

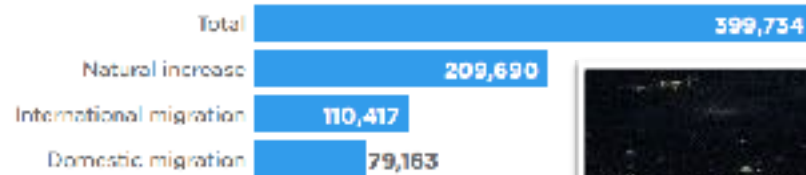


Houston-Galveston & Southeast Texas Land Cover Change

Bill Bass, GISP

Texas Population Growth

Over the past year, Texas' nation-leading population growth was largely driven by natural increase – or more babies being born than people dying.



SOURCE: U.S. Census Bureau

*Over 1,000 people per day increase.
Migrations account for 47%.*

- Area between Dallas-Houston-San Antonio is seeing the largest growth
- Not just major cities, but exurbs in close proximity to economic opportunity

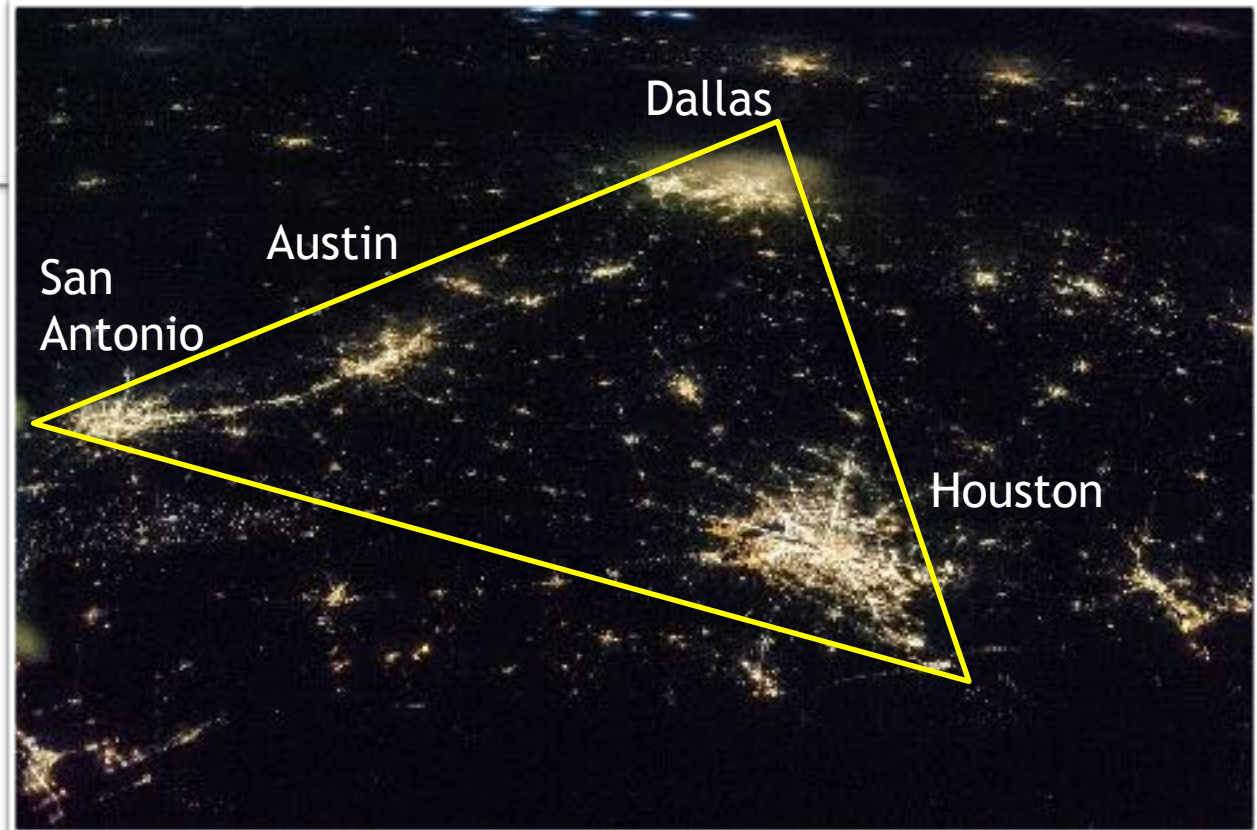
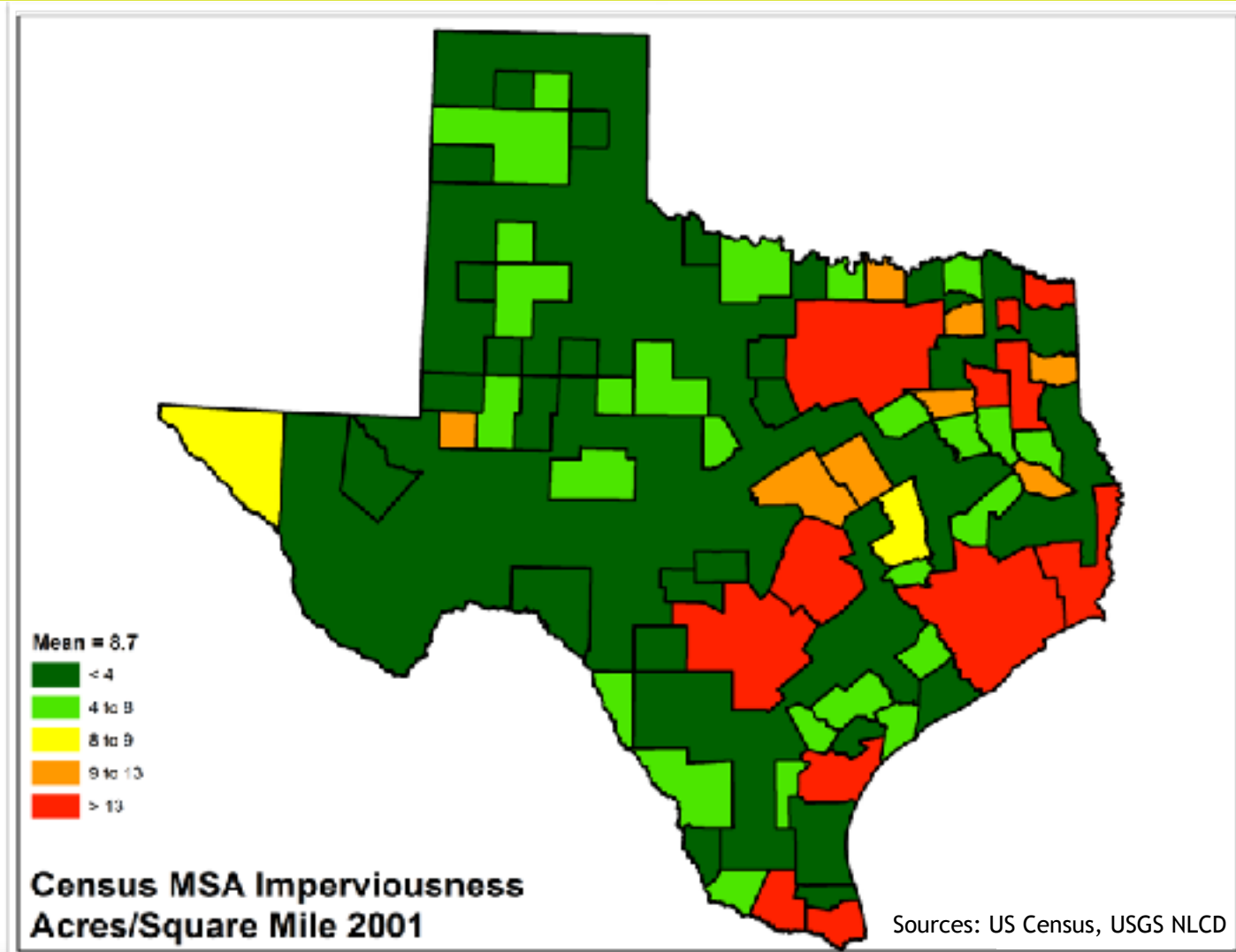
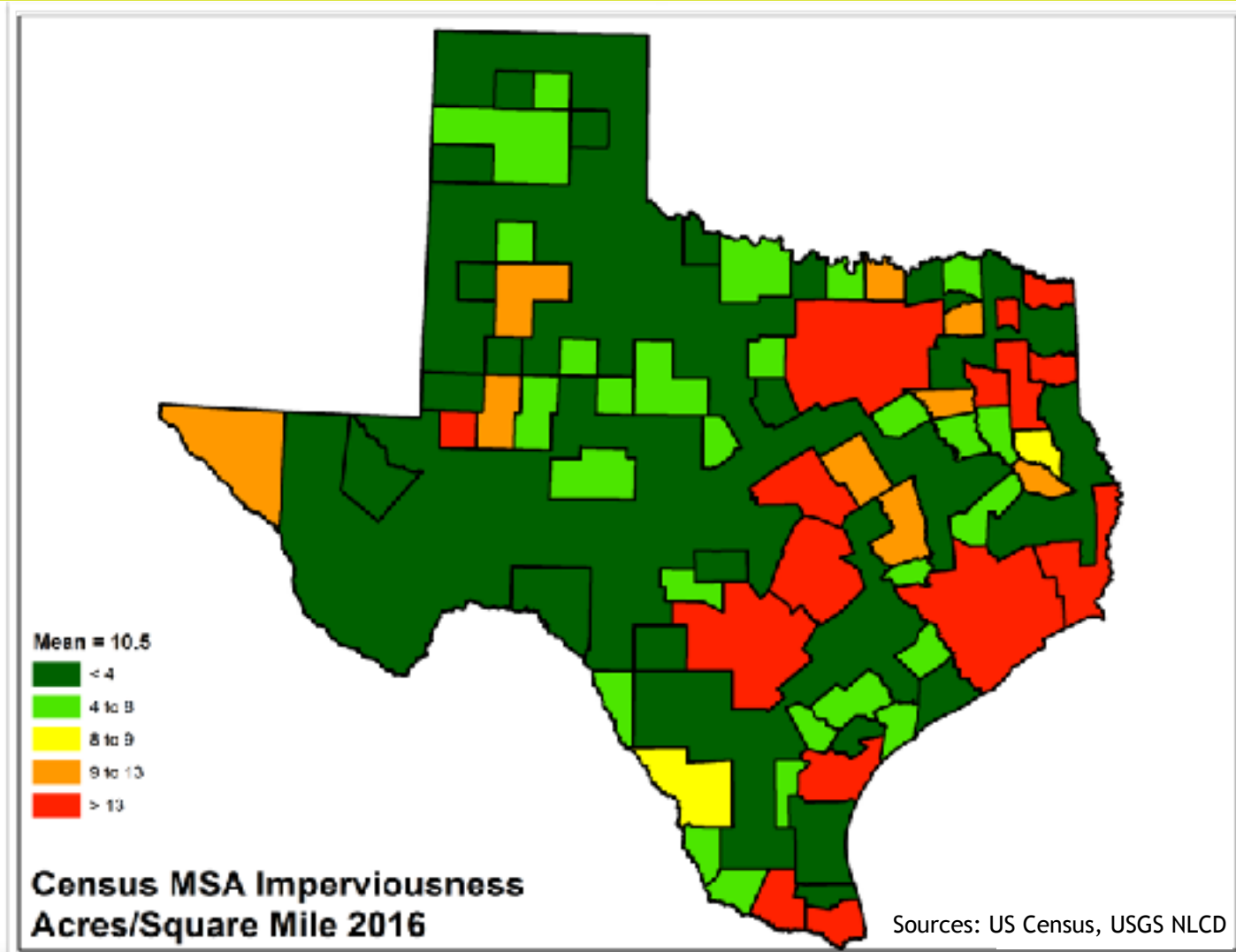


Image Courtesy: Wikipedia
Graph: Jill Cowan/Dallas Morning News

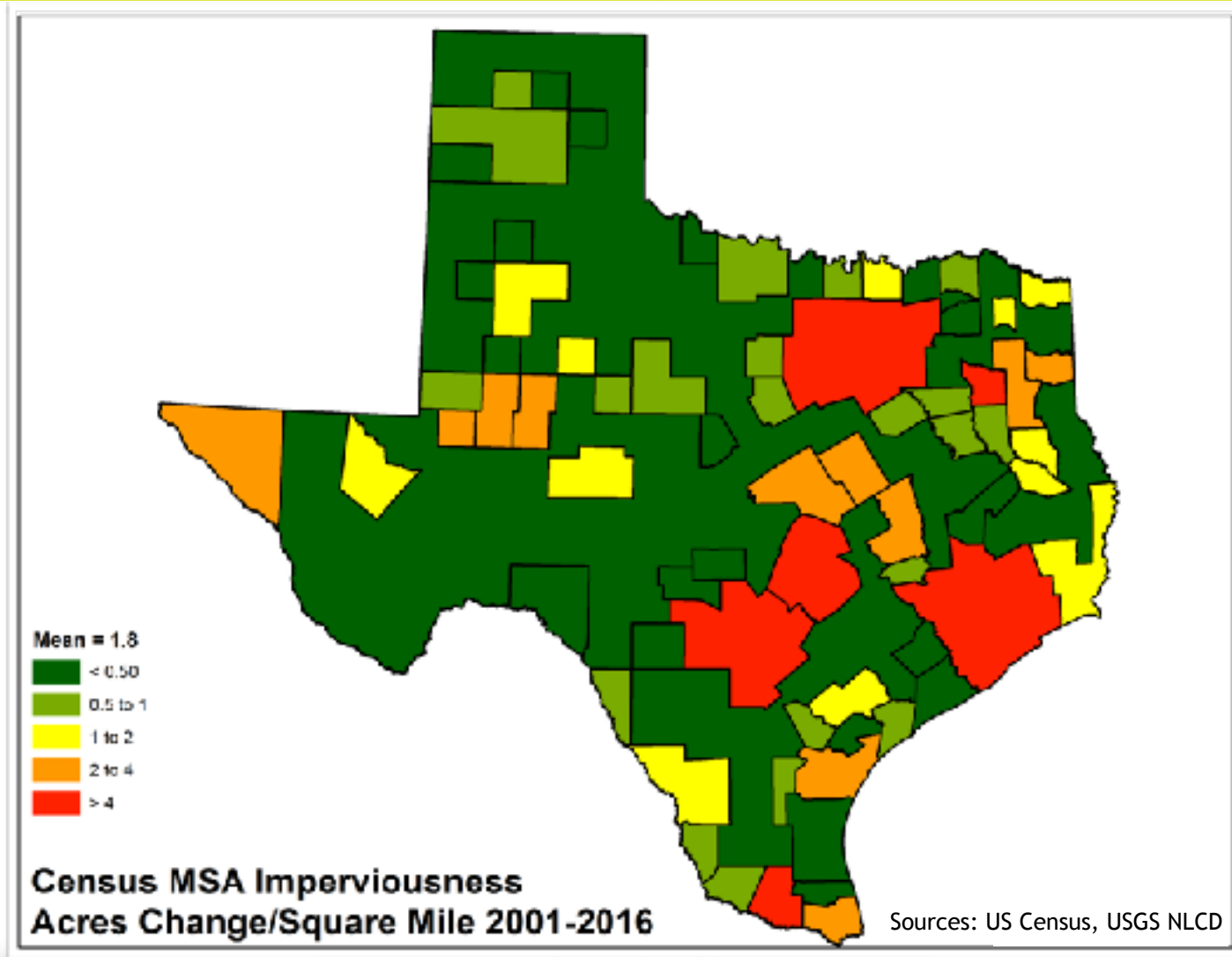
Imperviousness



Imperviousness



Imperviousness



Imperviousness by County 2001-2016

County <input type="text"/>	Imperviousness									
	2001		2006		2011		2016		Change 2001-2016	
	Pct	Acres	Pct	Acres	Pct	Acres	Pct	Acres	Acres	Pct
		492,194		547,046		591,728		625,884	133,690	27.16%
Brazoria	2.6%	27,229	3.0%	30,966	3.3%	34,003	3.5%	35,859	8,630	31.69%
Chambers	1.3%	7,038	1.4%	8,067	1.6%	8,976	1.9%	10,353	3,315	47.10%
Fort Bend	5.7%	32,214	7.0%	39,686	8.4%	47,723	9.9%	56,094	23,879	74.13%
Galveston	5.0%	28,228	5.6%	31,426	6.1%	34,015	6.3%	35,181	6,953	24.63%
Grimes	1.0%	5,308	1.0%	5,384	1.1%	5,617	1.1%	5,769	461	8.69%
Hardin	1.1%	6,584	1.2%	6,939	1.3%	7,240	1.3%	7,342	757	11.50%
Harris	25.1%	286,017	27.8%	316,687	29.7%	337,743	31.0%	352,911	66,864	23.38%
Jefferson	5.2%	37,172	5.4%	38,351	5.7%	40,390	5.8%	41,134	3,961	10.66%
Liberty	1.0%	7,902	1.1%	8,196	1.1%	8,491	1.2%	9,022	1,120	14.18%
Montgomery	5.1%	35,193	6.0%	41,401	6.8%	46,640	7.3%	50,400	15,206	43.21%
Polk	0.9%	6,718	1.0%	6,836	1.0%	7,075	1.0%	7,160	442	6.59%
San Jacinto	0.7%	2,872	0.7%	3,000	0.8%	3,086	0.8%	3,130	258	8.98%
Walker	1.3%	6,476	1.3%	6,648	1.3%	6,906	1.4%	7,077	601	9.28%
Waller	1.0%	3,212	1.0%	3,458	1.2%	3,824	1.3%	4,453	1,241	38.63%

Source: USGS NLCD

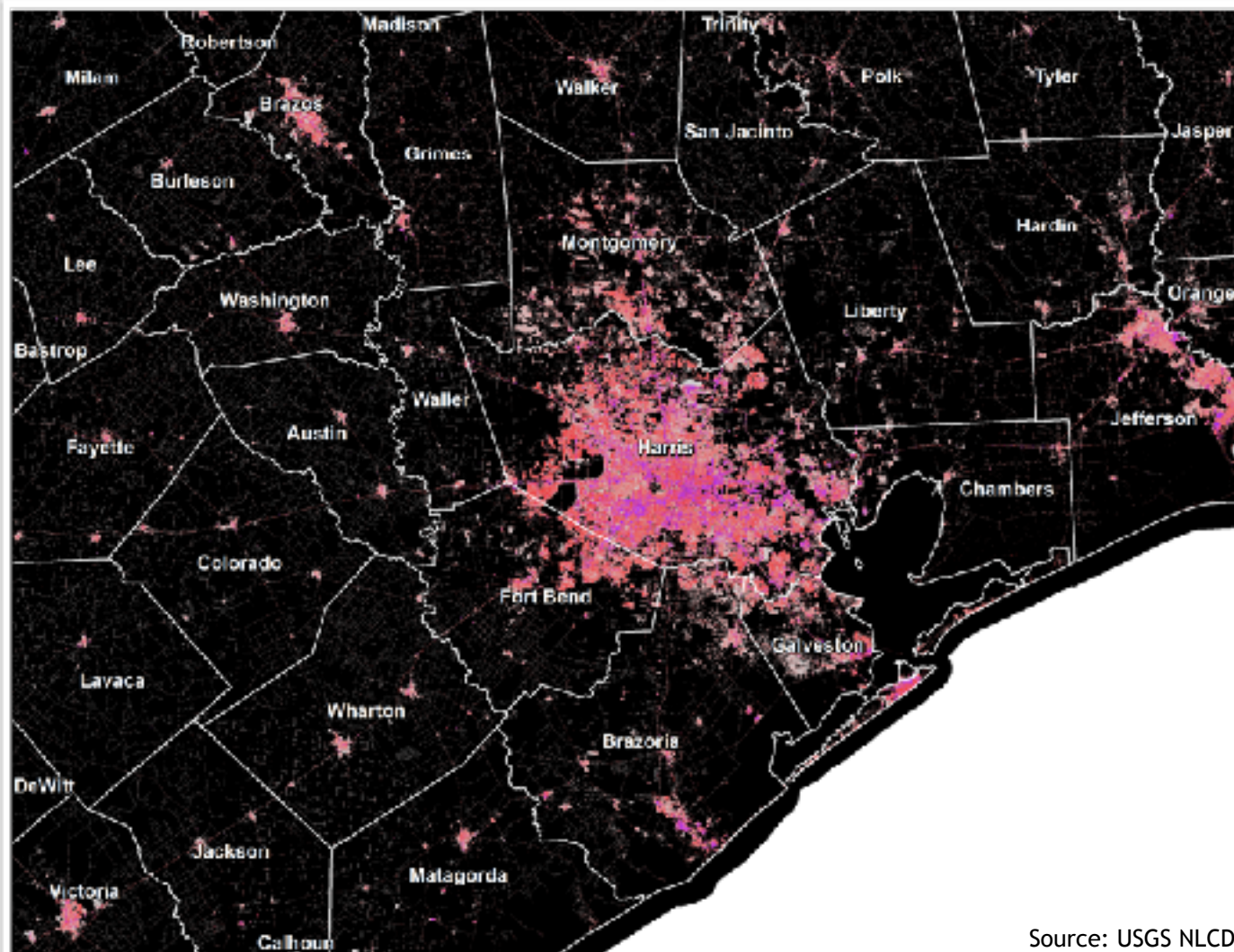


Imperviousness by Watershed 2001-2016

GBEP Watershed	Imperviousness									
	2001		2006		2011		2016		Change 2001-2016	
	Pct	Acres	Pct	Acres	Pct	Acres	Pct	Acres	Acres	Pct
GBEP Watershed		319,372		350,568		375,383		392,127	72,755	22.78%
Addicks Reservoir	14.3%	12,272	19.4%	16,638	21.1%	18,106	20.9%	20,571	8,299	67.62%
Armend-Taylor Bayou	25.0%	12,738	28.1%	13,774	30.7%	15,056	31.6%	15,532	2,794	21.93%
Austin-Bantrop Bayou	1.8%	2,852	1.9%	3,063	2.1%	3,320	2.1%	3,405	553	19.39%
Barker Reservoir	11.4%	9,080	14.2%	11,361	17.9%	14,301	21.5%	17,157	8,068	88.77%
Brays Bayou	53.8%	43,808	55.0%	45,602	57.4%	46,707	57.9%	47,166	3,358	7.67%
Buffalo Bayou	48.9%	32,821	51.3%	34,431	53.0%	35,519	54.3%	36,427	3,606	10.99%
Condon Bayou	4.0%	5,436	4.8%	6,454	5.4%	7,311	6.4%	8,660	3,223	59.30%
Chocolate Bayou	2.7%	2,895	3.2%	3,478	3.6%	3,859	3.8%	4,172	1,277	44.11%
Clear Creek	19.5%	22,629	23.5%	27,336	26.6%	30,940	28.2%	32,795	10,166	44.92%
Dickinson Bayou	6.0%	4,269	8.6%	5,566	10.3%	6,609	11.2%	7,208	2,939	68.85%
East Bay	0.8%	1,557	0.9%	1,575	0.9%	1,614	0.9%	1,630	73	4.70%
Gimons Bayou	22.8%	37,032	31.8%	42,401	34.3%	45,778	35.5%	47,546	10,514	27.85%
Houston Ship Channel	37.0%	39,397	38.6%	41,072	40.5%	43,088	41.6%	44,302	4,905	12.45%
North Bay	20.2%	3,208	22.6%	3,596	24.8%	3,931	25.6%	4,054	852	26.55%
San Jacinto River	8.0%	3,751	9.3%	4,065	10.7%	4,656	11.2%	4,914	1,163	31.00%
Sims Bayou	35.6%	21,175	37.5%	22,324	39.9%	23,730	40.8%	24,267	3,092	14.60%
South Bay	17.9%	8,876	18.8%	9,346	19.7%	9,784	19.8%	9,850	975	10.98%
Trinity Bay	1.4%	2,872	1.6%	3,154	1.7%	3,530	1.9%	3,799	927	32.27%
Trinity River	1.2%	8,673	1.2%	8,962	1.3%	9,306	1.3%	9,521	849	9.79%
West Bay	5.3%	10,413	5.7%	11,092	6.0%	11,711	6.2%	12,080	1,667	16.01%
White Oak Bayou	47.6%	33,610	50.0%	35,275	51.8%	36,516	52.8%	37,265	3,655	10.87%

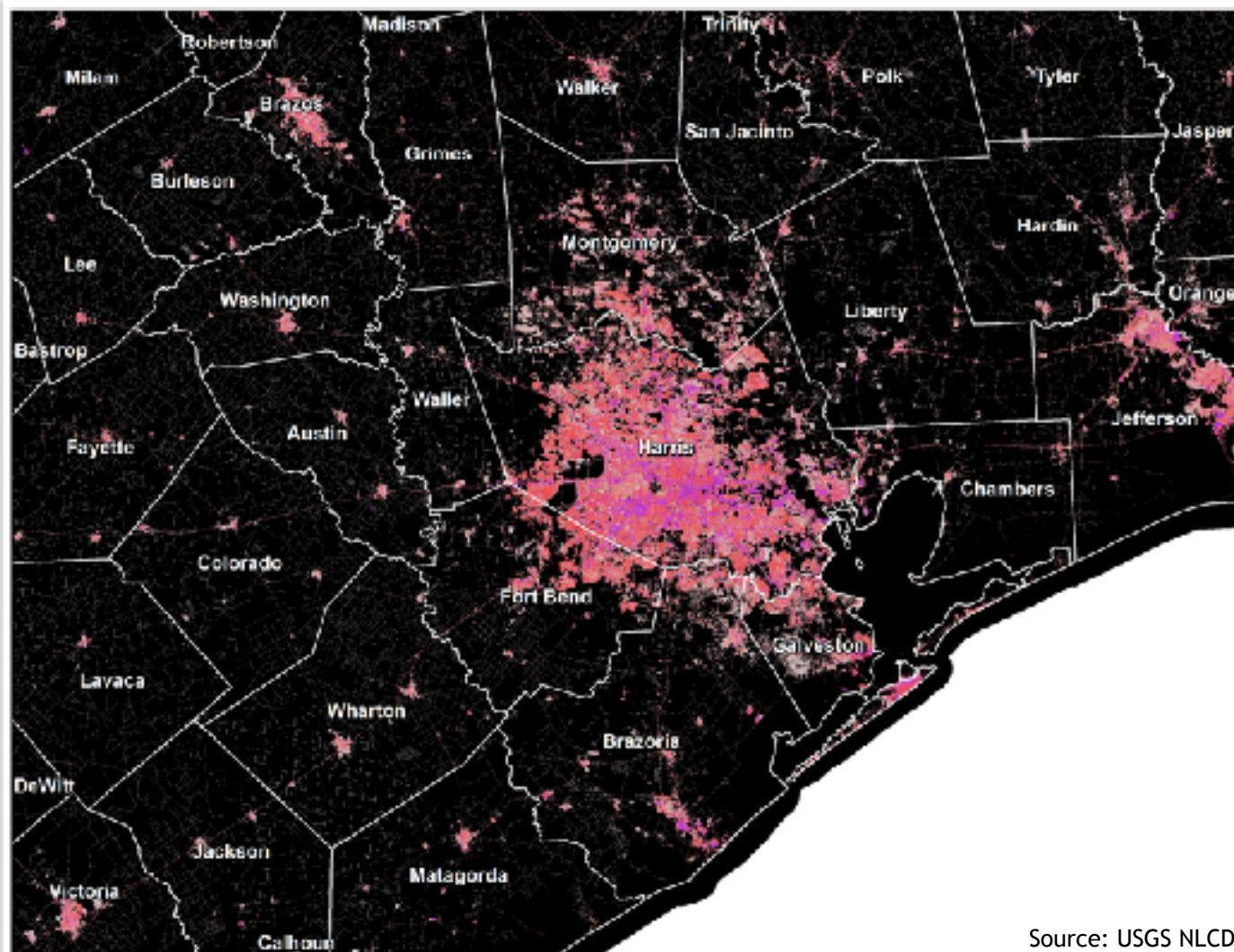
Source: USGS NLCD

Imperviousness 2001

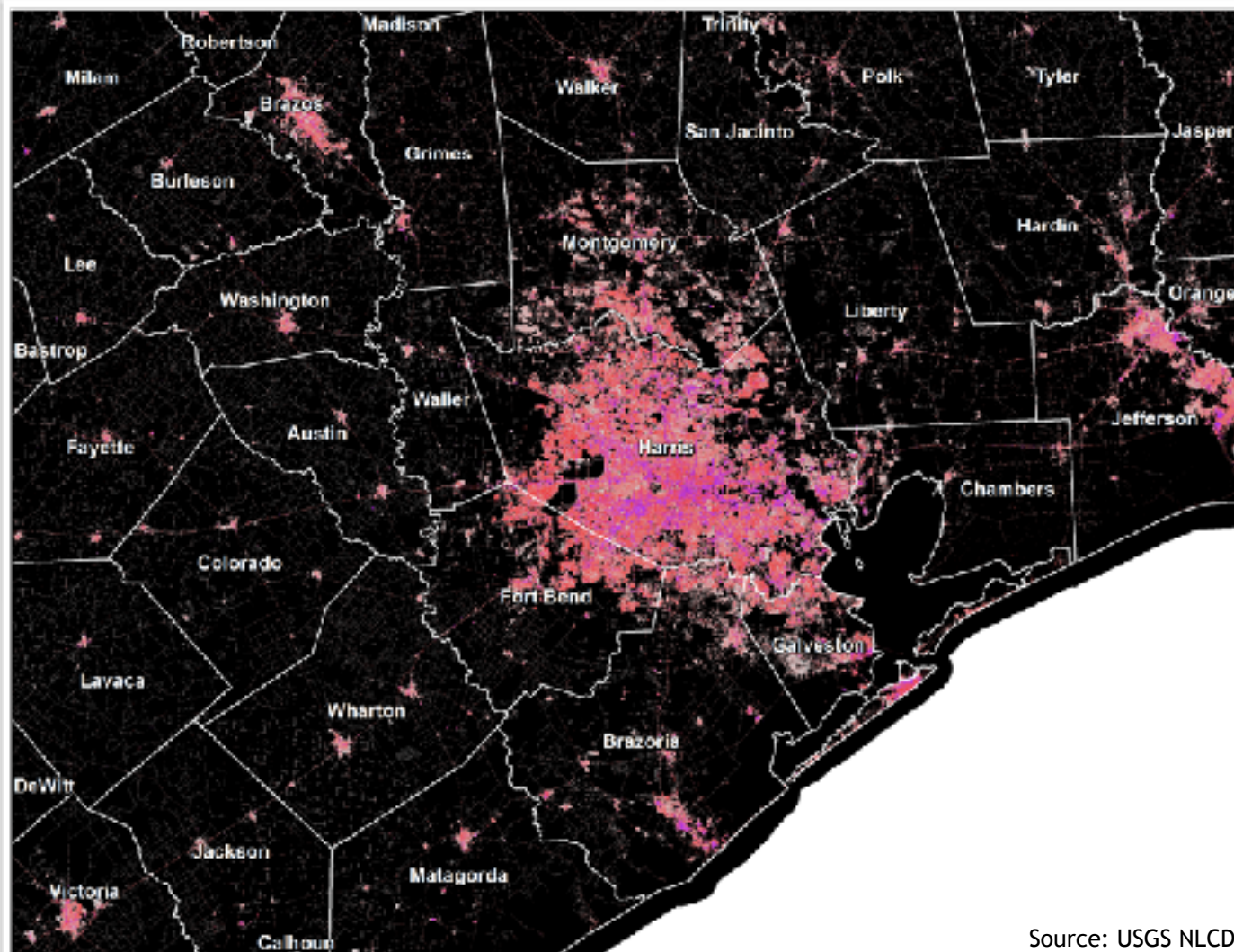


Source: USGS NLCD

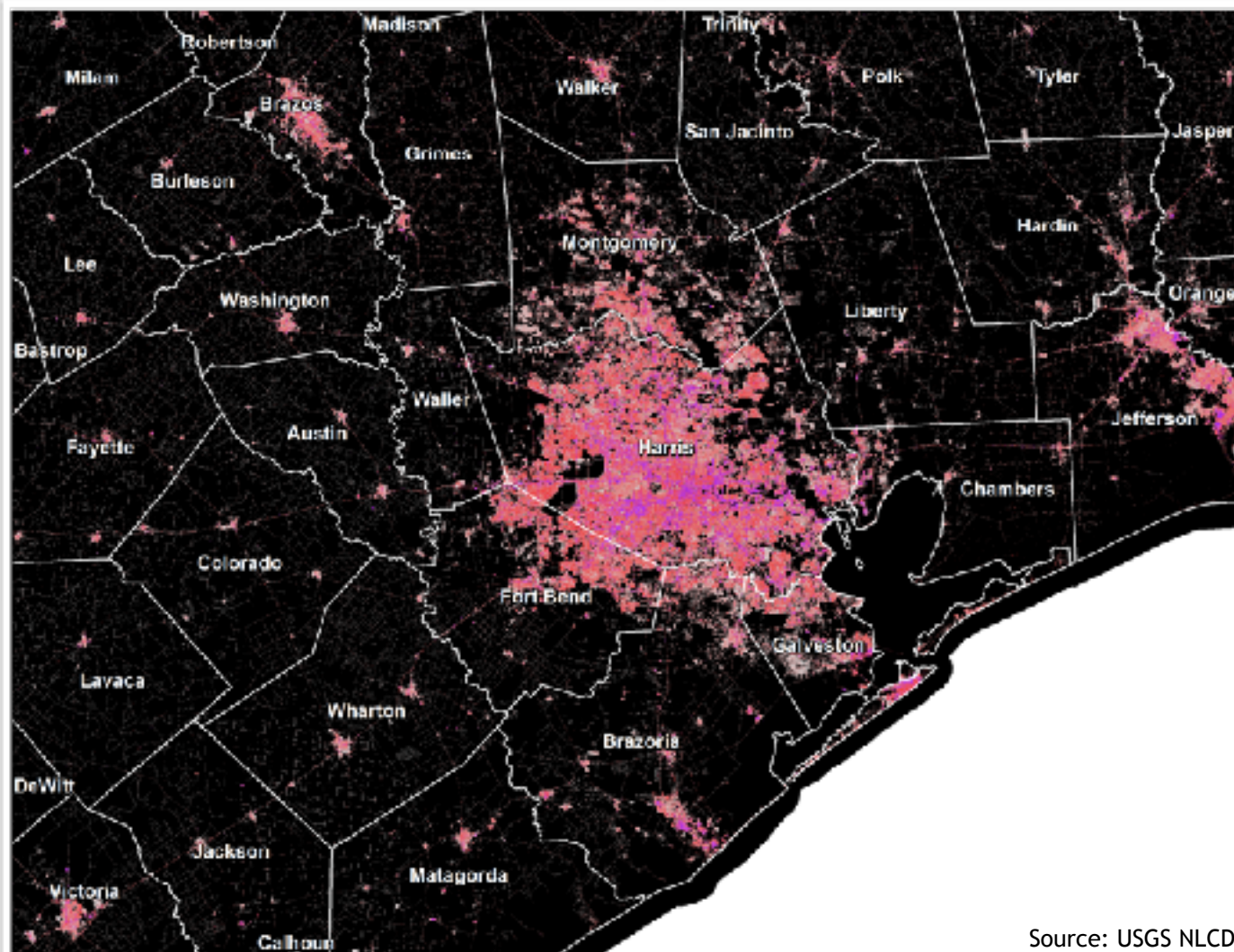
Imperviousness 2006



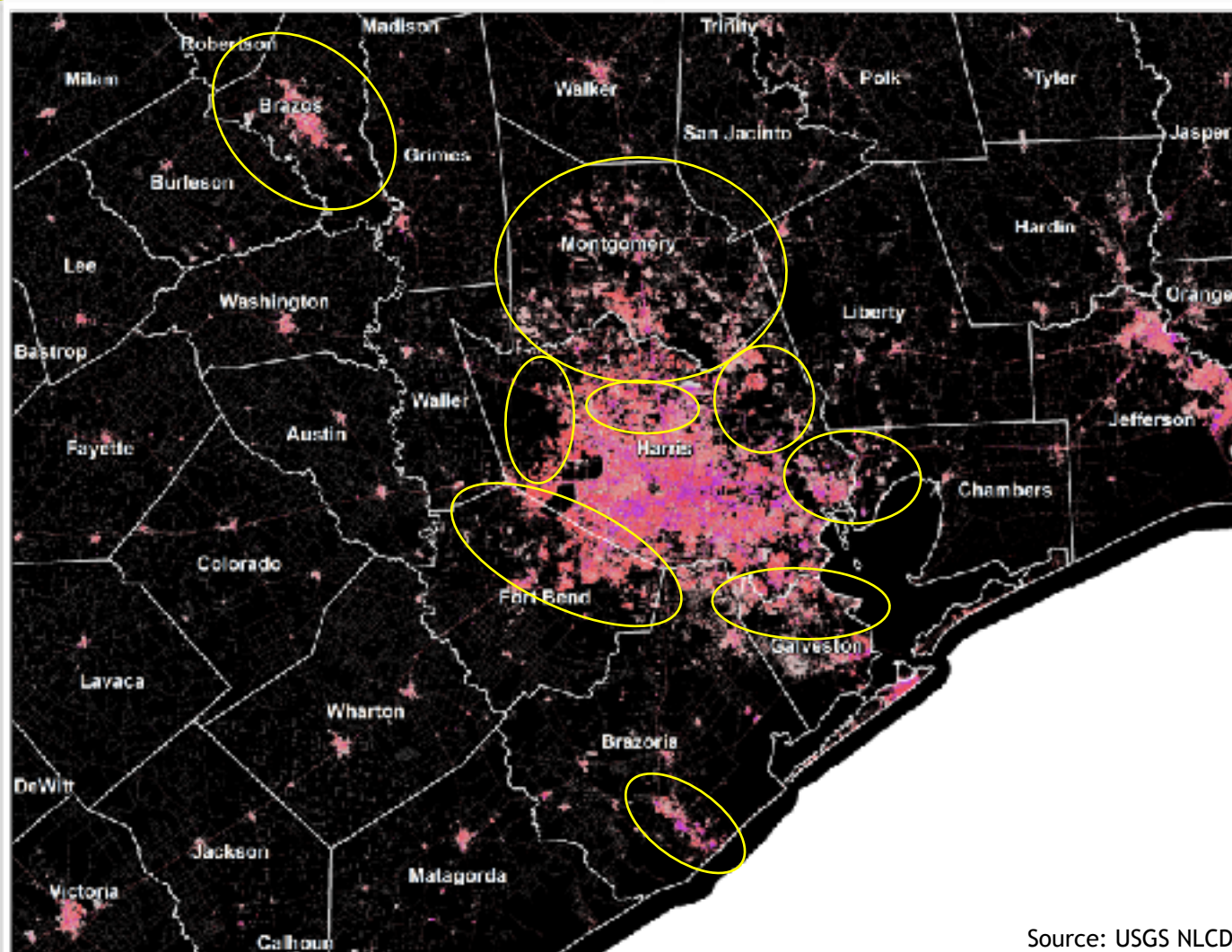
Imperviousness 2011



Imperviousness 2016



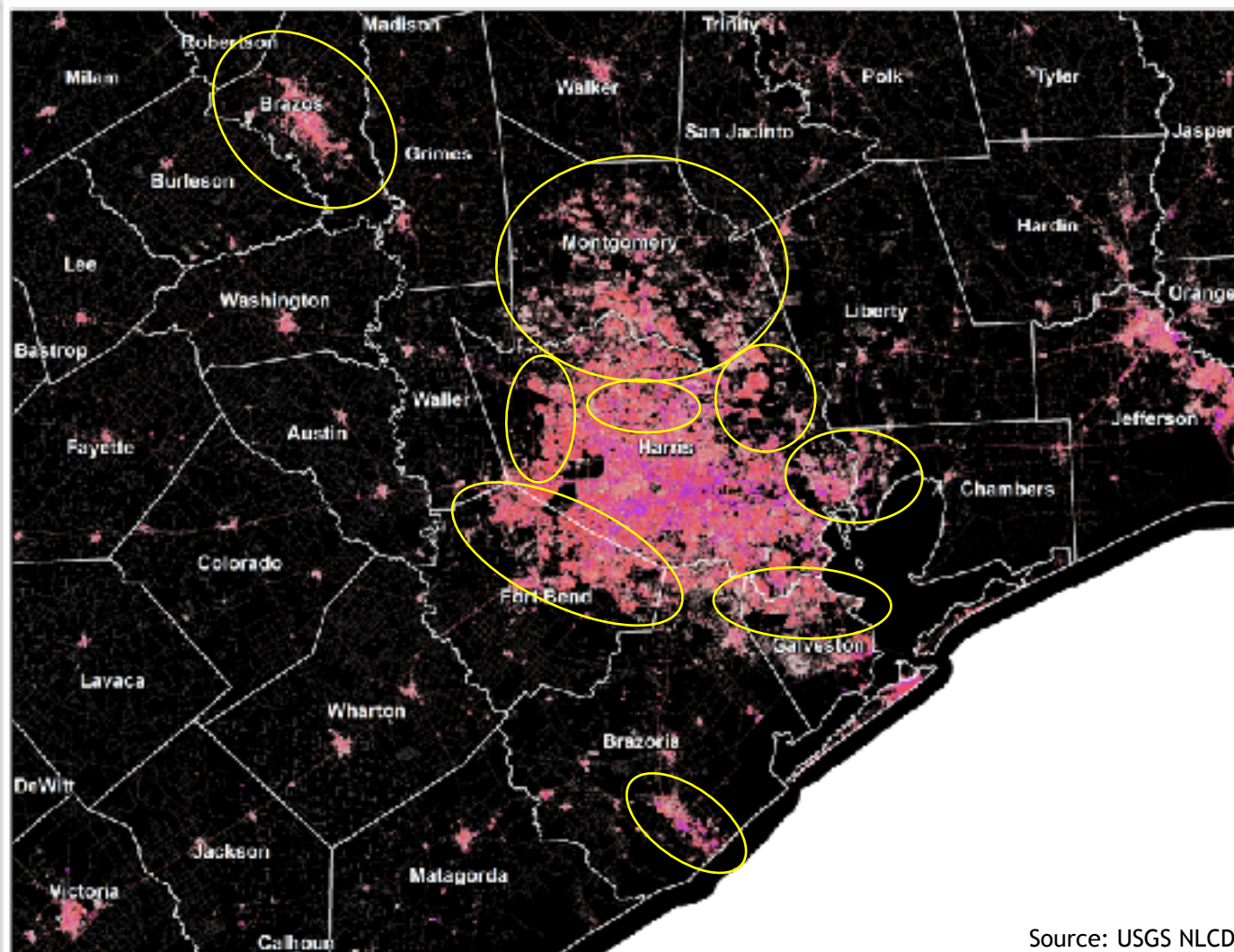
Imperviousness 2001



Source: USGS NLCD



Imperviousness 2016



Source: USGS NLCD



Land Cover by Watershed 1996-2010

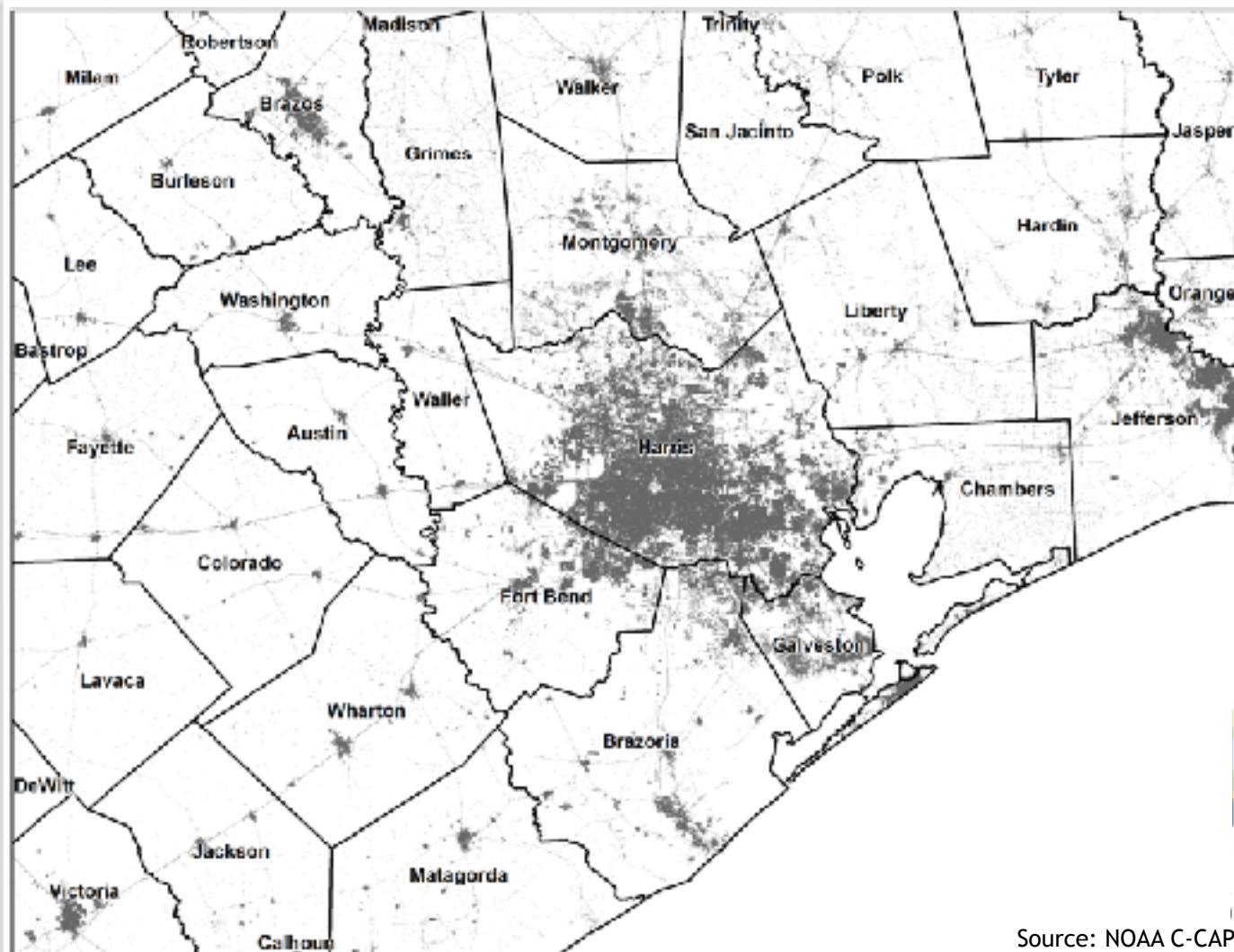
County	Developed						Wetlands					
	1996	2001	2006	2010	Change 1996-2010		1996	2001	2006	2010	Change 1996-2010	
	Acres	Acres	Acres	Acres	Acres	Pct	Acres	Acres	Acres	Acres	Acres	Pct
	1,020,135	1,107,589	1,193,798	1,274,562	254,427	24.94%	1,759,726	1,736,683	1,708,281	1,705,631	(54,095)	-3.07%
Drazoria	71,010	74,944	81,065	85,530	14,513	20.44%	307,870	307,299	304,889	304,674	(3,197)	-1.04%
Chambers	22,888	24,127	25,850	27,097	4,209	18.39%	137,993	137,786	135,554	135,344	(2,649)	-1.92%
Fort Bend	64,106	75,017	88,607	106,797	42,690	66.59%	63,901	63,683	61,545	59,983	(3,918)	-6.13%
Galveston	73,562	76,880	81,708	85,411	11,849	16.11%	78,606	77,833	76,574	75,358	(3,339)	-4.24%
Grimes	15,833	16,340	16,485	16,953	1,121	7.08%	38,294	38,112	38,131	38,247	(47)	-0.12%
Hardin	16,710	18,540	19,008	19,878	3,165	18.94%	202,515	195,441	193,322	197,379	(5,136)	-2.54%
Harris	522,137	562,100	605,605	639,135	116,998	22.41%	100,181	98,324	92,017	87,409	(12,772)	-12.75%
Helfman	88,113	90,850	92,636	94,828	6,715	7.62%	232,672	231,398	227,471	223,397	(9,275)	-3.99%
Liberty	22,794	24,766	25,275	26,126	3,331	14.62%	272,260	267,417	263,937	266,033	(6,228)	-2.29%
Montgomery	75,362	91,124	103,413	117,477	42,115	55.88%	90,108	87,140	84,668	83,464	(6,644)	-7.37%
Polk	14,750	17,064	17,078	17,436	2,686	18.21%	105,625	105,022	103,998	106,859	1,284	1.17%
San Jacinto	6,517	7,340	7,746	8,002	1,485	22.79%	55,041	54,475	54,093	54,856	(185)	-0.34%
Walker	16,942	18,209	17,862	18,317	1,375	8.12%	50,962	49,160	48,622	49,123	(1,840)	-3.61%
Waller	9,403	10,281	10,862	11,575	2,172	23.10%	23,607	23,585	23,458	23,506	(101)	-0.43%

Source: NOAA C-CAP

*2016 C-CAP Land Cover still pending release.



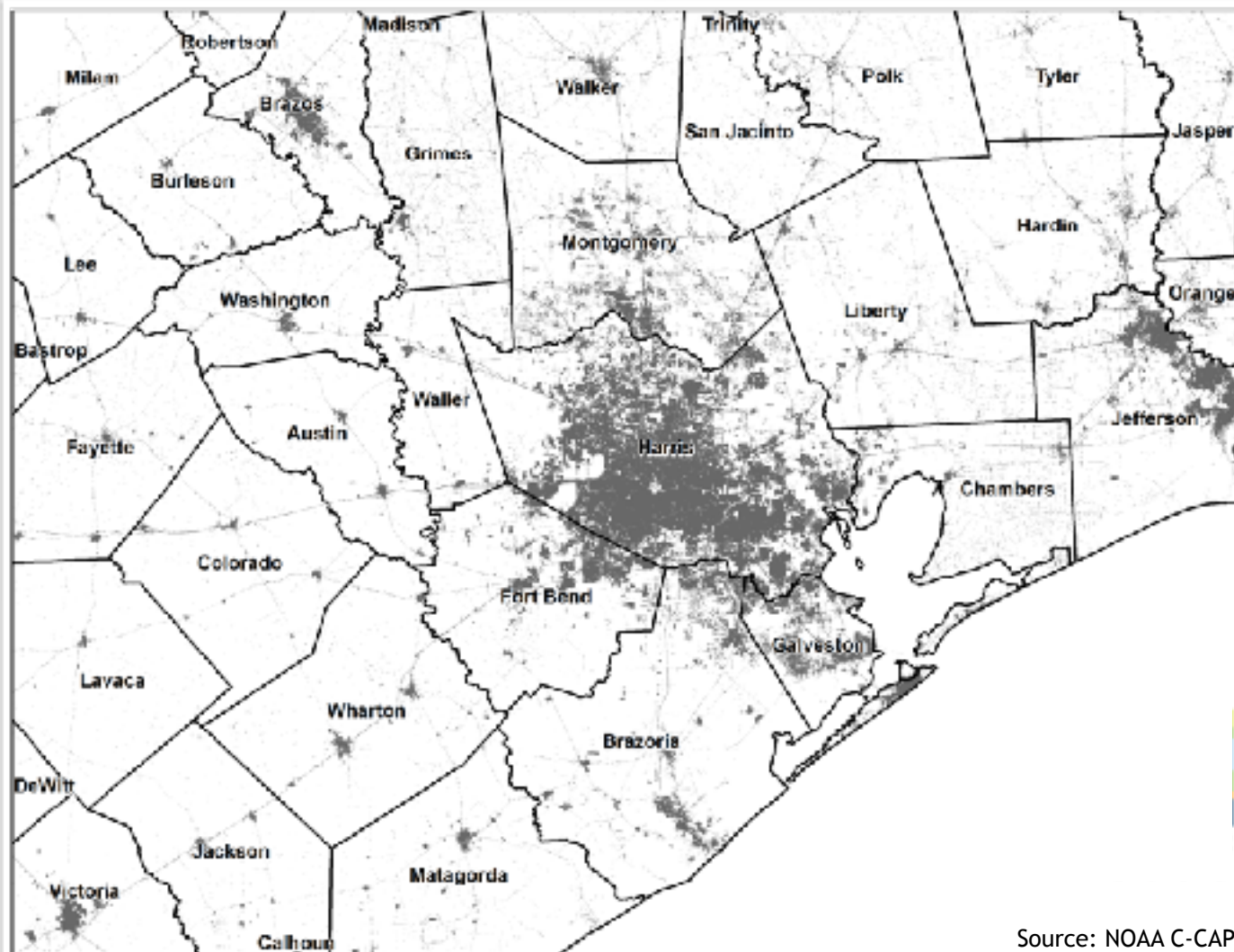
Developed Areas 1996



Source: NOAA C-CAP

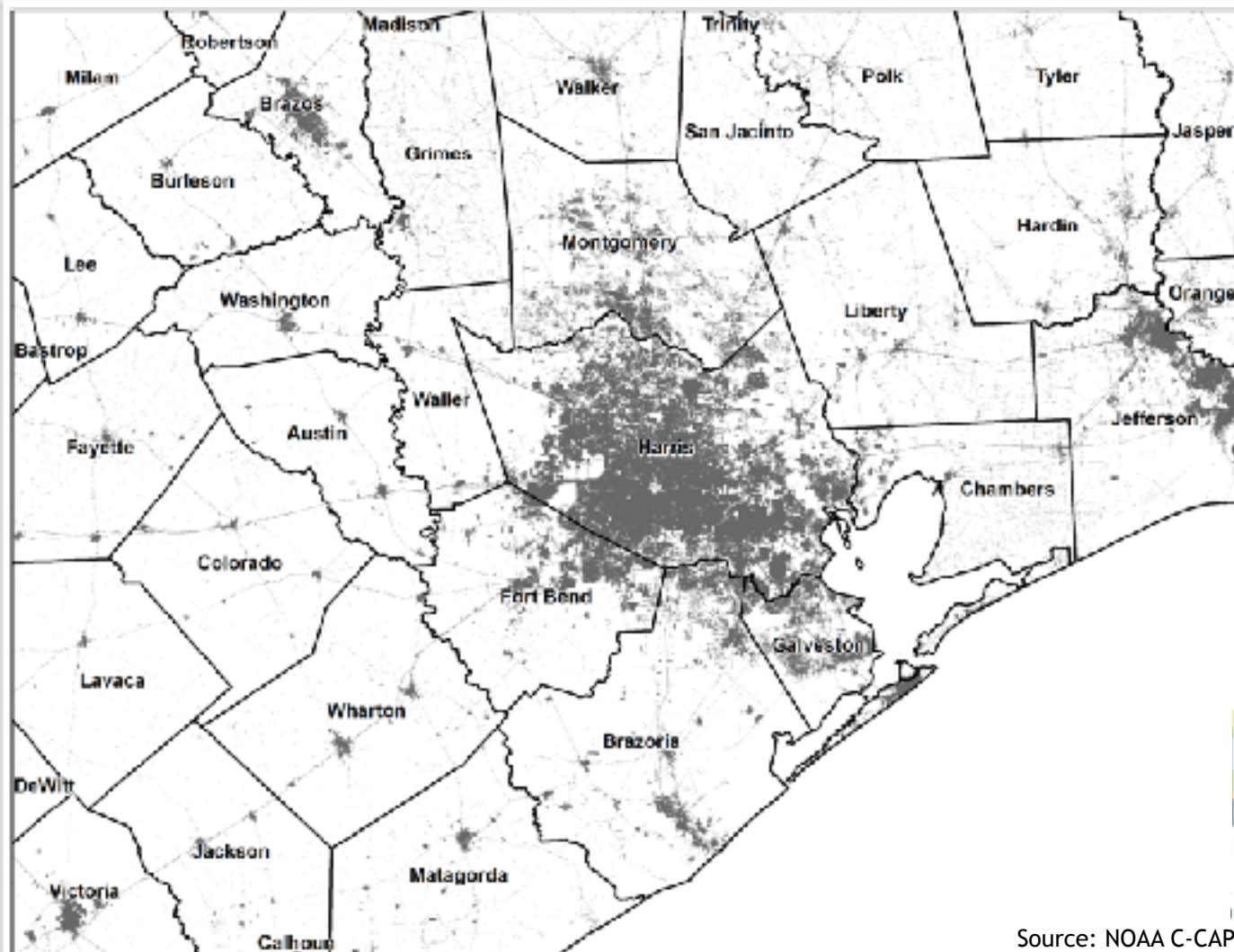


Developed Areas 2001



Source: NOAA C-CAP

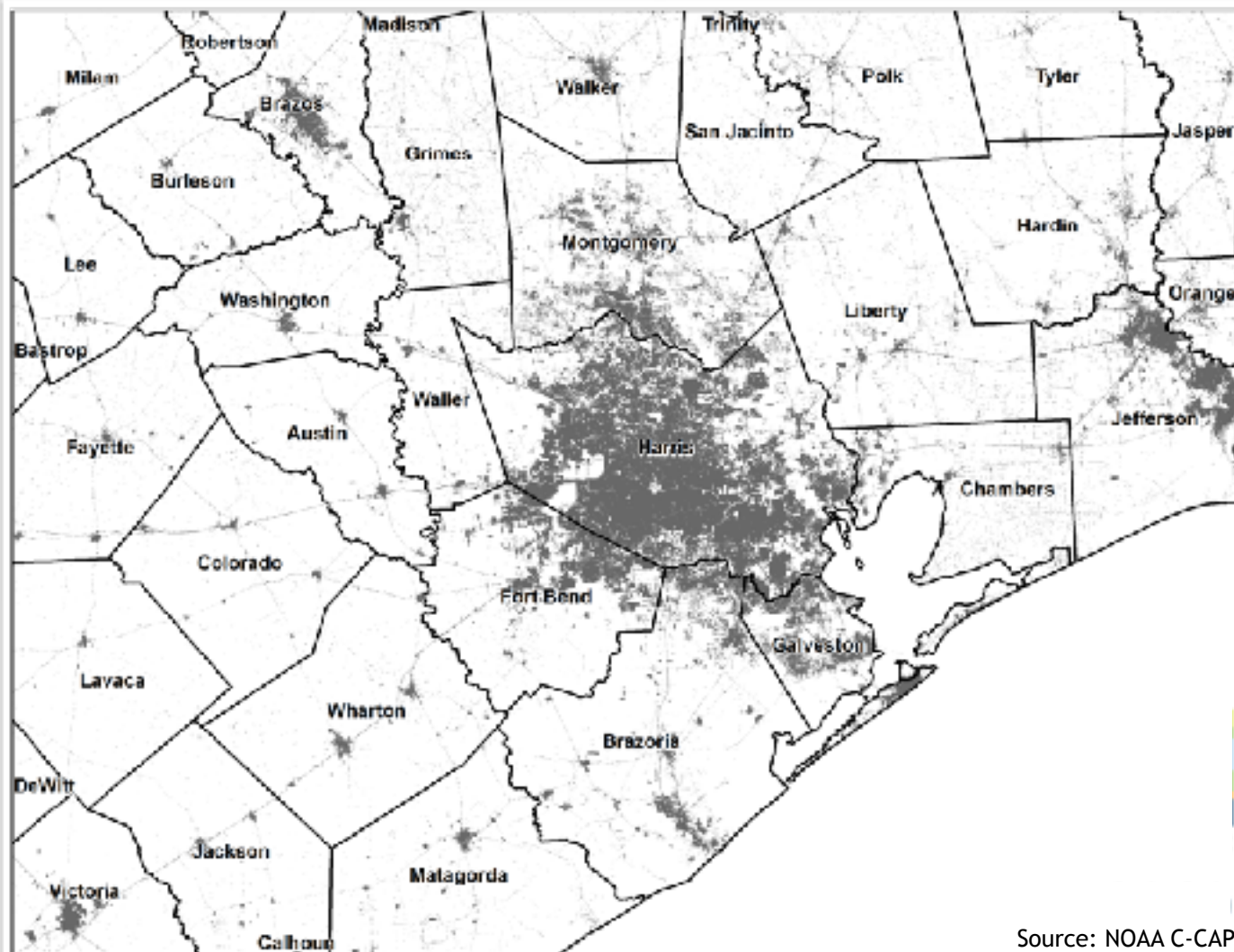
Developed Areas 2006



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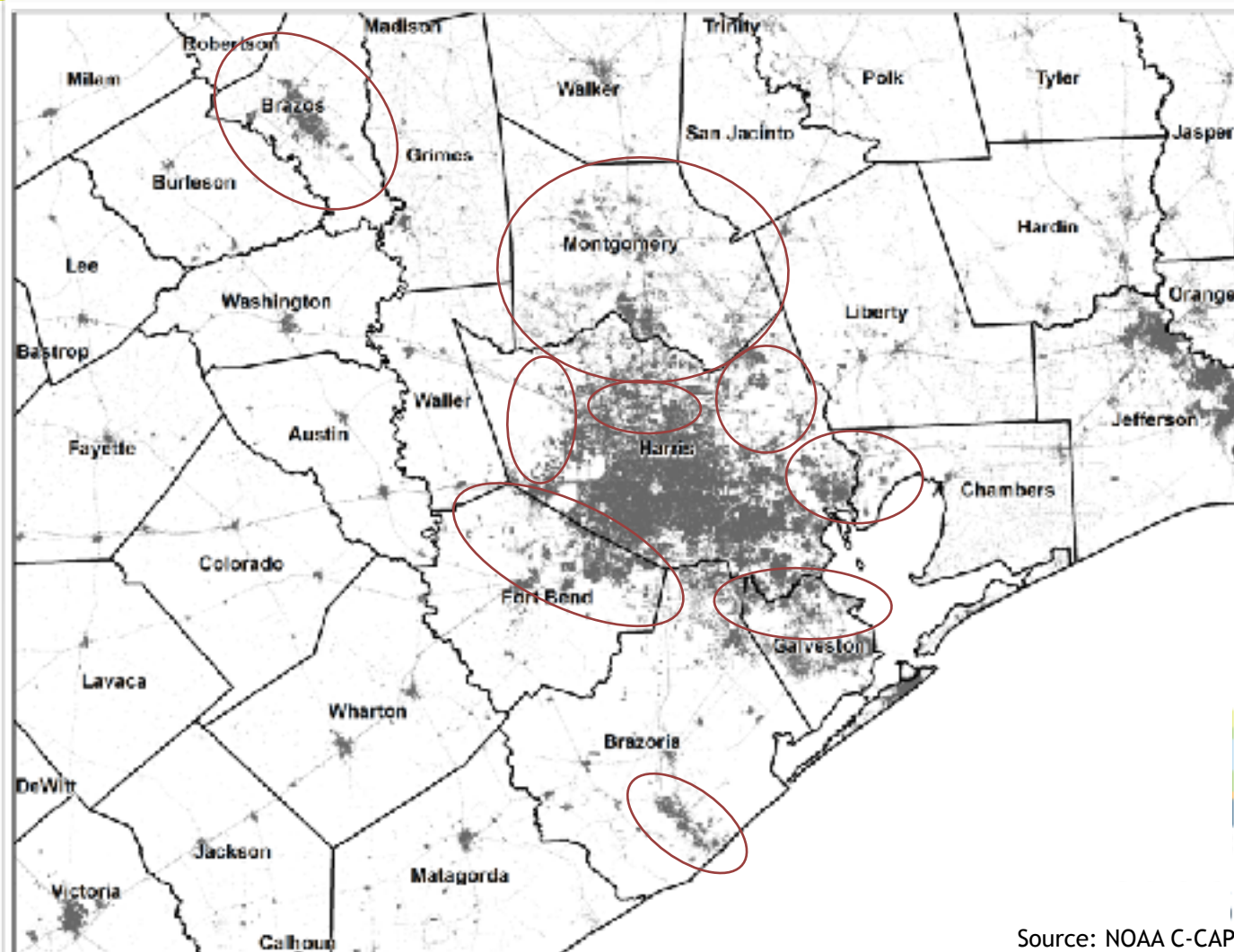
Developed Areas 2010



Source: NOAA C-CAP



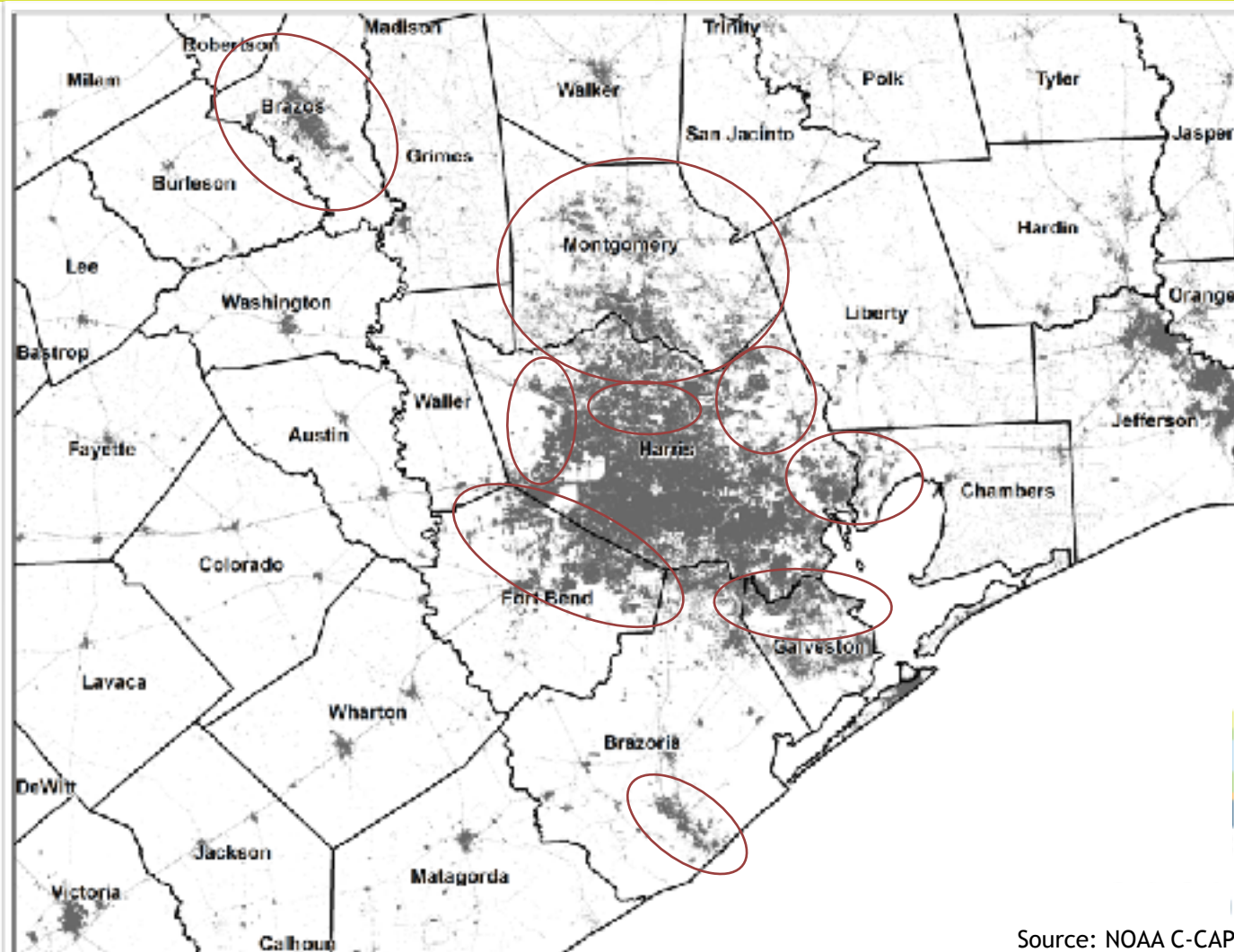
Developed Areas 1996



Source: NOAA C-CAP



Developed Areas 2010



Source: NOAA C-CAP



Land Cover by Watershed 1996-2010

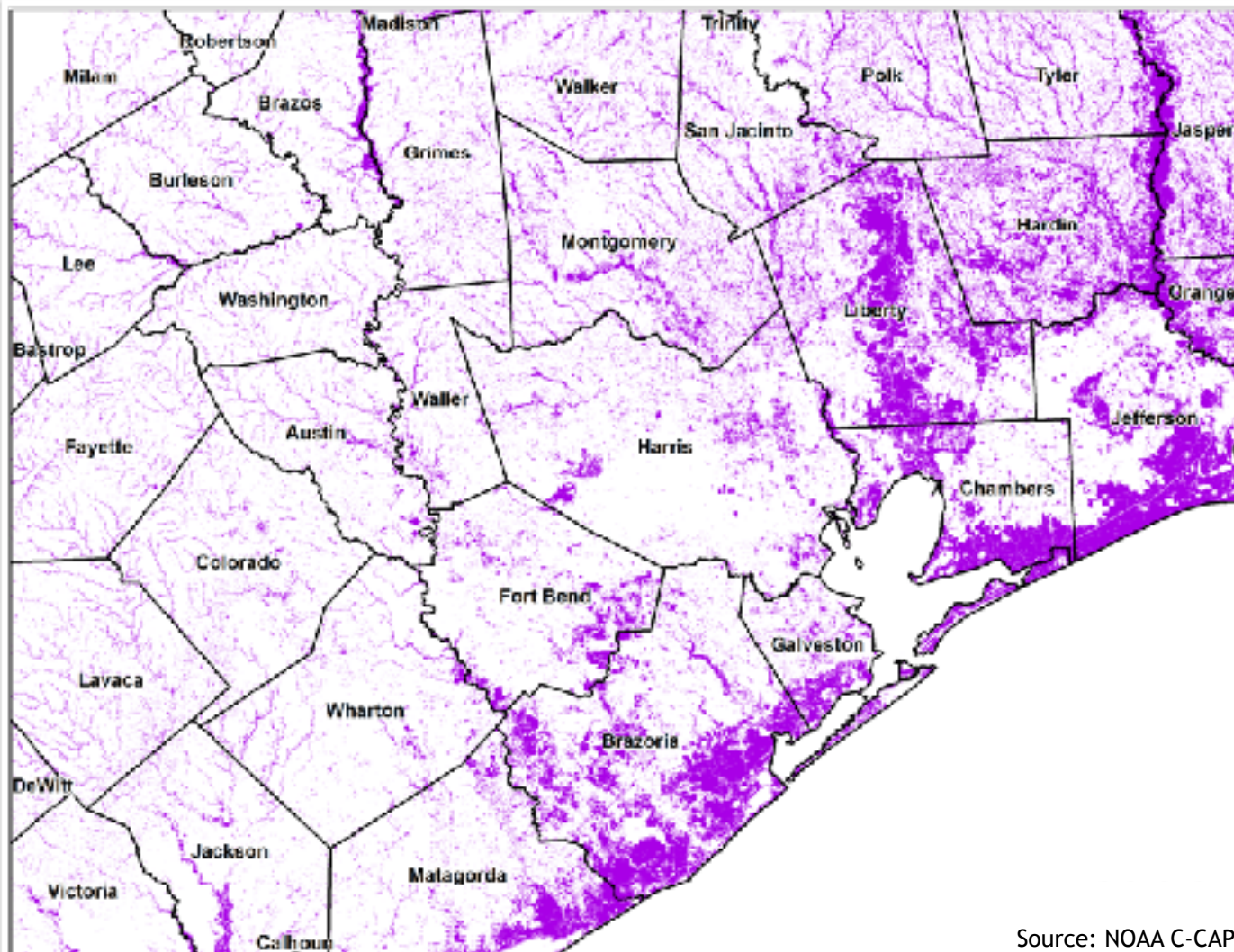
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Waller	9,403	10,281	10,862	11,575	2,172	23.10%	23,607	23,585	23,458	23,506	(101)	-0.43%

Source: NOAA C-CAP

*2016 C-CAP Land Cover still pending release.



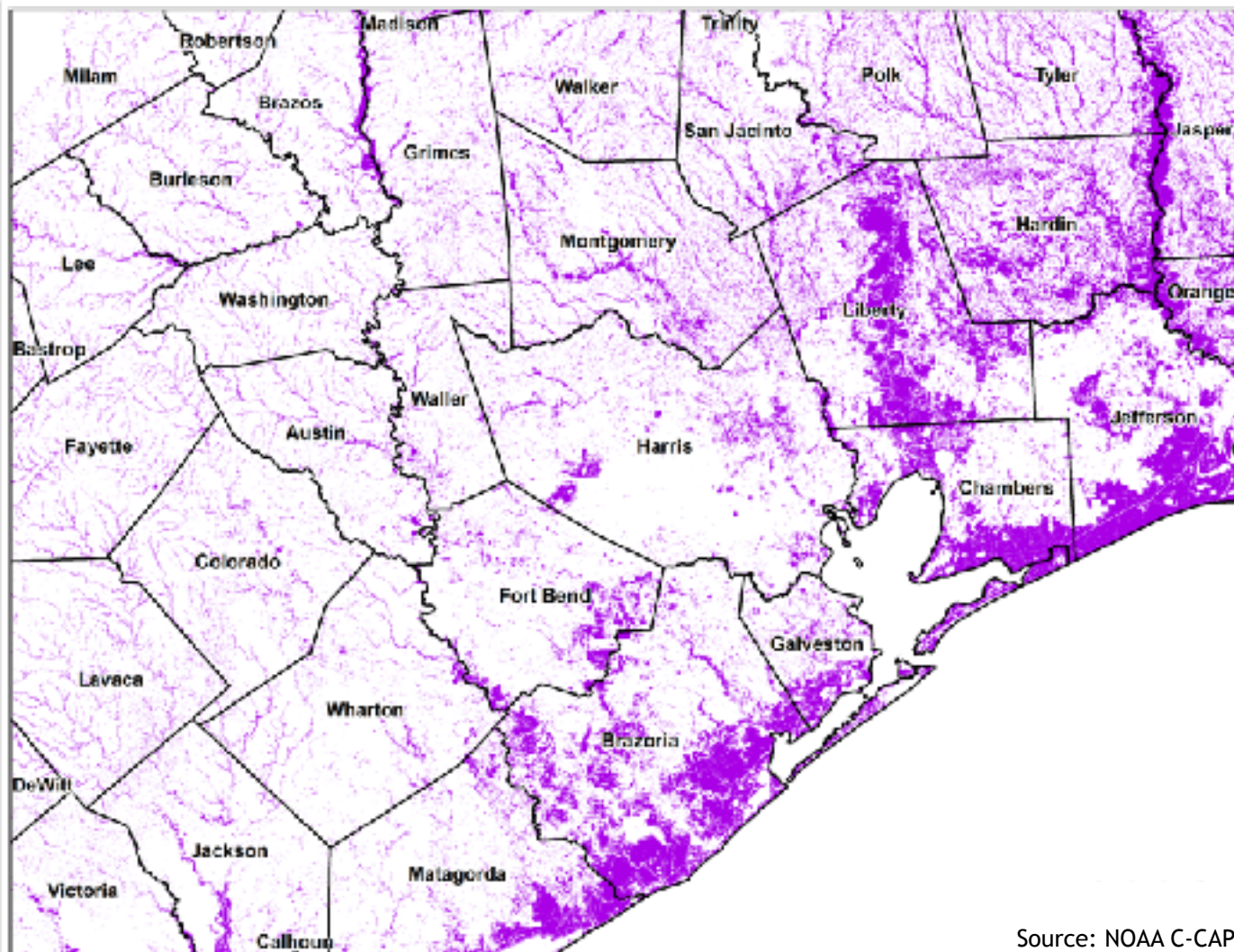
Wetland Areas 1996



Source: NOAA C-CAP



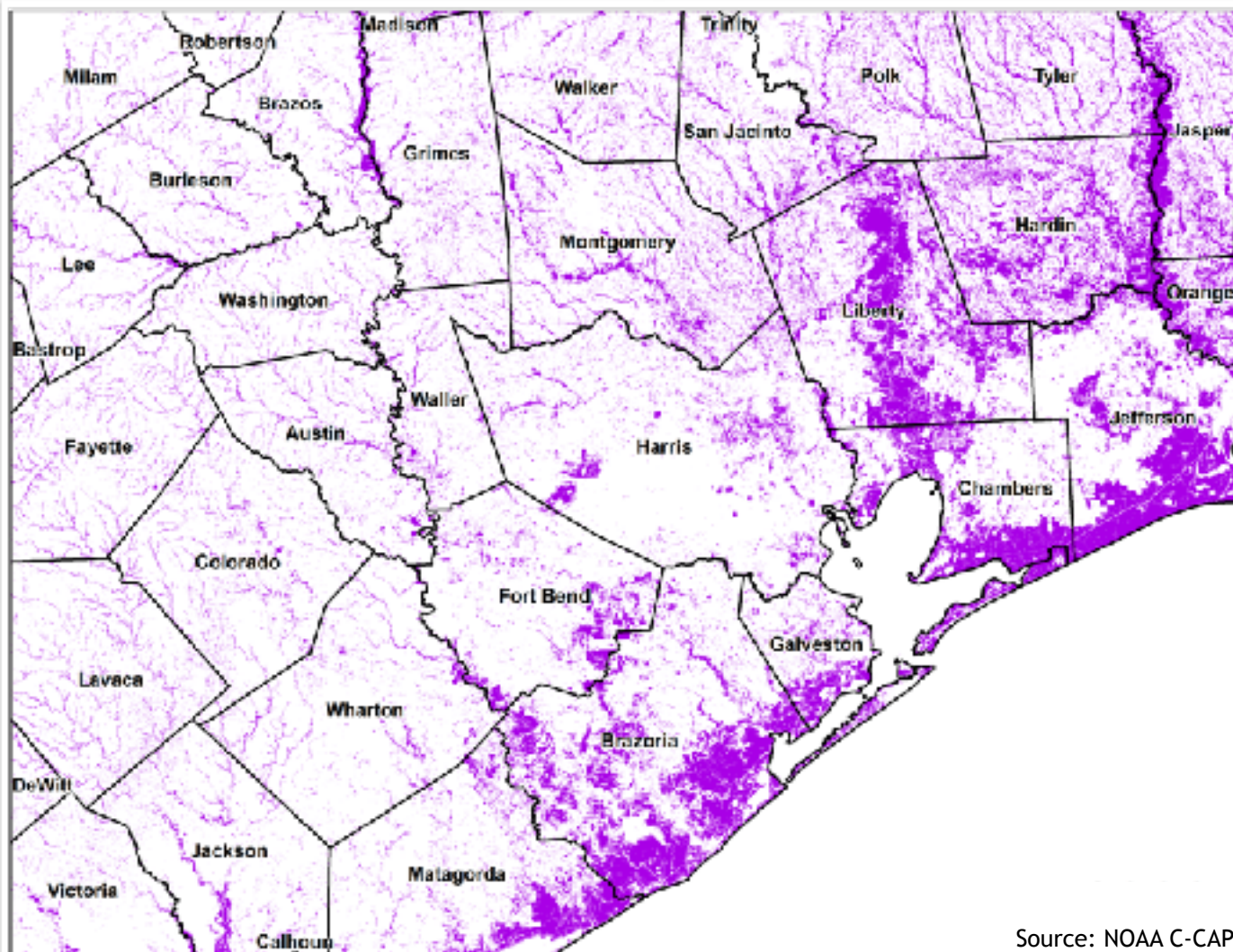
Wetland Areas 2001



Source: NOAA C-CAP



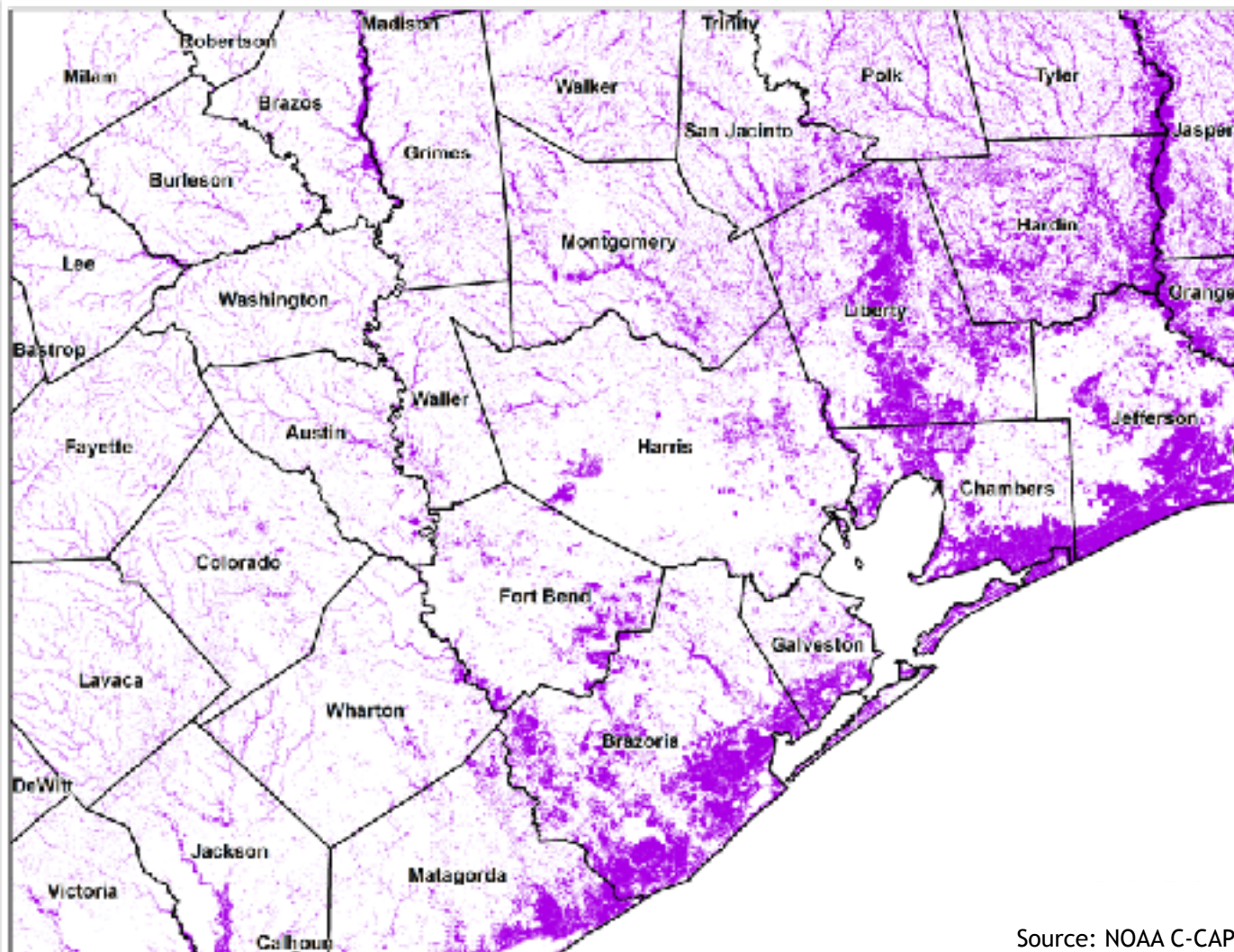
Wetland Areas 2006



Source: NOAA C-CAP



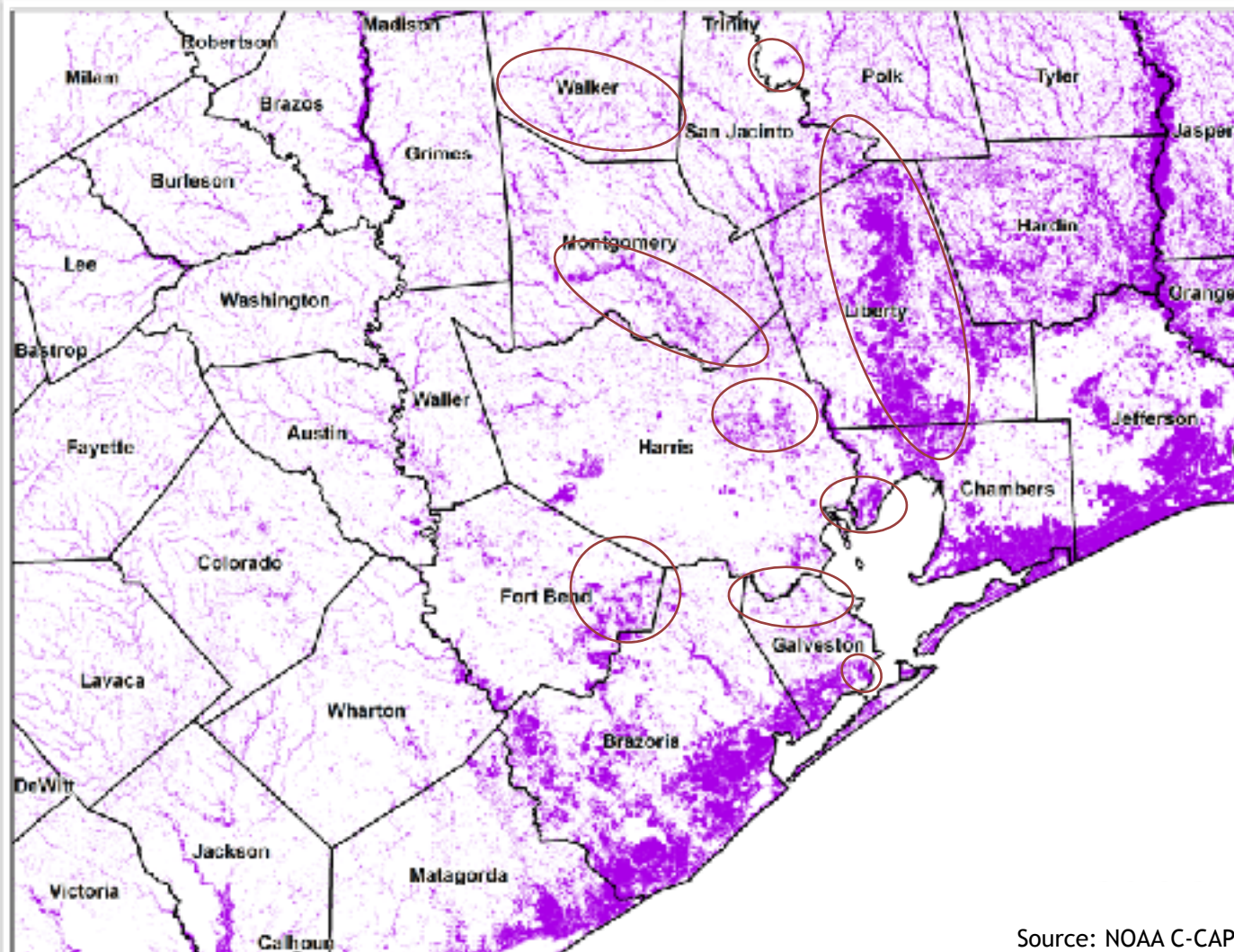
Wetland Areas 2010



Source: NOAA C-CAP



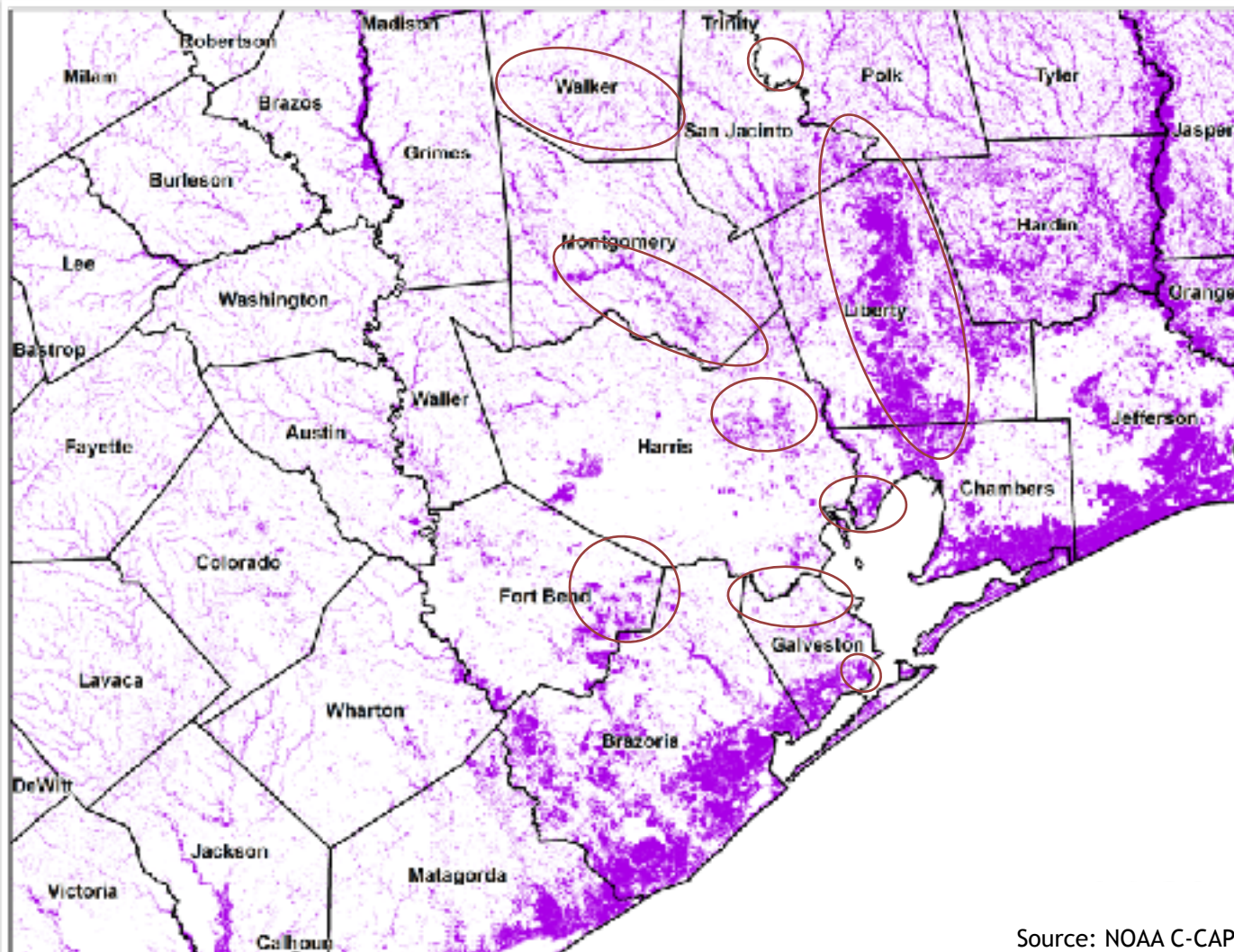
Wetland Areas 1996



Source: NOAA C-CAP



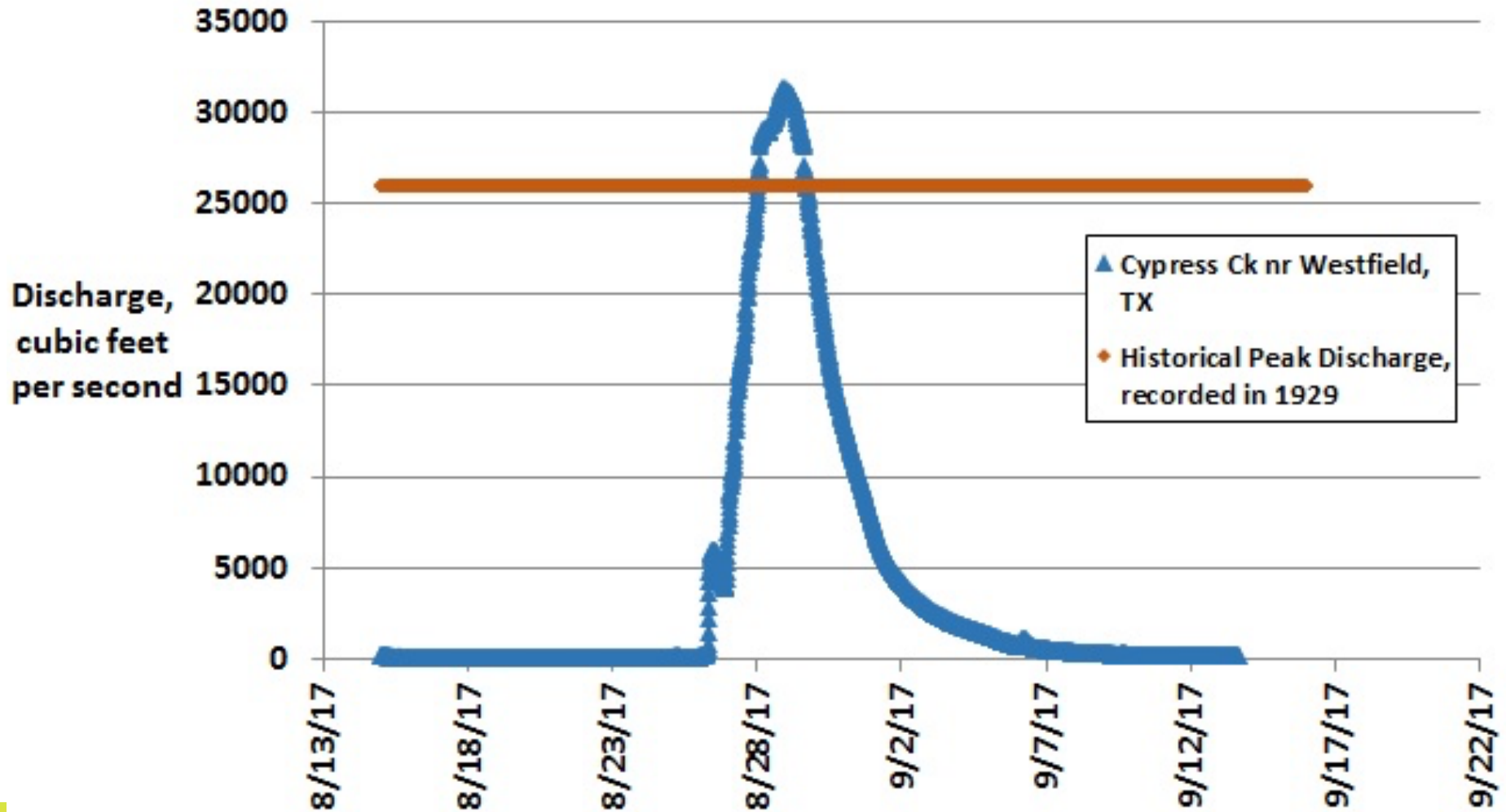
Wetland Areas 2010



Source: NOAA C-CAP



Historical & Harvey Flows Cypress Creek & I-45



Impacts of Increased Runoff



More Runoff = More Sediments

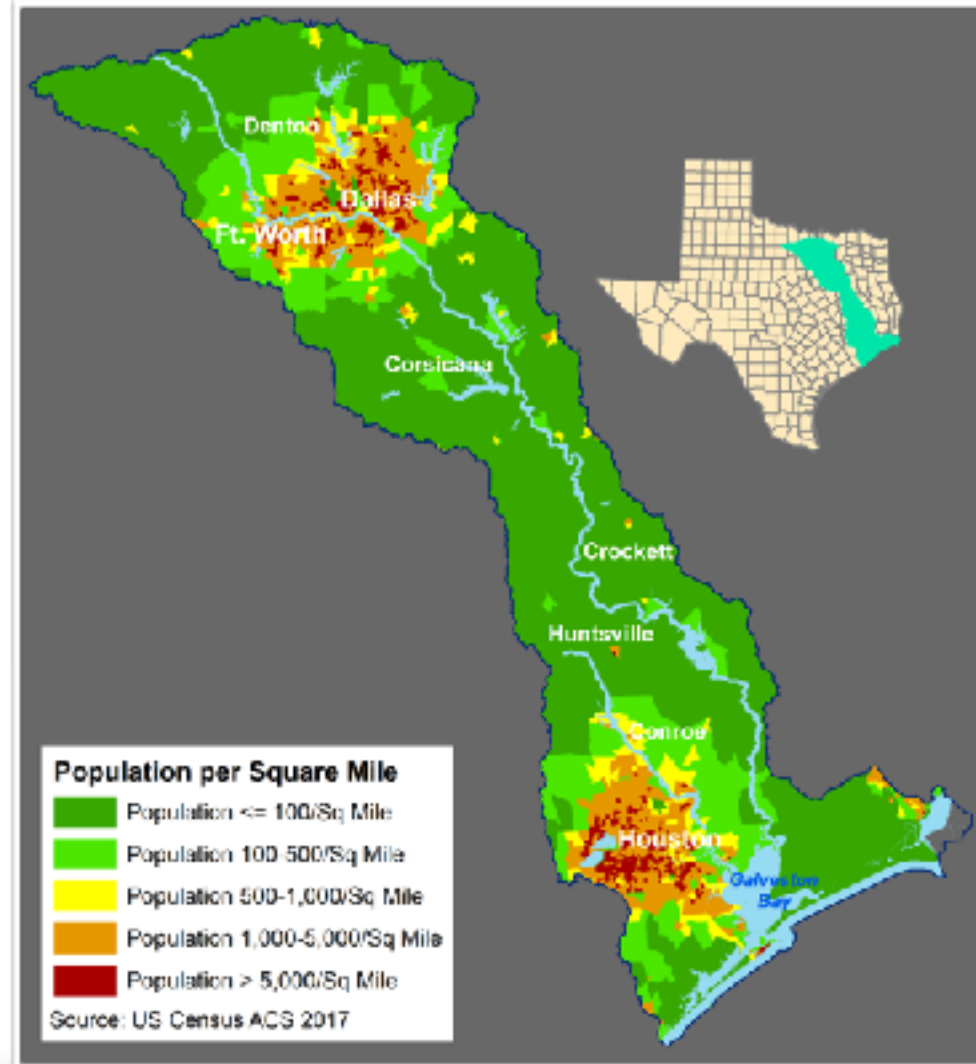


More Runoff = More Sediments



Galveston Bay Watershed

- The Galveston Bay watershed is approximately 24,000 square miles.
- Approximately 13.8 million people, half the population of Texas (27.4 million), live in the Galveston Bay watershed.¹



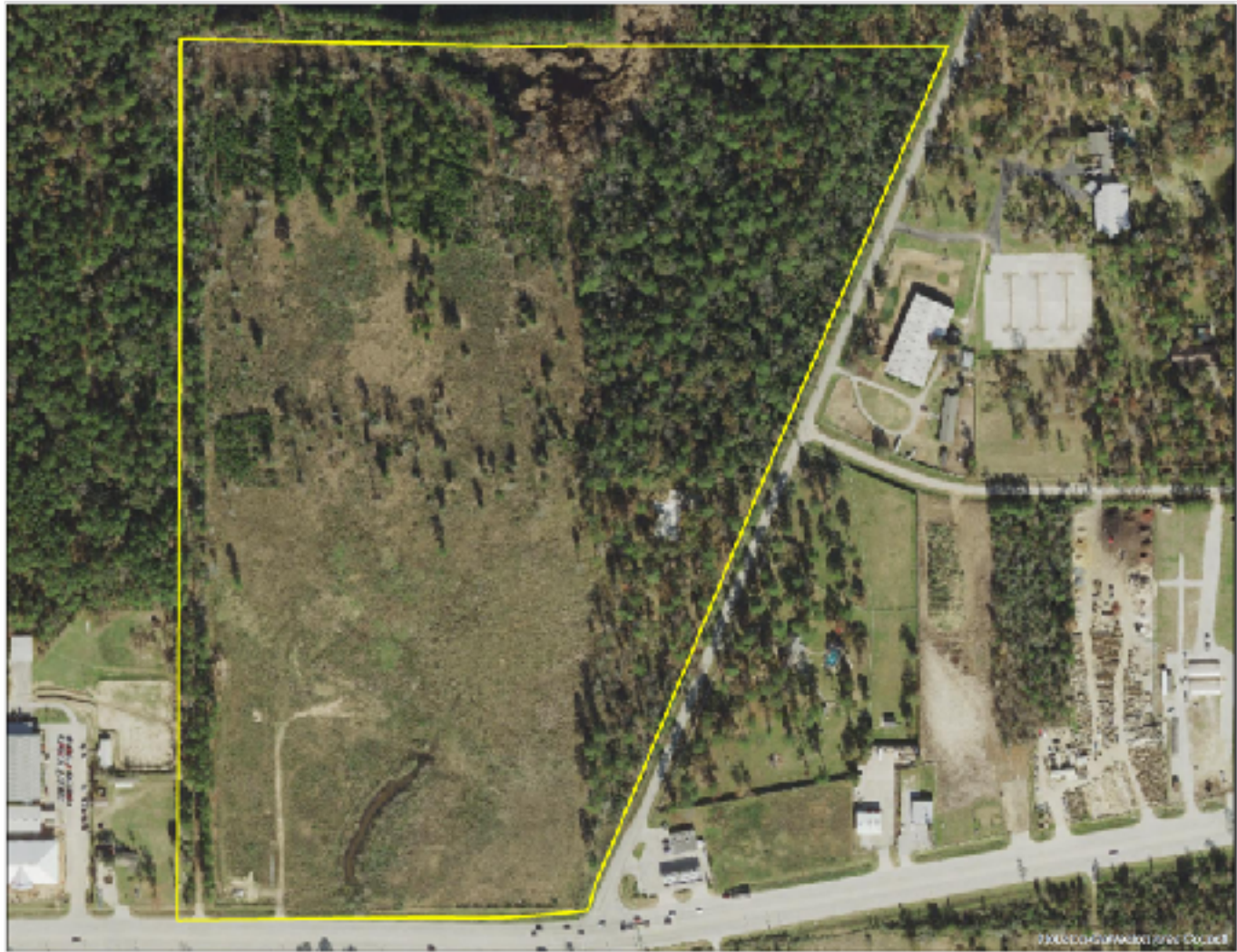
¹U.S. Census, ACS 2017

Changing Landscapes Forested to Farmland to Developed



Source: Houston-Galveston Area Council, Circa 2000

Changing Landscapes Forested to Farmland to Developed



Source: Houston-Galveston Area Council, Circa 2014

Changing Landscapes Forested to Farmland to Developed



Source: Houston-Galveston Area Council, Circa 2017

Changing Landscapes

Residential Development



Source: Houston-Galveston Area Council, Circa 2000

Changing Landscapes

Residential Development



Source: Houston-Galveston Area Council, Circa 2014

Changing Landscapes

Residential Development



Source: Houston-Galveston Area Council, Circa 2017

Changing Landscapes

Large Commercial/Mixed Use



Source: Houston-Galveston Area Council, Circa 2000



Changing Landscapes

Large Commercial/Mixed Use



Source: Grand Central Park



Thoughts & Conclusions

- Texas economic growth driving increased development and loss of ecosystems
- Solving flooding issues isn't just about engineered solutions, but also using green infrastructure
- Regulations only work for incorporated areas where ordinances and zoning can be applied; most of growth is in unincorporated areas
- Non-profit lands trusts are key to helping preserve land; work with willing land owners





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