

Ecosystem Services in the Greater Houston Region

Based on Ecosystem Services Primer

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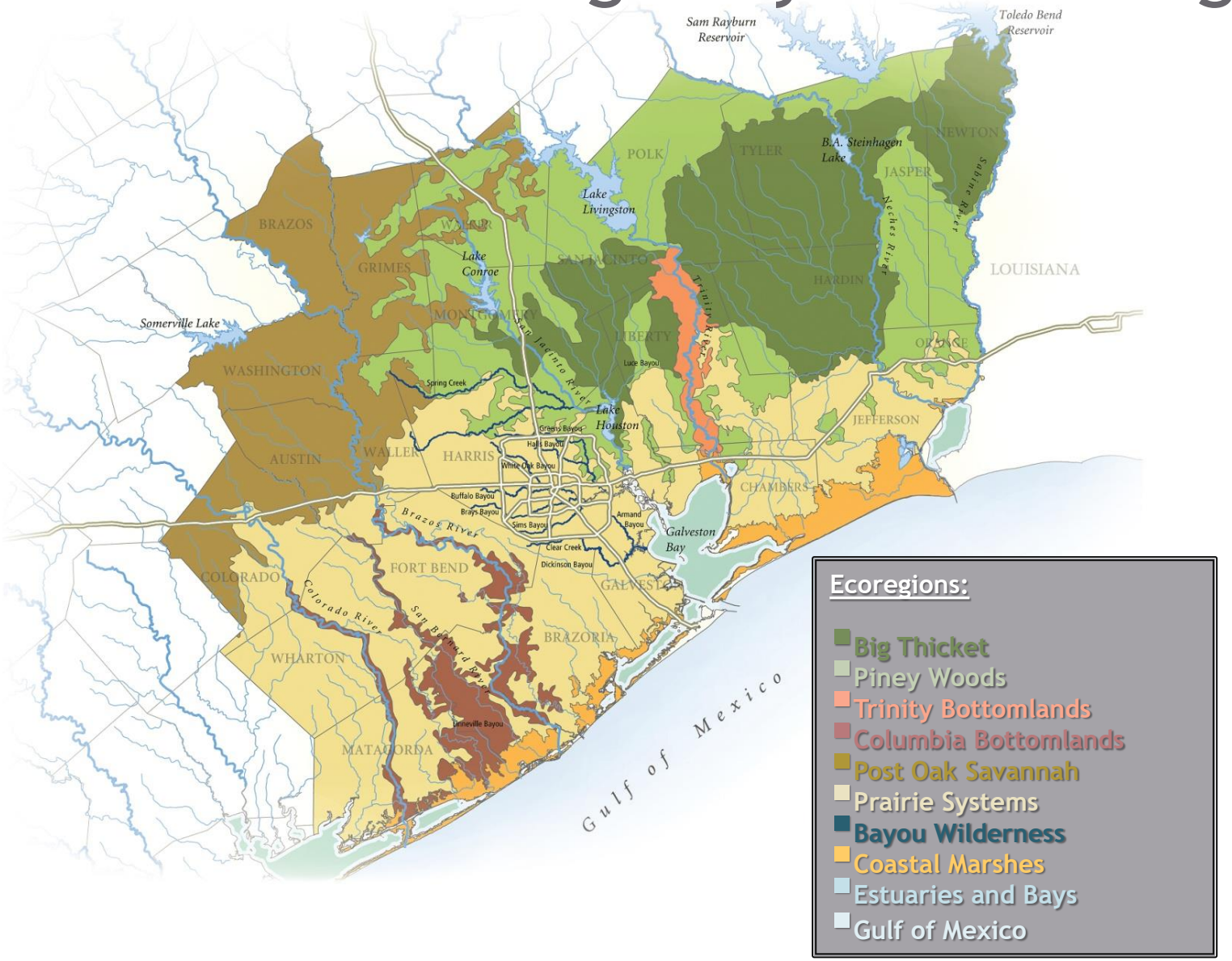
HOUSTON WILDERNESS
It's Our Nature

Houston is an Ecologically Diverse Region



The 13+ County Region surrounding Houston has 10 distinct ecoregions

There are over 20 major bayous and creeks that run 40-miles each like fingers through the Houston Region and flanked by 3 major rivers

And, over 8 million people living around these ecoregions and waterways

Local Ecosystem Service Benefits

Wetlands and Estuaries

- 1. Recreation
- 2. Recharge aquifers
- 3. Flood prevention
- 4. Freshwater inflows to estuaries
- 5. Wildlife viewing
- 6. Carbon sequestration
- 7. Erosion control
- 8. Water quality improved

Prairies

- 1. Aesthetic beauty
- 2. Eco-tourism
- 3. Water supply
- 4. Decrease flooding
- 5. Biodiversity
- 6. Control soil erosion
- 7. Carbon sequestration
- 8. Avoided engineered system costs
- 9. Water quality

Forests

- 1. Recharge aquifer
- 2. Retains storm water
- 3. Eco-tourism
- 4. Adds aesthetics to city
- 5. Outdoor activities
- 6. Noise control, property values
- 7. Reduced health costs
- 8. Carbon sequestration
- 9. Reduced energy use/costs

Ecosystem Services provided by a coastal wetland marsh

1. Water Recreation & Fishing

2. Aquifer Recharge

3. Flood Prevention by slowing storm surge

4. Improved habitat for juvenile fishery species

5. Wildlife habitat and Ecotourism

6. Carbon dioxide sequestration - reducing greenhouse gas air pollution

7. Erosion stabilizing of soil and roots system

8. Polluted water filtered through wetland grasses improving water quality

Ecosystem Services Provided by a Prairie

1. Aesthetic enhancement increasing property values

2. Increased wildlife habitat & ecotourism

3. Recharges groundwater

4. Flood control through Rainfall absorption by soil and plants

5. Provides seed bank for future agriculture and restoration projects

6. Roots prevent soil erosion

7. Absorption of carbon dioxide and other air pollutants

8. Replaces expensive drainage systems and retention ponds

9. Reduced runoff of pollution and nutrients into watersheds

Soil Content of the 8-County Gulf-Houston Region

Vertisols are clay-rich soils that undergo significant vertical cracking during the dry seasons. Typically forming under grassland vegetation in basin or rolling hill landscapes, they are best suited for use as pastureland and for the cultivation of plants, such as rice, that thrive in standing surface water. Their very low water permeability when wet and unstable structure make them unsuitable for most other commercial uses.

They are estimated to occupy about 2.7 percent of the continental land area on Earth, mainly in the Deccan Plateau of India, the Al-Jazīrah region of The Sudan, eastern Australia, Texas in the United States, and the Paraná basin of South America.

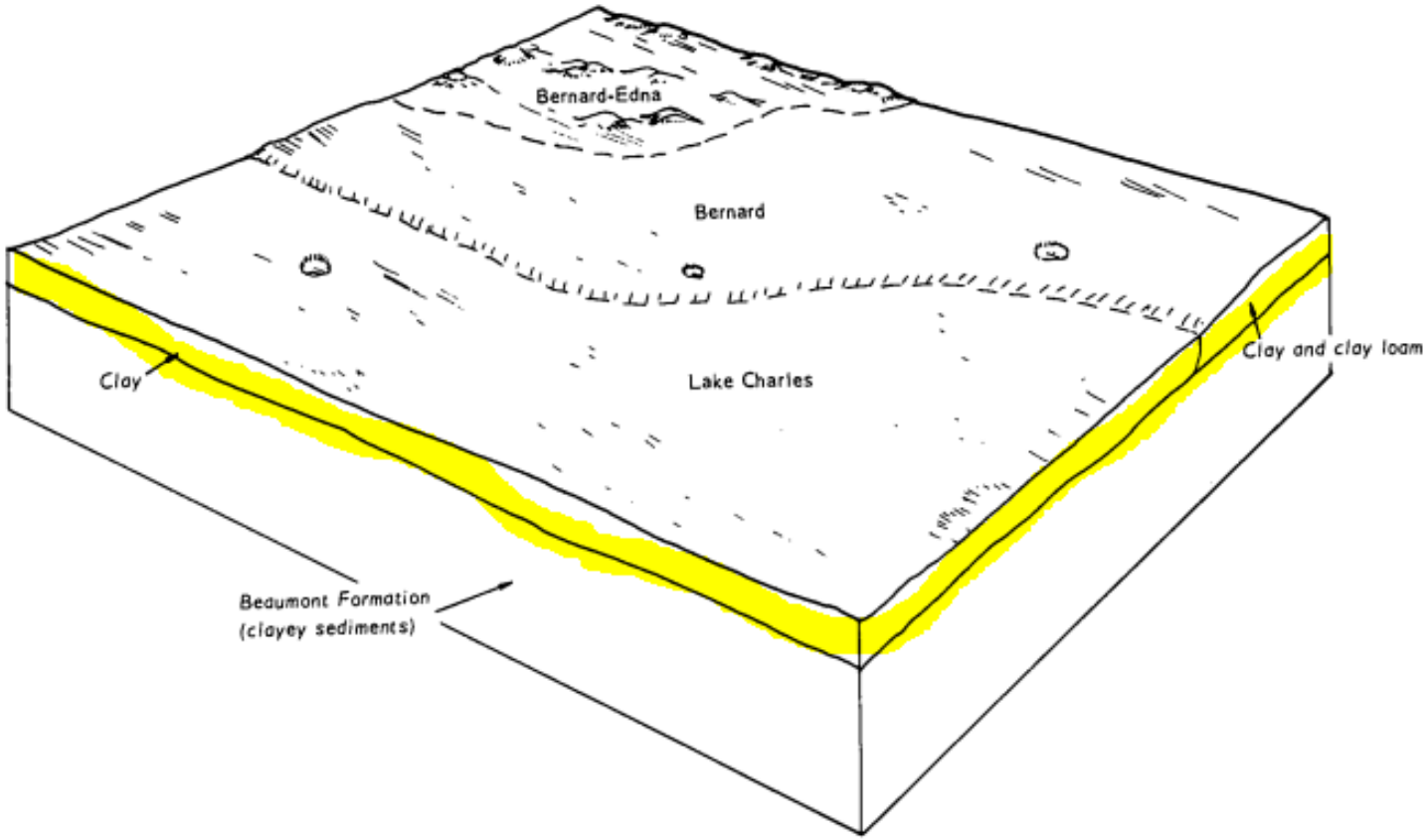


Figure 1. —Typical pattern of soils and underlying material in association 1.

Ecosystem Services Provided by a Forest

1. Cleaner water through root systems and recharges aquifers

2. Provides storm water retention

3. Provides habitat for wildlife and birds that people & ecotourism

4. Improved quality of life for residents

5. Provides outdoor recreational opportunities

6. Blocks noise coming from traveled roads, increasing property values

7. Improved air quality by absorbing city pollutants and greenhouse gases

8. Sequesters carbon

9. Reduced energy costs by shading buildings

http://jimolive.photoshelter.com/gallery-image/Memorial-Park/G0000tg7eebE3gkU/I0000tZ8P3.E6bbU/C0000wD6dE72H88s

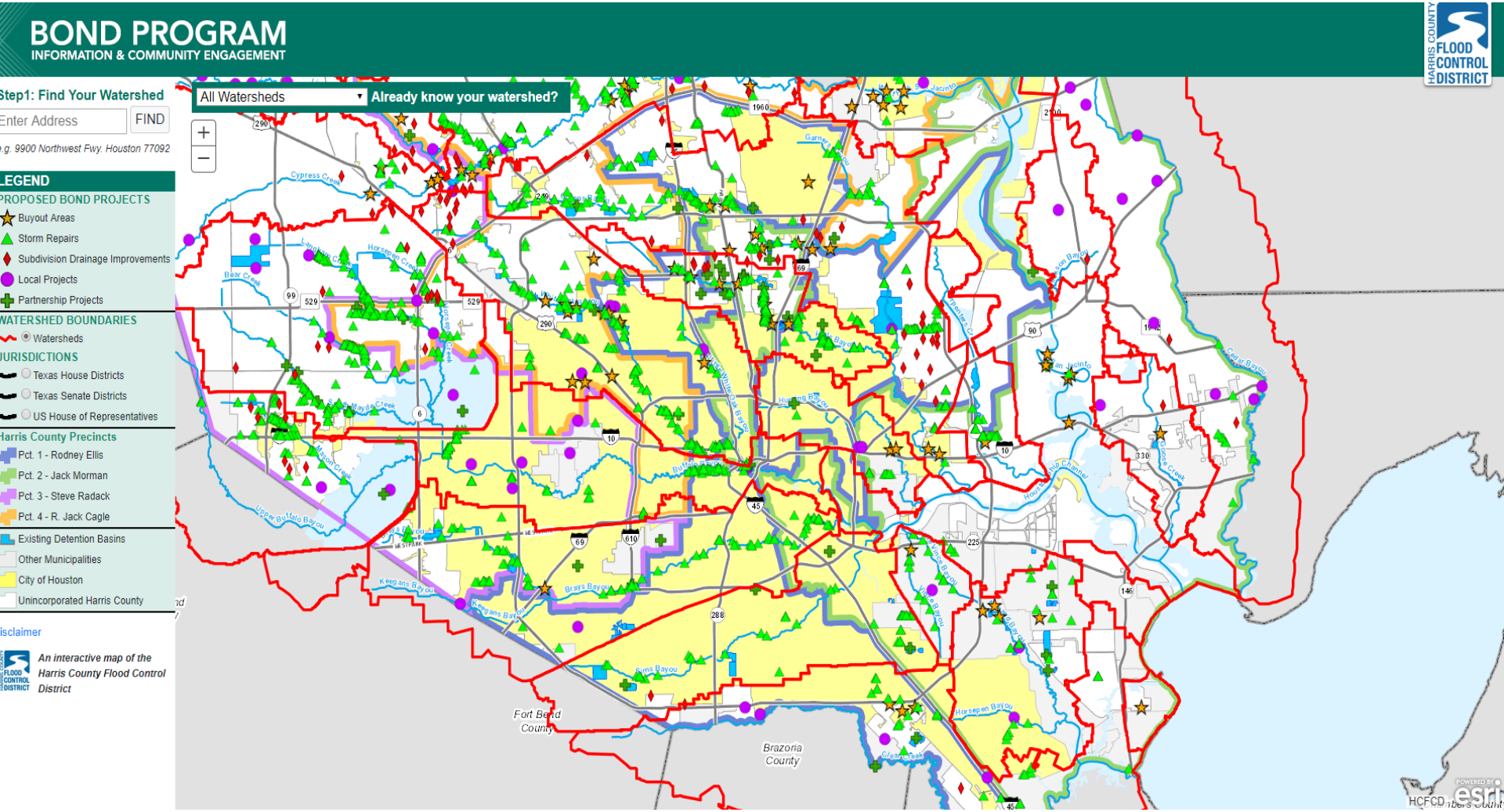

Friday
Saturday
Sunday

- The Houston region received more rain from Hurricane Harvey than any other American city has received from any storm in recorded history.
- Some areas experienced a 1,000–year flood, meaning there is a 0.1 percent chance of such a flood happening in any given year.
- For the past 40 years, the Gulf-Houston Region design standards are calibrated for 100-year events.
- Even if all of our drainage systems were built to this standard, Harvey would have caused massive flooding across the entire area.

Source: Houston Chronicle, Sept. 6, 2017 - D. Wayne Klotz - water resources engineer, RPS Klotz Associates and former president of the American Society of Civil Engineers

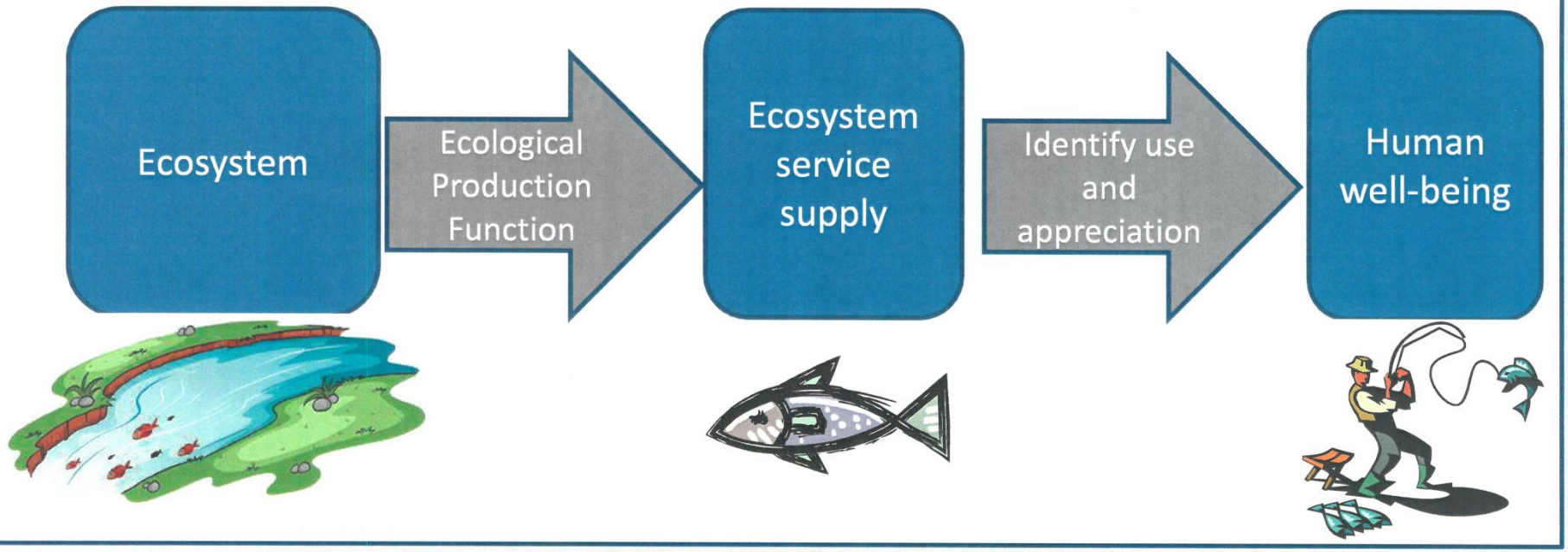

HURRICANE HARVEY
ONE YEAR LATER
RECOVERY BY THE NUMBERS
25,128
TOTAL CASES
Case Managers helped people navigate social services
CALL
211
United Way of Greater Houston hosts free 2-1-1 services that help people get in contact with local recources.
157,604
calls related to Harvey
OVER HALF A
MILLION
VOLUNTEER HOURS
TOTAL RESIDENCES
SERVED
62,775
muck and gut
repair/rebuild
mold removal and sanitation
DATA COURTESY OF
#HARRISCOUNTYSTRONG
THE HARRIS COUNTY LONG TERM RECOVERY COMMITTEE


Houston
— Galveston Bay
Colorado River —
— Brazos River
Sediment
— Lavaca River


BOND PROGRAM
INFORMATION & COMMUNITY ENGAGEMENT
HARRIS COUNTY FLOOD CONTROL DISTRICT
Step1: Find Your Watershed
Enter Address
FIND
e.g. 9900 Northwest Fwy. Houston 77092
All Watersheds
Already know your watershed?
LEGEND
PROPOSED BOND PROJECTS
Buyout Areas
Storm Repairs
Subdivision Drainage Improvements
Local Projects
Partnership Projects
WATERSHED BOUNDARIES
Watersheds
JURISDICTIONS
Texas House Districts
Texas Senate Districts
US House of Representatives
Harris County Precincts
Pct. 1 - Rodney Ellis
Pct. 2 - Jack Morman
Pct. 3 - Steve Radack
Pct. 4 - R. Jack Cagle
Existing Detention Basins
Other Municipalities
City of Houston
Unincorporated Harris County
isclaimer
An interactive map of the Harris County Flood Control District
Fort Bend County
Brazoria County
HCFCD
esri

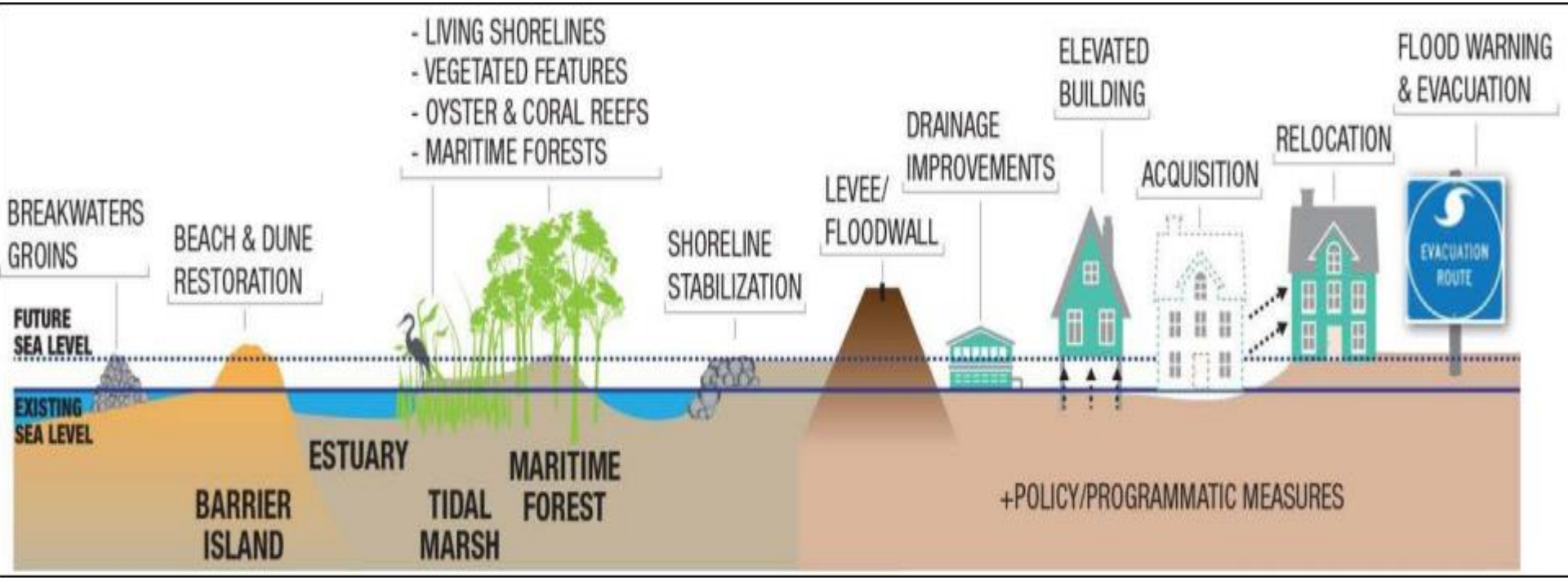
How does ecosystem services information get used in planning?

Baseline (current conditions, business as usual)



Coastal Integrated "Lines of Protection"

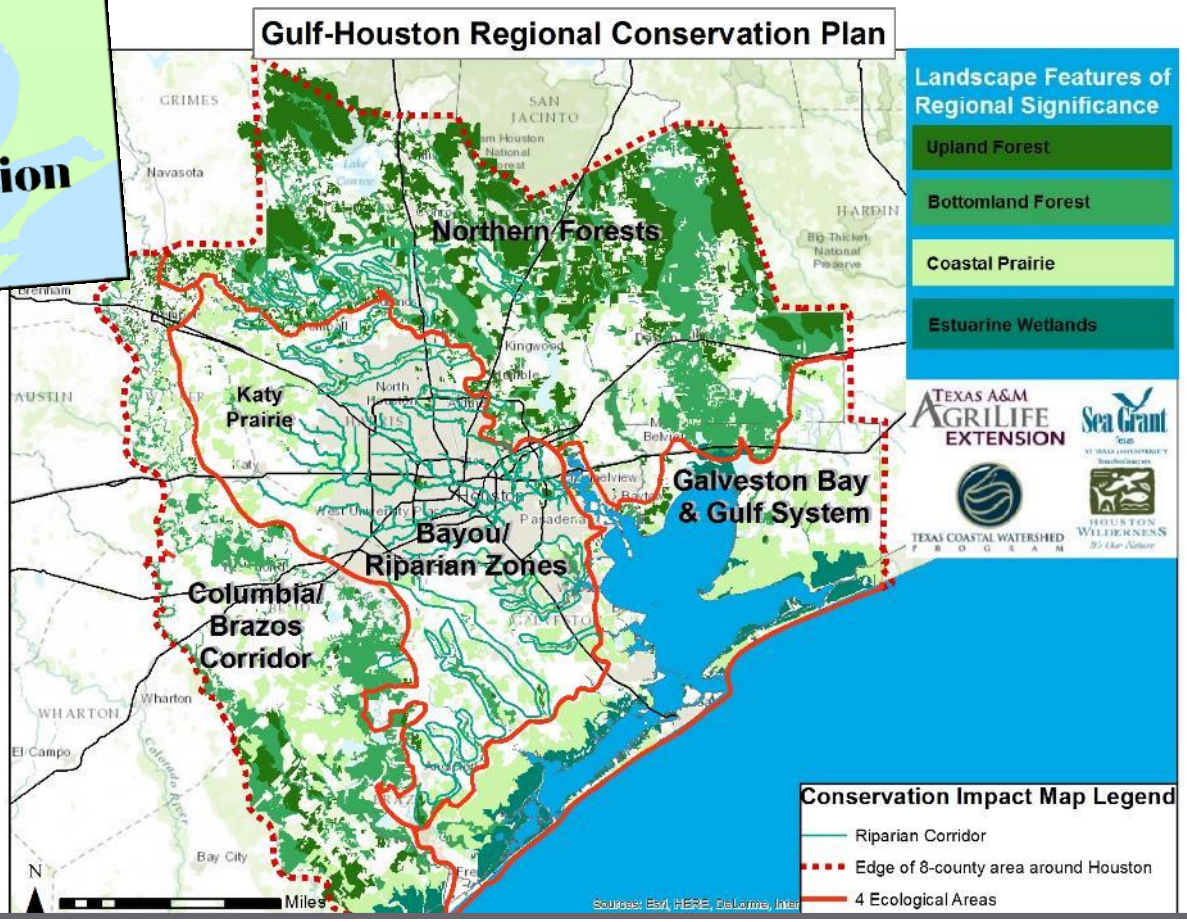
- Combination of natural and structural features
- Increasing levels of protection from offshore to inshore



Slide adapted from GalvCorps, 2014 Coastal Protection & Restoration Project.

24% by 2040 Strategy - Regional Resilience

Gulf-Houston Regional Conservation Plan



THE 24% BY 2040 STRATEGY: The Gulf-Houston Regional Conservation Plan (GulfHoustonRCP.org) is a long-term collaborative of environmental, business and governmental entities working together to create enhanced environmental services, continuity and connectivity for the **8-County Gulf-Houston Region:**

26% is developed land-use

9.2% is protected nature-based infrastructure

64.8% is undeveloped

24% nature-based infrastructure is needed by 2040

Where is the 9.6% in the 8-County Region?

Gulf-Houston Regional Conservation Plan

HOUSTON WILDERNESS
It's Our Nature

County	Total Land Cover (acres)	Total Developed Land %	Land Currently Protected % (w/ acres)	Available Undeveloped Land%
Harris	1,095,040	51%	**2.5%** (122,064)	46.5%
Montgomery	663,616	32%	**1.3%** (62,081)	66.7%
Fort Bend	554,624	25%	**0.4%** (19,065)	74.6%
Liberty	740,096	13%	**0.7%** (36,004)	86.3%
Waller	326,336	12%	**0.2%** (9,305)	87.8%
Galveston	235,008	10%	**0.5%** (22,796)	89.5%
Brazoria	878,080	10%	**2.7%** (135,043)	87.3%
Chambers	378,496	8%	**1.3%** (62,498)	90.7%
Total	**4,871,296**	**26%**	**9.6%**	**64.4%**

REACHING THE 24%

14.8% in NBI projects in need of full or partial funding via various funding sources:

- **6%** from "shovel-ready" Gulf-Houston RCP Working List of NBI projects & HCFCD $2.5 billion program (www.gulfhoustonrcp.org)
- **6%** from public and private NBI projects in various study/planning/proposal stages
- **2.8%** from future regulatory-based wetland mitigation projects and master planned communities

Benefit Relevant Indicator Examples:

Fishing related BRIs

Better BRIs

- Increased abundance of fish in a lakes used by recreational anglers
- Number of recreational anglers with access to lakes with improved fish abundance
- Number of recreational fishing days due to improved fish abundance in lakes
- Additional catch by anglers due to improved fish abundance in lakes

Flood risk related BRIs

Better BRIs

- Reduced frequency of river flooding in heavily populated areas
- Number of residents in areas experiencing reduced frequency of river flooding
- Value of residential properties in areas experiencing reduced frequency of river flooding
- Avoided property damages due to reduced frequency of river flooding in heavily populated areas

Gray v. Green Infrastructure

Gray Infrastructure

- Mechanical processes
- Man-made
- Facilities, buildings
- Artificial
- Complete a function

Green Infrastructure

- Naturally occurring processes
- Existing or engineered/ enhanced natural areas
- Ecosystem services
- Complete a function

Green infrastructure is the most direct way to include ecosystem services into development decisions

Local Examples of Green Infrastructure

Project Brays

- Provide retention area for heavy rain events
- Develop natural marshlands and green spaces along Brays Bayou
- Improve water quality and reduce the need for treatment
- Provide recreation and tourism opportunities for the community

Infrastructure need:
Water Quality, Water Supply, Water Detention/Retention and Flood Control

Solution(s):
•Filtration and absorption of pollutants using wetland and prairie grasses
•Community recreational park
•Green spaces that allow for water retention in heavy rain events

•**Cost to Construct:**
$3.2 Million

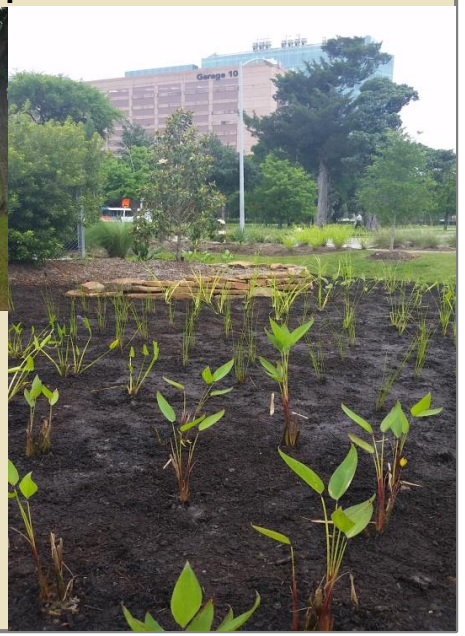
In 2006, the Brays Bayou Marsh at Mason Park, near the mouth of the bayou was completed.

http://www.projectbrays.org/about.html

Local Examples of Green Infrastructure

M.D. Anderson – The Prairie Project

- Developed prairie and wetland green spaces throughout the Texas Medical center
- Serves as a filter for storm water and reduces run off
- Provides a habitat for many species of wildlife
- Provides recreation opportunities for the patients, visitors and staff in the community
- Provide health benefits for cancer patients through green space access



Infrastructure need: Water Quality, Water Detention/Retention, and Recreation

Solution: Reduction run off in the area, restored wildlife habitat and created recreation opportunities and stress reducing aesthetic for surrounding community

Cost to Construct: **$1 Million**

Millennium Ecosystem Assessment (MEA) Classification of Ecosystem Services

- ***Provisioning*** **– provides direct material and consumable benefits**
  - Food and fiber
  - Timber and minerals
  - Fuels
  - Medicinal resources
- ***Cultural Services*** **– provides direct social and spiritual benefits**
  - Recreation
  - Spiritual and historic
  - Science and education
- ***Regulating*** **– provides direct benefits to support and maintain control of ecosystems**
  - Climate regulation
  - Waste treatment
  - Water regulation
  - Nutrient regulation
- ***Supporting Services*** **– provides direct benefits to support and maintain control of ecosystems**
  - Primary production
  - Nutrient cycling
  - Water cycling

From Jim Lester

Ecosystem Service Valuation

Goals

- Function Monitoring
- Spatial Impact on Function
- Outright Losses
- Substitute Equivalency
- Building Something New
- Energy Savings
- Insurance Savings
- Property Value
- Cost of Illness

Methods

- On-site Ecological Function Analysis
- Benefit Transfer
- Literature Review
- Avoided Cost
- Replacement Cost
- Mitigation/Restoration Cost
- Direct Market Price
- Hedonic Pricing

1 Ecological Function Analysis

- Uses on-site measurements of the ecosystem services in a particular location to determine their value
- The measurements that are taken will show the extent of the service in a particular ecosystem
- Once the capacity of the ecosystem service is known, it can be given value when connected to existing markets
- This method is useful when a service might vary considerably from one ecosystem to the next

Use for Ecological Function Monitoring, Spatial Scale Impact on Function, and Building Something New

2 Direct Market Price

- Looks at the actual price of a commodity derived from an ecosystem in an existing market
- Determines the value of the ecosystem service based on the price that is paid by consumers multiplied by the marginal product of the service

Use for Provisioning Ecosystem Services (goods harvested from ecosystem) and some applications for Property Value and for Carbon markets

3 Avoided Cost Method

- Determines the cost that would have been incurred in the absence of the ecosystem service
- The costs that are not incurred are a reflection of the value of the ecosystem service because they are direct savings

Use for Outright Losses, Energy Savings, Insurance Savings, and Cost of Illness

4 Replacement Cost Method

- Determines the cost that would be incurred in the replacement of an ecosystem service with gray infrastructure to accomplish the same task
- An analysis of the current service that is provided would be performed to determine the extent of the service the ecosystem provides, then the cost of building gray infrastructure to achieve the same level of services would be determined

Use for Outright Losses and Substitute Equivalency

5 Mitigation and Restoration Cost Method

- Looks at the cost of getting ecosystem services restored in damaged ecosystems
- Looks at the cost of mitigating the negative impacts of their loss

Use for Ecological Function Monitoring, Spatial-Scale Function on Impact, Outright Losses and Building Something New

Hedonic Pricing

- Value recreational and aesthetic services by looking at a surrogate market where the ESS has indirect ties
- Determines the implicit demand for an ecosystem service by looking at how it affects values in a related market, usually real estate, using regression analysis

Use for Property Values

Contributors:

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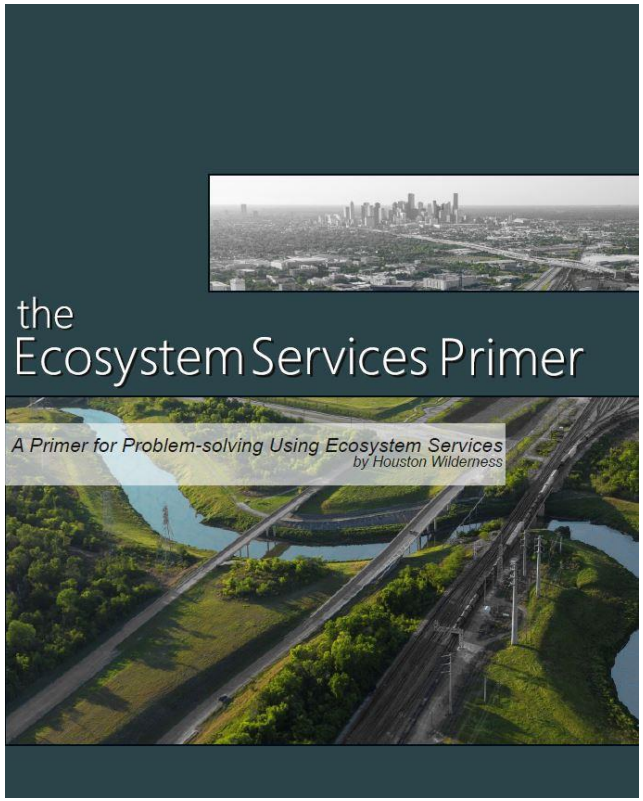

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