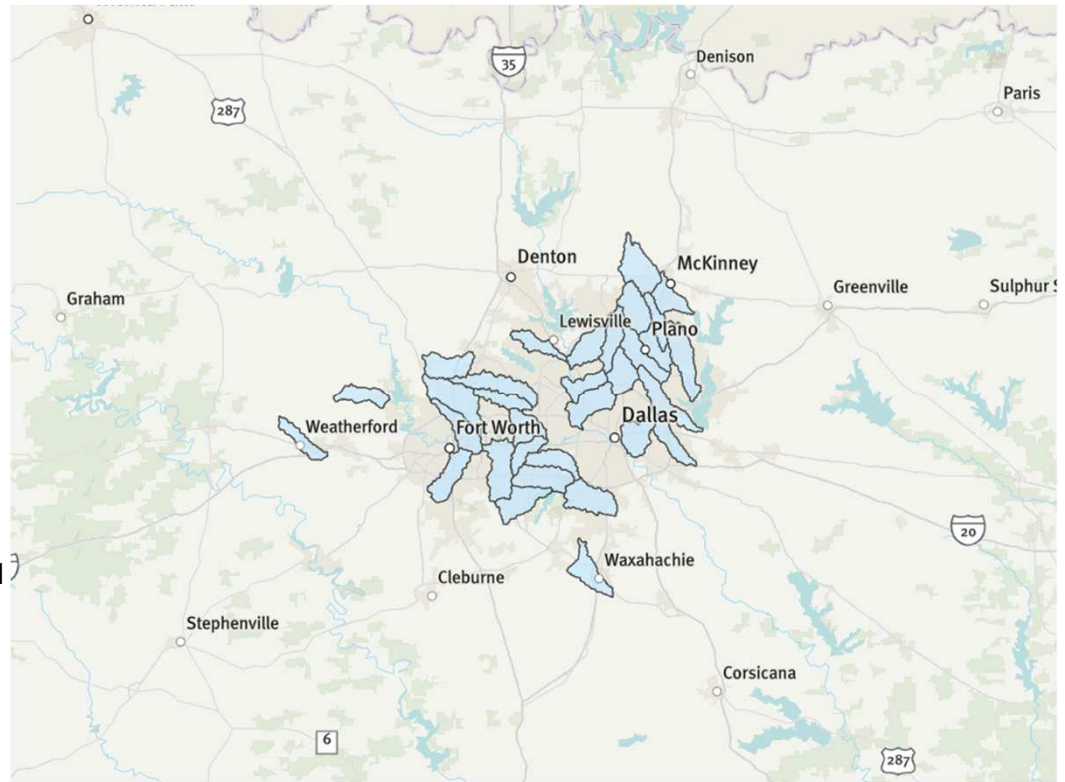


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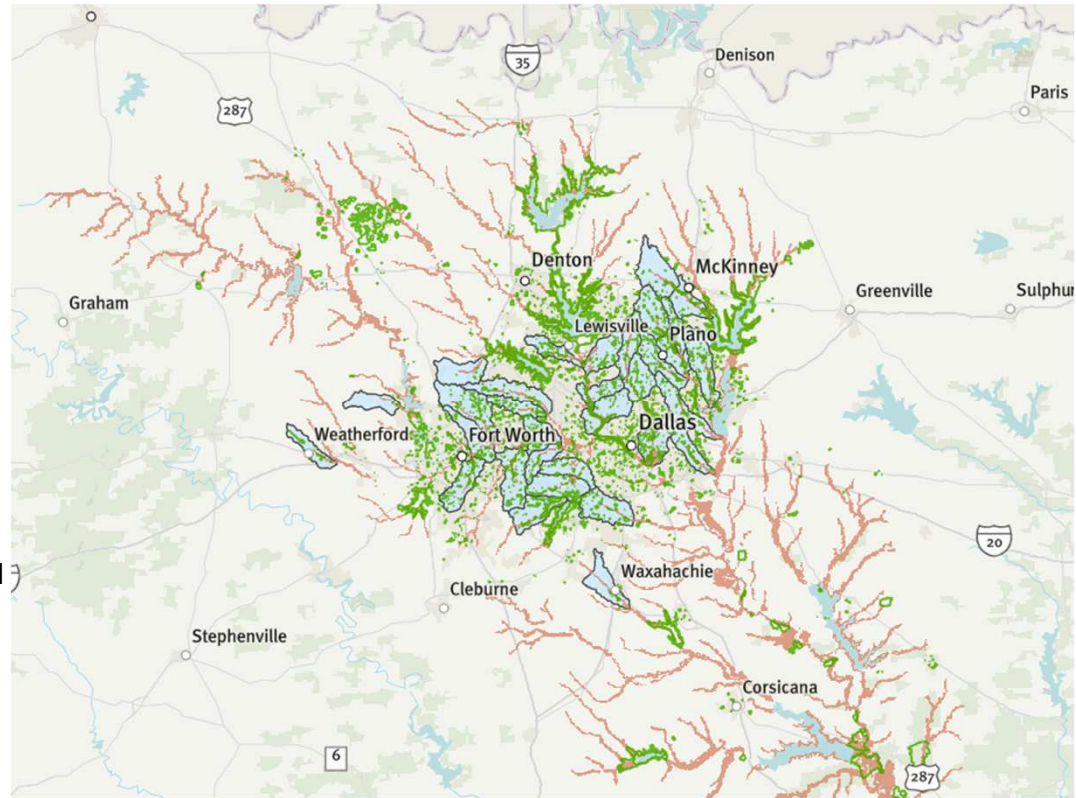


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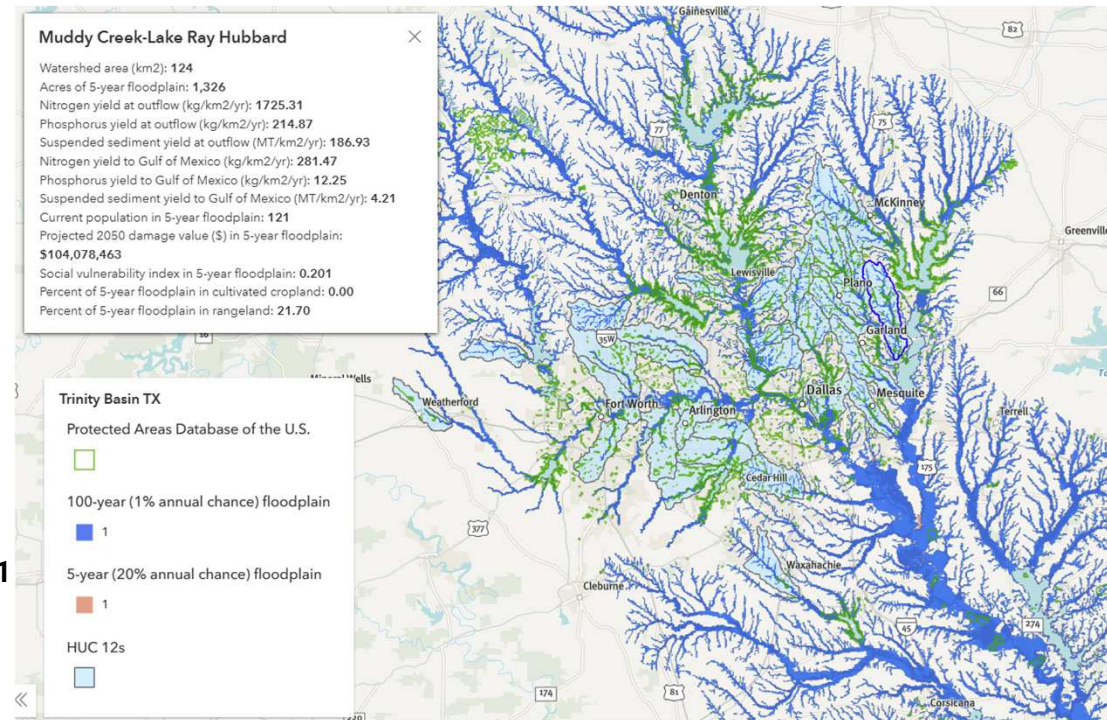


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 - ✓ Protected areas



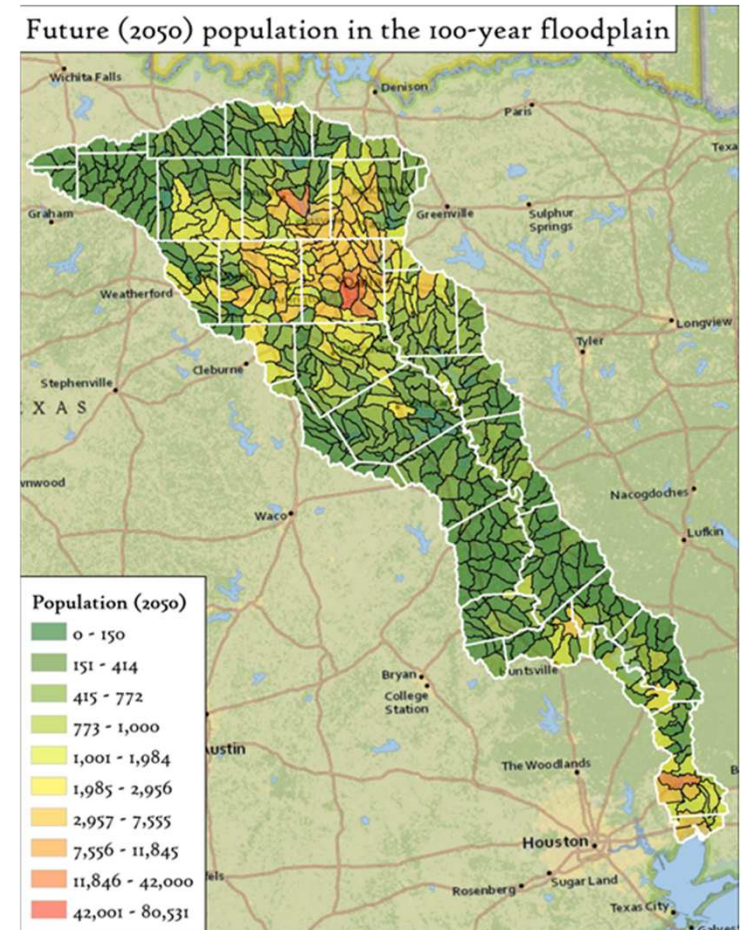
Next Steps



Includes adaptation of TNC's Floodplain Prioritization Tool (FPPT) to the Trinity Basin: [Trinity Floodplain Prioritization Tool](#)

Inform Regional and State Flood Plan investment

Stakeholder planning to prioritize, evaluate, and prepare a portfolio of NBS for implementation



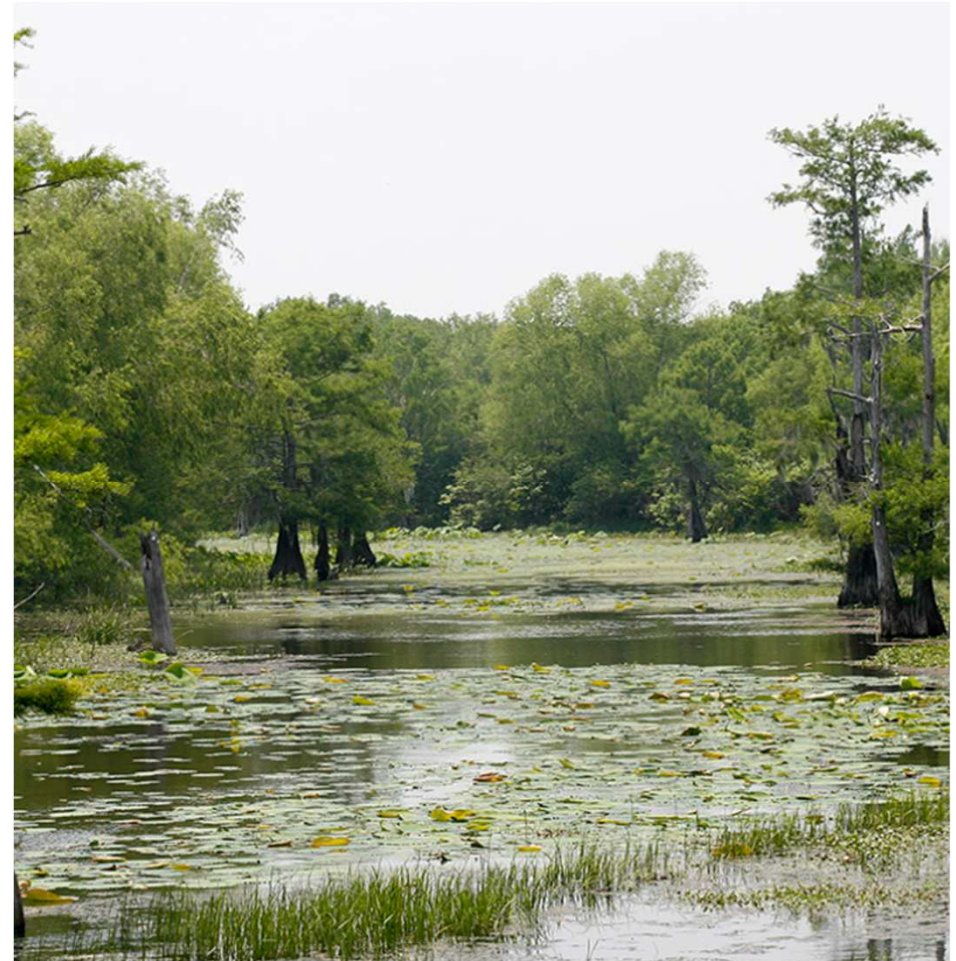
Stakeholder Planning & Project Development

~Share with stakeholders to encourage on the ground investment.

~Stakeholder planning to prioritize, evaluate, and prepare a portfolio of NBS for implementation.



<https://nature.org/suns>





Thank You

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