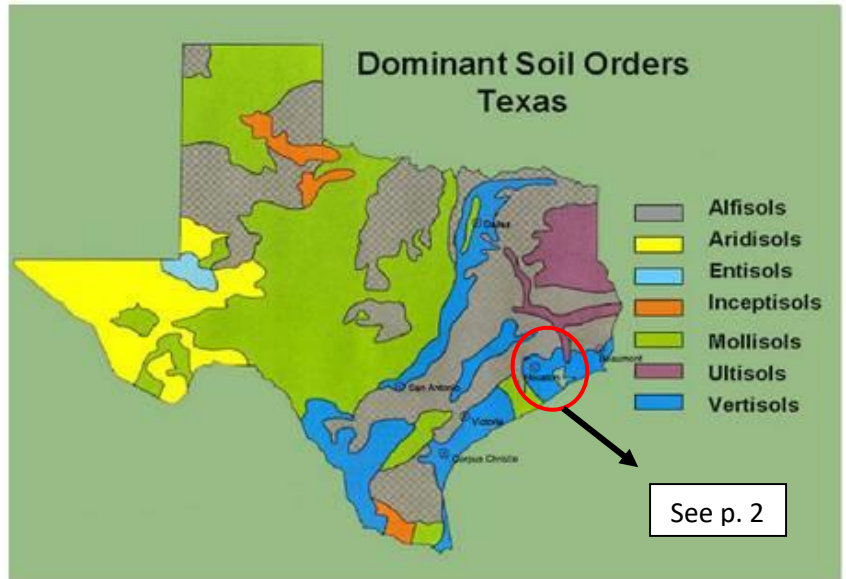


Understanding the Soil Content of the 8-County Gulf-Houston Region

In working to enhance protected/preserved land (nature-based infrastructure) from 14.7% to 24% by 2040, our region's unique soils play a critical role. The National Resources Conservation Service (NRCS) classifies dominant soil types for the 8-County region as **Gulf Coast Prairie Soils**. The U.S. Dept. of Agriculture identifies twelve soil orders, with Texas containing seven of those twelve orders (see below). From those seven orders, four major urban regions of Texas all contain either **Vertisols** or **Alfisols** as their dominant soil orders.

Global (ice-free) Coverage Area

1. **Alfisols:** Mod. weathered (clay/sand) **10.1%**ⁱ
2. **Andisols:** Volcanic ash 1.0 %
3. **Aridisols:** Very dry 12.0%
4. **Entisols:** Newly formed 18.0%
5. **Gelisols:** Frozen 9.1%
6. **Histosols:** Organic, wet 1.2%
7. **Inceptisols:** Slightly developed 15.3%
8. **Mollisols:** Deep, fertile 7.0%
9. **Oxisols:** Very weathered 7.5%
10. **Spodosols:** Sandy, acidic 4.0%
11. **Ultisols:** Weathered 8.1%
12. **Vertisols:** Shrink/swell (mainly clay) **2.7%**



Texas Soil Is Rare in the World

NRCS: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/tx/home/?cid=nrcs144p2_003094

Vertisols are very unique soils and only occupy less than 3 percent of the continental land area on Earth, mainly in the Deccan Plateau of India, the Al-Jazīrah region of Africa, eastern Australia, Texas in the United States, Paraná basin of South America, and Mexico/Central America.ⁱⁱ Estimated global vertisols soil coverage area totals 300 million hectares (mh), equaling 741,316,144 acres or just 2.7% of continental land.ⁱⁱⁱ

Alfisol & Vertisol general pattern of soils

Major Areas of Vertisol	Vertisol Cover (hectares)	Percent Cover of 2.7%
USA (Texas)	6.5 million	2.1%
Turkey	600,000	0.2%
South America	6 million (est)	2.1% (est)
Mexico/Central America	12 million (est)	5% (est)
India	70 million	23%
Africa	100 million	33%
Australia	70.5 million	23%

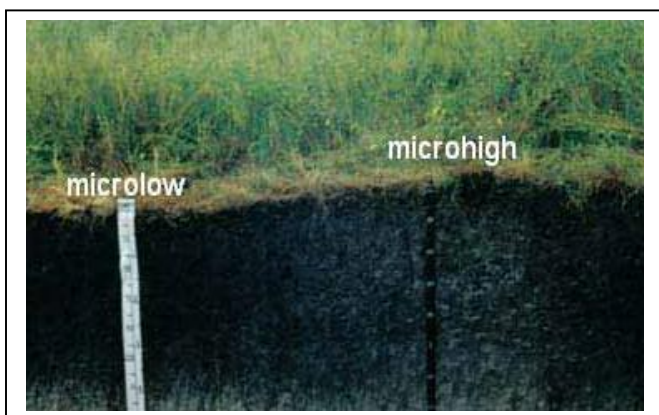
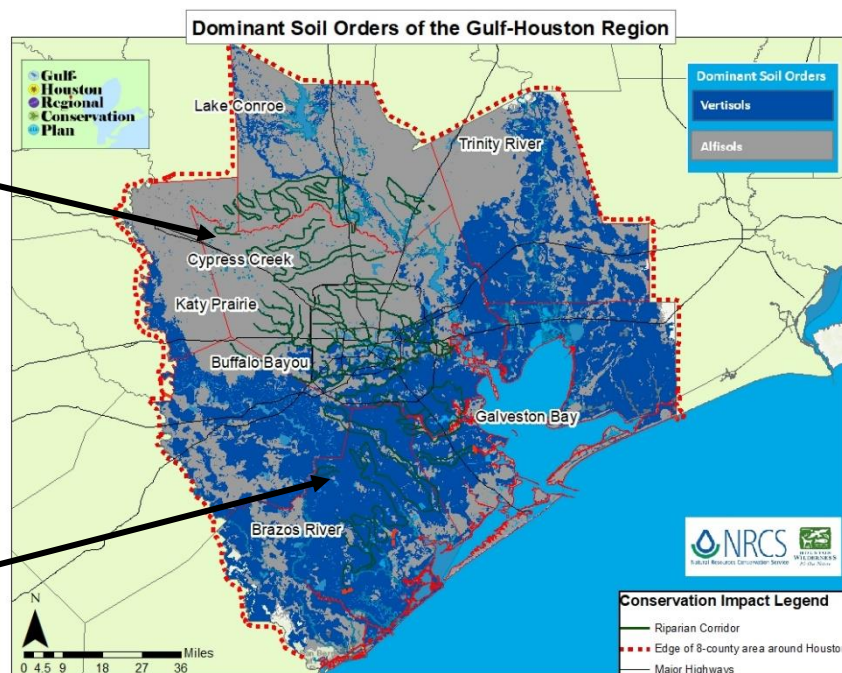
UPDATED January 2021

See more at www.GulfHoustonRCP.org

Vertisols and Alfisols in the 8-County Region

Alfisols contain topsoil and up to 20-40 inches of sandy loam (sand mixed with clay) before reaching a clay pan. These soils typically form under grassland vegetation.^{iv} Surface runoff is slow to very slow, permeability is very slow, and the available water holding capacity is high⁷ due to high clay content at depth.

Vertisols are clay-rich soils (40-75% clay content) that shrink when dry, swell when wet, and consist of topsoil sitting atop a deep clay pan. When dry, vertisols form large cracks that may be more than three feet deep and several inches wide.^v These cracks greatly influence the infiltration and runoff behavior particularly during rain events, and are responsible for many building foundation and road repairs.^{vi} Vertisols typically form under grassland vegetation and are self-mulching, highly fertile soils due to their high clay content.^{vii} The vertisol's self-mulching allows for unique surface features called **gilgai**, which consists of subtle topographic changes of microhighs surrounding circular microlows (mounds & depressions)^{viii} – see image below. The subsurface clays become saturated quickly during rain events, causing runoff to pool on the surface. Depressions associated with gilgais allow the excess runoff to be detained until evaporation or drainage to a waterway. Historically these depressions were used as temporary watering holes and habitat for wildlife and as a natural farming irrigation system.^{ix}



Soil Considerations for Key Goals of Gulf-Houston RCP

As thousands of local and regional projects continue to be funded to increase ecosystem services, particularly related to storm-resilience, the **Gulf-Houston Regional Conservation Plan (RCP)** two key goals: 1) Increasing the current 14.7% in protected/preserved land in the eight-county region to 24% of land coverage by 2040, and 2) providing research and advocacy for an increase of 4% annually in air quality offsets through carbon absorption in native soils, plants, trees, and oyster reefs throughout the eight county region. Knowledge and understanding of our region's unique Vertisols and Alfisols can help guide the discussion on the importance of (1) the need to "spread out" protected land to

naturally hold water necessary to mitigate downstream flooding, (2) create and maintain additional detention basins throughout targeted parts of our region that allow for additional storage of water during large rain events, (3) encourage increased native plants and trees on all available lands in our region, and (4) target measurable carbon sequestration as a major factor in restoration/enhancement efforts. For more information, see www.GulfHoustonRCP.org

ⁱ <https://globalrangelands.org/topics/rangeland-ecology/twelve-soil-orders>

ⁱⁱ www.britannica.com/science/Vertisol-FAO-soil-group

ⁱⁱⁱ www.fao.org/Wairdocs/ILRI/x5493E/x5493e04.htm

^{iv} <https://www.soils.org/discover-soils/soil-basics/soil-types/alfisols>

^v www.fao.org/Wairdocs/ILRI/x5493E/x5493e04.htm

^{vi} Pathak et al. 2012. Hydrological behavior of Alfisols and Vertisols in the semi-arid zone: Implications for soil and water management. *Agricultural Water Management*. Vol 118. 12-21.

^{vii} www.soils.org/discover-soils/soil-basics/soil-types/vertisols

^{viii} www.soils4teachers.org/files/s4t/k12outreach/tx-state-soil-booklet.pdf

^{ix} www.revolvy.com/page/Vertisol

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