Flood Protection and Ecosystem Restoration in an Urban Environment: The Dallas Floodway Extension, Dallas, TX

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What we want is to integrate functionality with infrastructure.

**Ecosystem restoration**

**Flood protection**

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**Definition of USACE Ecosystem Restoration?**

“Ecosystem restoration is the process of assisting in the recovery of ecosystems that have been degraded, damaged, or destroyed and focuses on establishing the ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions.”

**Focus?**

“The focus of the Corps ecosystem restoration program is on water-related ecosystem projects, including restoration of wetland, riparian and aquatic systems.”
Major Challenges to Aquatic Ecosystem Restoration in an Urban Environment

Aside from reliable funding sources to forming partnerships that work

- Hydrology - we need water, but not too much!

- Compatible floral associations that promotes desirable vegetation in an urbanized floodplains that provide the sustainable ecosystem goods and services we desire

- O&M – operations and maintenance
Overcoming Challenges* to Aquatic Ecosystem Restoration in an Urban Environment

- Defining project goals - include realistic objectives and performance measures that work with the hydrology of the project
- Involving ALL the stakeholders throughout planning, implementation, and monitoring
- Adaptive Management - this approach incorporates flexibility into project management and provides an avenue to accomplish those realistic goals and objectives; QA/QC during monitoring

*Lessons Learned
Overview - The Dallas Floodway Extention

- Component of the Dallas Floodway Project located within the Trinity River Basin in North Texas
- General Investigation authorized in 1965 by Section 301 of the Rivers and Harbor Act authorized; modified by Section(s) 351/356 of Water Resources Development Act(s) of 1996/1999; construction began 2001
- Amended to include environmental & recreational components
- Sponsor: City of Dallas, Texas; Fort Worth District requested assistance from Engineer Research and Development Center
- Focus areas: Flood protection, Ecosystem Restoration, Recreation
The Dallas Floodway Extension

Purpose: provide overbank flowage capacity for Trinity River flood waters, ensuring reduced flood risk to the City of Dallas

South Dallas flooding in 1989
Dallas County, TX
Pop.: 1.714 million (1984)*

Image: GE 1984

Trinity River:
710 mi.
4 forks
18K mi²

Trinity Bay

*US Census Bureau
The Dallas Floodway Extension
Project Components

- Flood control – levees = ~3.7 miles
- Contiguous chain of constructed emergent wetlands with adjacent grasslands (~271 acres); replace woody with herbaceous plants
  - 9 wetland cells; ~6-20 ac. each
  - ~123 ac. emergent wetlands; ~45 ac. open water; ~102 ac. grasslands
- Wetlands provide quality habitat during periods of no-flow – 95% of the time
- Recreation
  - Tie-ins to existing/proposed trails (keeps stakeholders engaged)
Dallas Floodway

1950s

Trinity River channelized

Mowed regularly to deter woody vegetation; turf grass dominated vegetation

*Image credit: Jon Loxley, COE-SWF
Dallas Floodway Extension
Chain of Wetlands

Dallas Floodway

I-45

Google Earth

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Trinity River during an overbanking event
Design and Function - Wetlands

- What does an aquatic plant want?
  - Design a system conducive to wetland plant growth
- Contours promote variety in structure/food availability
  - 1-ft shelf --- mixed grassland & wetland plants – moist soil
  - 3-ft shelf --- wetland & aquatic plants
  - 7-ft channel --- open water (& flood conveyance)
Hydrology - Wetlands

- Vary water level to attract migratory birds (moist soil management)
  - Fall & winter pools (full) for waterfowl (Central Flyway)
  - Spring & summer pools (1 foot or more lower) for plants

Gadwall

Northern shoveler

Northern pintail
Hydrology - Wetlands

- Wetlands hold water during non-flood periods
- RELIABLE WATER = sustain wetland plant communities

- Three water sources
  - Precipitation --- unpredictable
  - Overbanking --- unpredictable
  - Pumping --- managed, reuse from Dallas’ Waste Water Treatment Plant
  - Gravity fed through the wetland cells
Hydrology - Challenges

- Too little water to wetlands
  - Pump malfunction; weir gate vandalism
  - Delays in repairs – sometimes for months
  - Water loss during the wrong time of the year, i.e. mid-summer

- Too much water
  - Stormwater/overbanking
  - 13 of the top 120 historic crests since 1908 occurred early in the project
Hydrology – Overcoming Challenges

- Include species that can tolerate adverse conditions; diversity is key
- Promote desirable volunteer annuals (fac, facw, facu)
- Choose hardy perennial species able to tolerate drought or prolonged inundation; tuber producers and/or rhizomatic species
- Go with what works! Use reference wetland plant associations!

- Monitor closely the effects of water level manipulations on vegetation, what worked last year may not work this year
Compatible Flora Association – Wetlands/Grassland

- Herbaceous vegetation required for flood conveyance (grassland/emergent wetland)
- “Dig it” & they will come - Not recommended
  - Some volunteer species are good, some are bad; depends on the seed bank
- Assisted succession for plant establishment
  - Manage volunteer species
  - Combine with aquatic & wetland plantings
  - Ensures beneficial species are present
  - Manage undesirable (pre-emption)
Compatible Flora Association – Challenges

- Urban floodplain hydrology promotes disturbance = succession
- Propagule source
  - Hard to find aquatic/wetland plants in the numbers needed that are the species desired and regionally appropriate
  - Seeds are scarce for aquatic/wetland plants
  - Seeds/plants for grasses and forbs
    - Found commercially; germplasms avail.
    - Regionally appropriate?
- Herbivory
  - Thanks USACE for bringing dinner
Herbivory

- Carp
- Geese
- Crayfish
- Semi-aquatic turtles
- Feral hog activity
- Nutria
Flora Association – Overcoming Challenges

- Containerized perennial plants are more robust; withstand adverse conditions, can be planted at any time – even when dormant
  - Grow your own to ensure species/biotype desired; stay within your ecoregion/watershed to get desired genetics
  - Quarantined from exotics, i.e. zebra mussels

- Supplement commercial seed mixes with regionally harvested seed (stakeholders)
  - Interseeding and re-seeding may be required; especially in areas managed for invasive species

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Flora Association – Overcoming Challenges

- Herbivory – implement strategies to protect establishing plants (especially aquatic species); established plants usually outgrow herbivore populations
- Implement vegetation management strategies that promote desirable vegetation
  - IPM – Integrated Pest Management (mowing, chemical, mechanical, biocontrol) for invasive species
    - i.e. Biocontrol/chemical control/drawdown - alligatorweed
- Identify problematic species in baseline vegetation surveys; identify sources and target those for management
Submersed aquatic vegetation establishment in exclosures

Photo credit: Aaron Schad

Winter plantings

Emergent vegetation

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The Dallas Floodway Extension (DFE) Project is located in Dallas, Texas, along the Trinity River beginning where the Dallas Floodway ends (at the abandoned Atchison, Topeka and Santa Fe trestle) and extending downstream to the area where IH-20 and Dowdy Ferry Road intersect. It is a complex project in cooperation and partnership with multiple units of local, state and federal government. It addresses a number of regional concerns, although reducing flood risk for the citizens of Dallas remains the cornerstone of this multi-faceted effort.

The U.S. Army Corps of Engineers has oversight responsibility for all activities within the federally authorized Dallas Floodway System. The Corps’ Fort Worth District is a lead actor in some of the projects, such as the Dallas Floodway Extension Project here. In other projects within the confines of the Dallas Floodway Extension Project listed below, the Corps plays a supportive role.

This Corps project is focused on three of the inter-related components: flood protection, ecosystem restoration and recreation in partnership with the City of Dallas, which is the Dallas Floodway Extension’s local sponsor.

The Corps also has some role, but not a lead role, in two other major components: transportation and community/economic development.

Public safety is the No. 1 priority in the Corps’ Levee Safety Program. The DFE Project, now in the construction phase, is one of two adjacent Fort Worth District projects on the Trinity River designed to reduce flood risks for the citizens of Dallas. The other project, the Dallas Floodway Project, is in a feasibility study/Draft Environmental Impact Statement phase and is also in partnership with the City of Dallas, the non-federal sponsor. The Corps and the City of Dallas share the responsibility of public safety and both are committed to flood risk management. Each project has its own web section accessed from the Fort Worth District home page. The Corps also provides public access to a National Levee Database providing more information on Dallas levees.

Map credit: Texas Water Development Board
References/helpful links:


Dick, G. O., Smart, R. M. and Dodd, L. L. 2013. Propagation and establishment of native plants for vegetative restoration of aquatic ecosystems, ERDC/EL TR-13-9, U.S. Army Engineer Research and Development Center, Vicksburg, MS.


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