

Louisiana Black Bear Post-Delisting Monitoring



2nd Annual Report
2017

Monitoring Team Cooperators:

Louisiana Department of Wildlife and Fisheries

U.S. Fish and Wildlife Service

U.S. Geological Survey - Southern Appalachian Research Branch
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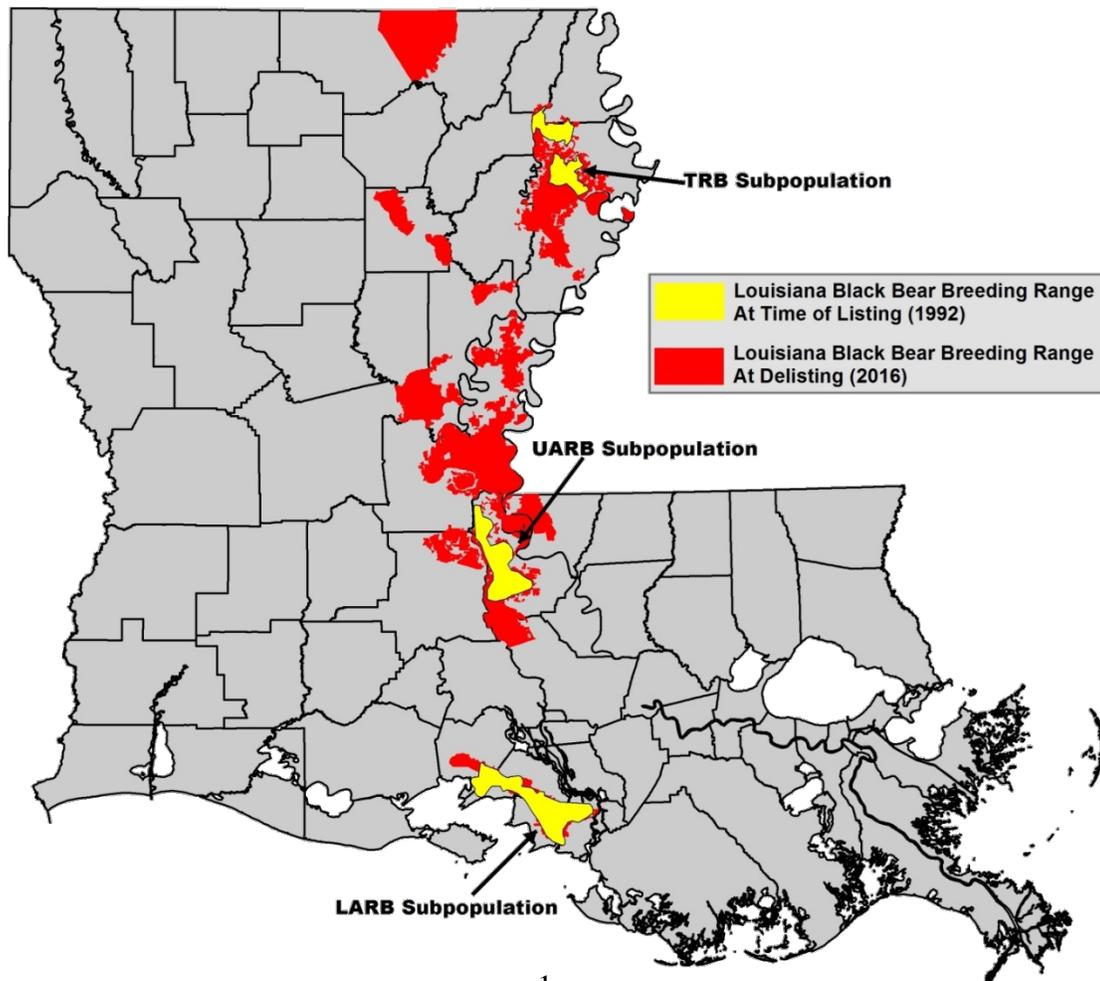
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This annual report is available on the web at:
https://www.fws.gov/Lafayette/la_black_bear.html

Introduction

The Louisiana black bear is one of 16 subspecies of the American black bear. It historically inhabited the forests of Louisiana, southern Mississippi, and eastern Texas, but extensive land clearing, mainly for agricultural purposes, reduced its habitat by more than 80 percent. The Louisiana black bear was listed as threatened on January 7, 1992, primarily due to the reduction in population size resulting from extensive historic habitat loss, reduction in habitat quality due to fragmentation, and human-associated mortality (57 FR 588). Simultaneously, other free-living black bears within the historic range of the Louisiana black bear were listed as threatened due to their similarity of appearance to the Louisiana black bear. On March 10, 2009, the Service published a final rule in the Federal Register (74 FR 10350) designating 1,195,821 acres of critical habitat for the Louisiana black bear.

At the time of listing, the subspecies was restricted to core subpopulations in the Tensas River Basin (TRB subpopulation), the upper Atchafalaya River Basin (UARB subpopulation), and the lower Atchafalaya River Basin in coastal St. Mary and Iberia Parishes (LARB subpopulation). After more than two decades of management, we were able to conclude that the threats to the species had been eliminated or reduced, adequate regulatory mechanisms existed, and subpopulations were stable. Due to recovery, the Louisiana black bear was officially removed from the List of Endangered and Threatened Species on March 11, 2016 (81 FR 13124); critical habitat designation for this subspecies was also withdrawn at that time.



The Service and state resource management agencies have latitude in determining the post-delisting monitoring activities that are necessary and appropriate. The Endangered Species Act does not require the development of a formal Post-Delisting Monitoring (PDM) Plan. However, concurrent with our delisting rule, the Service and the Louisiana Department of Wildlife and Fisheries (LDWF) published a plan to extensively monitor the status of the Louisiana black bear for 7 years following its delisting (though the Endangered Species Act only requires that such monitoring occur for a minimum of 5 years post-delisting). That monitoring, which is ongoing, is designed to detect any potential population decreases or threat increases that may warrant the implementation of measures to ensure that the Louisiana black bear remains secure from risk of extinction. There have been no modifications made to our methodology during our last year of monitoring. The results of our second year of annual post-delisting monitoring are provided in this report.

Results/Conclusions

LDWF Bear Sighting Data

LDWF personnel recorded 80 sightings and 152 bear-related complaints during the current reporting period (April 1, 2016 – March 31, 2017). Additional information regarding LDWF's bear incident reporting data can be found in Appendix I.

Radio Telemetry

Radio telemetry analysis includes known-fate survival data and cub/yearling recruitment data gathered in the post-delisting monitoring period (2013-2016*). The annual female survival rate average ranged from 0.924 (when lost signals were assumed to be live bears) to 0.908 (when lost signals were assumed to be dead bears) for the UARB subpopulation. The annual female survival rate averaged 0.937 (regardless whether lost signals were assumed to be dead or live bears) for the TRB subpopulation. A more detailed description of the analysis and results is provided in Appendix I.

Capture-Mark-Recapture (CMR; Hair-Snare)

Capture-mark-recapture (CMR; hair-snare) data was gathered during the summers (typically during the month of June) of 2012 - 2016. The rationale for using a 5-year average is provided on page 4 of our first annual PDM (2016 Report). The apparent female survival rate was 0.928 for the TRB subpopulation and 0.937 for the UARB subpopulation, during this monitoring period. A more detailed description of the analysis and results is provided in Appendix I.

Habitat Analysis

Permanently Protected Lands

From 2014 to the end of 2017, there has been an addition of over 12,400 acres of permanently protected lands (National Wildlife Refuges/Wildlife Management Areas/Wetland Reserve Program Perpetual Easements/Compensatory Wetland Mitigation Banks) within the Louisiana black bear habitat restoration planning area (HRPA). Since the Louisiana black bear five-year review was completed in 2011, over 37,000 acres of land have been permanently protected within the HRP.

A more detailed description of all habitat analyses is provided in Appendix II.

OVERALL CONCLUSION

Bear sighting and radio telemetry data for our analysis period appear typical and suggest that no new or increasing threats are impacting the subpopulations. CMR data indicate that there is a high probability of long-term persistence ($\geq 95\%$) for the TRB and UARB subpopulations, based on apparent female survival rates that exceed 0.91 for both subpopulations. Our analysis of permanently protected lands in the vicinity of breeding subpopulations indicates that bear habitat is stable to increasing. Based on the analyses described above, we conclude that for the second straight year all Category I standards have been achieved as described in Section IV of the PDM Plan indicating that the “Louisiana black bear metapopulation remains secure without ESA protections.”

Appendix I. Field Data Analysis and Results

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Louisiana Department of Wildlife and Fisheries



U.S. Geological Survey - Southern Appalachian Research Branch
University of Tennessee



POPULATION MONITORING FIELD ACTIVITIES

This report contains all population monitoring activities from April 1, 2016 – March 31, 2017. We live-captured bears and outfitted these individuals with VHF or VHF-GPS radio-collars, or marked bears based on sex and age class. Using monthly aerial telemetry, we monitored 56 radio-collared bears (9M;47F) from all four subpopulations. We conducted our tenth consecutive year of non-invasive hair trapping in the Tensas River and Upper Atchafalaya River basin subpopulations during May-July 2016. Samples were collected from 209 and 116 sites in both subpopulations, respectively, resulting in 2,670 hair samples. All hair snare season samples combined with live capture and mortality samples (total: 2,748) were sent to Wildlife Genetics International (WGI). To collect information on reproductive vital rates, we conducted adult female den visits across all four subpopulations during February-March, 2017 to count and mark cubs-of-the-year, and to count yearlings. From these efforts, we estimated an average litter size of 1.8 cubs for the metapopulation. Adult female collars were changed as necessary. We continued carcass recovery (marked and unmarked bears) and documented 34 mortalities from all causes during the reporting period. Roadkill remains the leading cause of documented mortality (67%). The Beartrak database was routinely updated and we logged 80 sightings and 125 complaints during this reporting period. All complaints received a response as detailed in the LDWF Louisiana black bear Management Plan.

MONITORING PROTOCOLS

Thresholds or tipping points are commonly used to indicate when vulnerabilities to extinction change which can trigger conservation actions. Laufenberg et al. (2017) performed a reanalysis of black bear capture-mark-recapture (CMR) data from 2006 to 2012 from the Upper Atchafalaya River Basin to identify demographic parameters that were good predictors of extinction risk and to quantify thresholds useful for estimating probability of extinction. Conditional classification trees indicated that annual apparent survival rates (ϕ) for adult females averaged over 5 years >0.90 were reliable for predicting likelihoods of population persistence $>95\%$ for 100 years.

The original post-delisting monitoring plan called for population parameters to be averaged over the most recent 3-year period of monitoring, primarily to average out spurious high or low estimates for potentially anomalous years (U.S. Fish and Wildlife Service 2016). The Laufenberg et al. (2017) analysis is more statistically robust and involves a quantitative analysis of triggers and extinction risk, but averaged over a longer (5-year) period. I therefore report estimates for ϕ and other population parameters averaged over the last 5 years. For some parameters, this will include data from 2012, which was included in the population viability analysis by Laufenberg et al. (2016). Though not part of what is considered the post-delisting monitoring data set, the inclusion of that 1 year of data was necessary to obtain a 5-year estimate, upon which the threshold is based. Next year's report will be wholly based on averages from data collected after those analyzed by Laufenberg et al. (2016).

RADIO-TELEMETRY DATA

Survival.—The radio telemetry data consisted of known-fate survival data from 2002-03 to 2016-17. Although I averaged survival rates over the past 5 years, data from previous years were needed to develop complete capture histories. The objective was to use known-fate analysis in Program MARK to estimate annual survival rates (White and Burnham 1999). Survival rates (S) were annual rates beginning on 1 April (approximate date of den exit) to 31 March of the following year. The models were based on the assumption that every bear was radiolocated monthly. Entries were censored only if the bear was not detected for >4 months. Annual survival rates were estimated by censoring animals whose collars ceased to function (S_{AA} or assumed alive) and also assuming those animals died at the time of signal loss (S_{AD} or assumed dead). The study areas consisted of the Tensas River Basin (TRB), Upper Atchafalaya River Basin (UARB), and Three Rivers Complex (TRC).

Annual survival rates for 110 females at TRB, assuming lost signals were alive (S_{AA}) and assuming lost signals were mortalities (S_{AD}) were identical, averaging 0.941 (95% CI = 0.851–0.977) over the previous 5 years. Fourteen females were monitored at UARB and S_{AA} and S_{AD} were both 0.922 (95% CI = 0.779–0.974) over the past 5 years. At TRC, 62 females were monitored and S_{AA} and S_{AD} were again identical, averaging 0.875 (95% CI = 0.726–0.946) over the past 5 years.

Fifteen males were monitored at TRC and S_{AA} and S_{AD} were 0.887 (95% CI = 0.621–0.971) and 0.835 (95% CI = 0.574–0.944) over the past 5 years, respectively. Seven males were monitored at UARB and S_{AA} and S_{AD} were identical at 0.695 (95% CI = 0.242–0.914) over the past 5 years. Only 1 male was monitored at TRB. Numerical convergence was suspect for the male data set, probably because of low sample sizes for some populations.

Fecundity.— The proportions of the radiocollared females that were in 1 of 3 reproductive states: no cubs ($P_{no\ cubs}$), with cubs (P_{cubs}), and with yearlings ($P_{yearlings}$) were estimated, assuming that the collared females were representative of adult females in the population. The reproductive state proportions were based on a Bayesian formulation. Cub and yearling litter sizes and cub and yearling fecundity rates were similarly estimated. Modes of posterior distributions and 2.5 and 97.5% credible intervals are reported. I then used those data to estimate per capita recruitment or fecundity (f_{telem}). Transition data from 2016 to 2017 were needed to estimate some 2016 parameters, so reproductive parameters are reported through 2016.

On TRB, cub fecundity (f_{cub}), or the number of female yearlings annually produced per breeding age female, averaged 0.426 (95% CI = 0.226–0.586) over the past 5 years. Yearling fecundity ($f_{yearling}$) averaged 0.263 (95% CI = 0.131–0.384) over the past 5 years. On UARB, f_{cub} averaged 0.476 (95% CI = 0.288–0.622) and yearling fecundity ($f_{yearling}$) averaged 0.286 (95% CI = 0.151–0.427) over the past 5 years. On TRC, f_{cub} averaged 0.458 (95% CI = 0.051–0.765) and yearling fecundity ($f_{yearling}$) averaged 0.228 (95% CI = 0.023–0.439) over the past 5 years. Population growth rate (λ) over the past

5 years, estimated by adding S_{AA} and $f_{yearling}$, at TRB, UARB, and TRC were 1.203 (95% CI = 1.058–1.335), 1.201 (95% CI = 1.031–1.362), and 1.096 (95% CI = 0.862–1.328), respectively.

CAPTURE-MARK-RECAPTURE DATA

The capture-mark-recapture data to be analyzed consisted of bear captures as a result of DNA extracted from hair collected at barbed-wire sampling sites at TRB from 2006 to 2016 and at UARB from 2007 to 2016. The data were reformatted and analyzed as a Pradel robust design framework in Program Mark (White and Burnham 1999). The data were analyzed based on apparent survival (ϕ) and the finite rate of population increase (λ) differing by sex. Models whereby capture probabilities (p) were estimated as time independent, by sex, with an additive behavioral effect, as 2 heterogeneous mixtures (Pledger 2000), and with a year effect were most supported.

At TRB and UARB, ϕ for females averaged over the past 5 years was 0.928 (95% CI = 0.889–0.954) and 0.937 (95% CI = 0.872–0.971), respectively. Thus, both estimates were well above the minimum threshold of 0.90 suggested by Laufenberg et al. (2017). The finite growth rate (λ) over the past 5 years for females at TRB and UARB was 0.999 (95% CI = 0.961–1.037) and 1.056 (95% CI = 0.989–1.122), respectively. Per-capita recruitment ($f, \lambda - \phi$) at TRB and UARB was 0.071 and 0.119, respectively. Apparent survival rates (ϕ) for females, which include emigration, were above the threshold and similar to rates estimated from telemetry (S_{AA}) suggesting that emigration was low. However, population growth rate estimates (λ) from telemetry were generally higher than estimates from the CMR data, largely because of higher $f_{yearling}$ from the telemetry data compared with f estimated with the CMR data. Estimates of f from the CMR data were probably lower because mortality and emigration occurred between den emergence and future capture in hair snares whereas those factors were not included in estimates of $f_{yearling}$; the latter estimates were based on counts of yearlings that had not yet emerged from winter dens with their mothers.

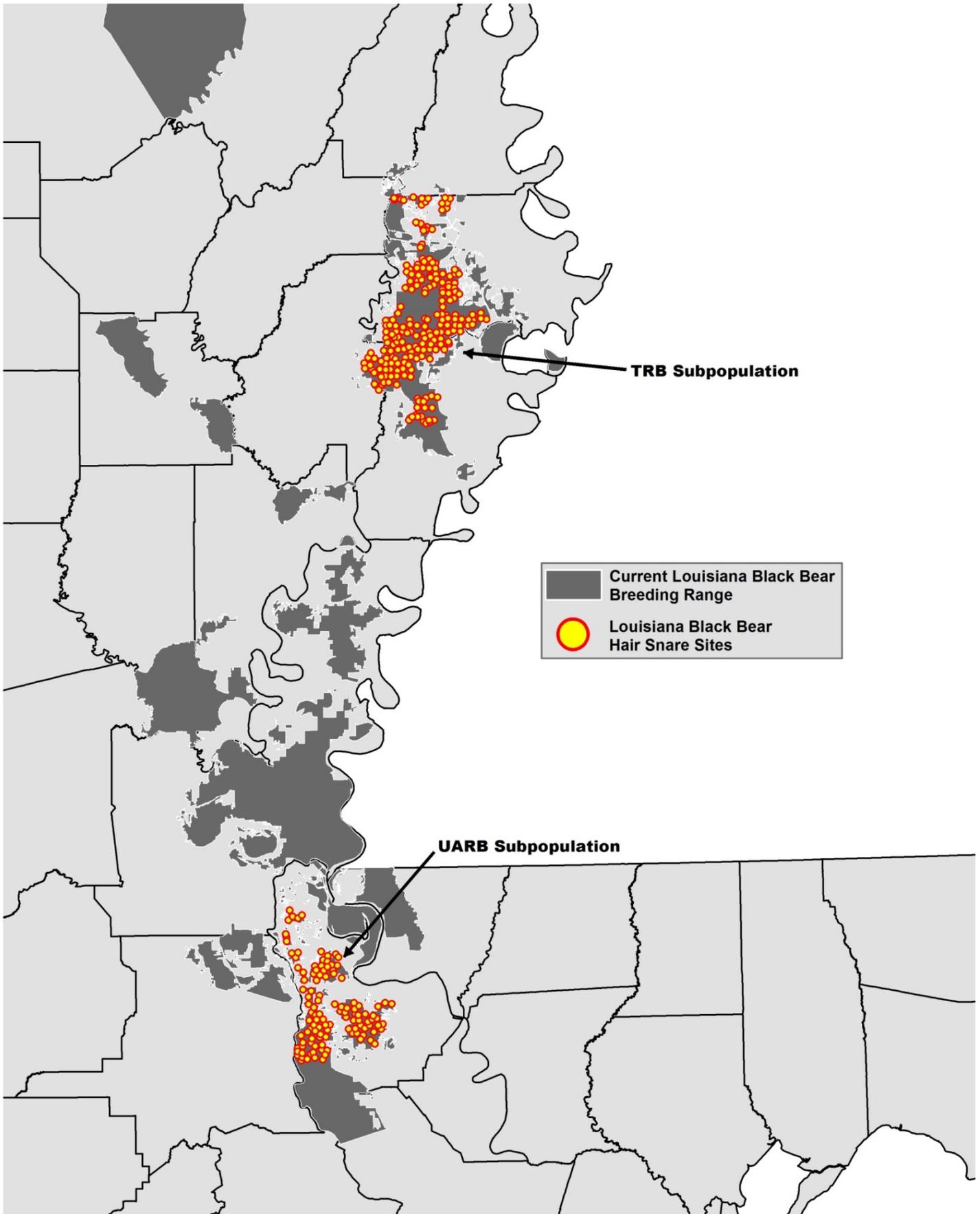
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U.S. Fish and Wildlife Service. 2016. Post-delisting monitoring plan for the Louisiana black bear (*Ursus americanus luteolus*). U.S. Fish and Wildlife Service, Lafayette, Louisiana. 52 pp.

White, G. C., and K. P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. *Bird study* 46:S120–S139.

Map of Louisiana black bear hair snare locations.



Appendix II. Habitat Analysis and Results

Prepared By:

U.S. Fish and Wildlife Service – Louisiana Field Office

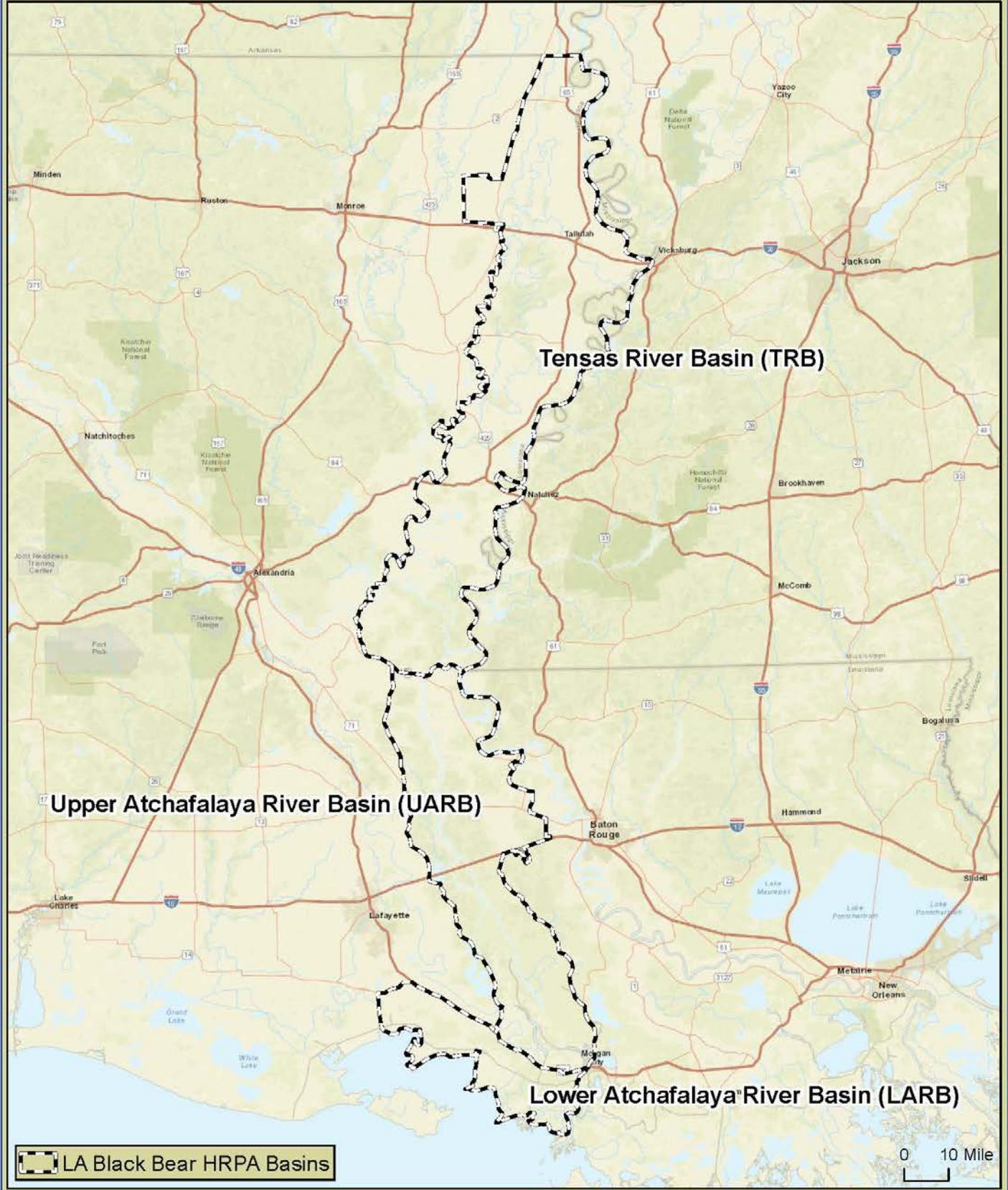


Habitat Monitoring

Monitoring Changes in Permanently Protected Lands

Annual updates were obtained for state and federally owned wildlife managed lands, privately owned mitigation banks and USDA-NRCS Wetland Reserve Program permanent easement enrollments within the Louisiana black bear habitat restoration planning area (HRPA). These datasets were verified for accuracy, summarized acreages and depicted their spatial locations using geographic information systems (GIS) ArcGIS 10.4.1 (ESRI, Redlands, California, USA).

From 2014 to the end of 2017, there has been an addition of over 12,400 acres of permanently protected lands (NWR/WMA/WRP/MB) within the HRPAs (over 4,500 acres of which were added in the last year alone). Over the last year, only the UARB HRPAs experienced a decline in permanently protected lands. Those lands are associated with Racourci Island a portion of which was formerly managed by the State of Louisiana, but is now under private management. The area has remained forested, however, and due to severe annual flooding, is not expected to undergo any significant land use changes. It should be noted that, in spite of the management change on this particular tract of land, the 3-year average for this HRPAs basin shows a significant increase in permanently protected lands.



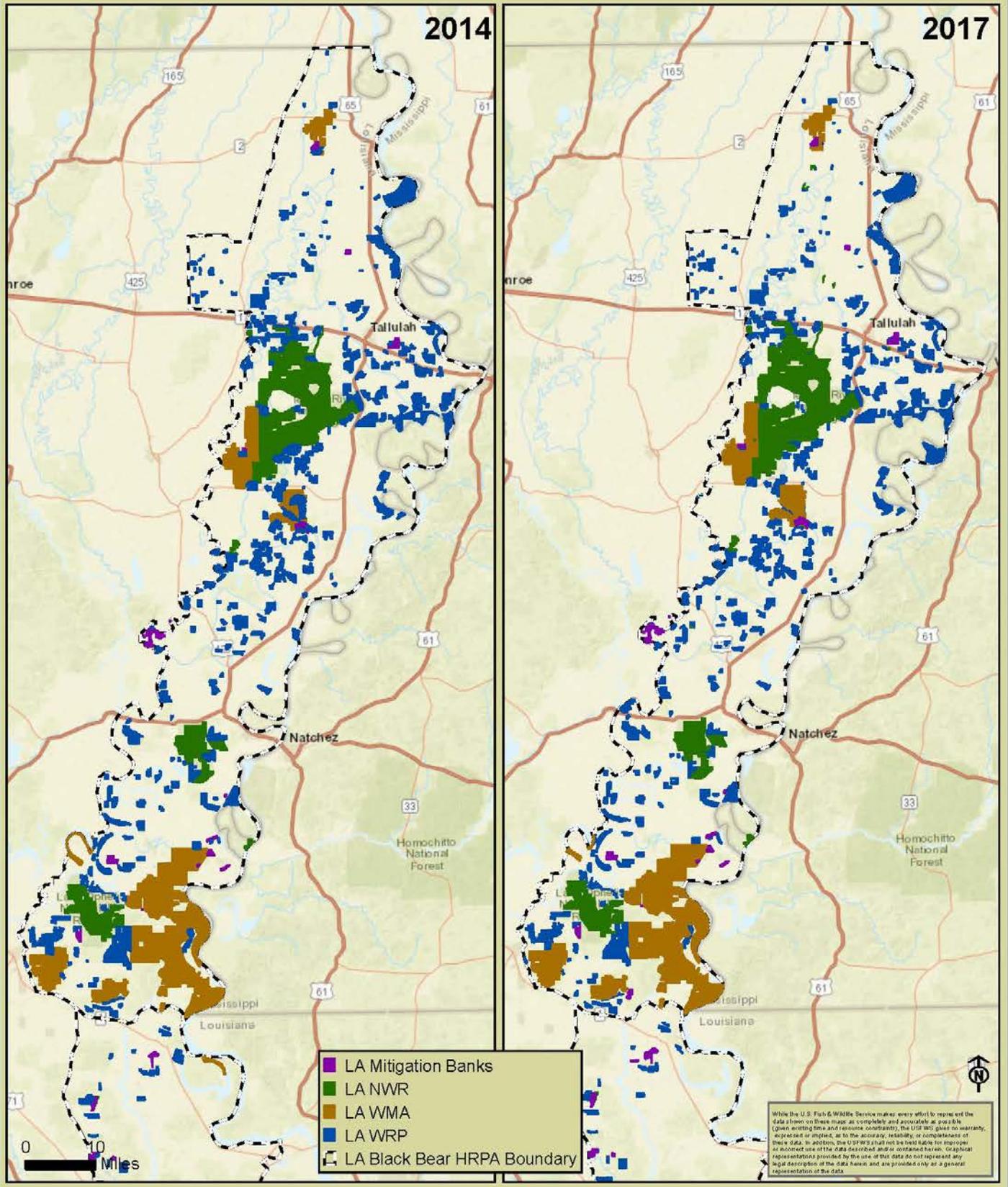
Conservation Lands Within HSPA	HRPA Acres Change 2016 to 2017	HRPA Acres Change 2014 to 2017
NWR / WMA / WRP / MB	4,585.58	12,455.31

Tensas River Basin (TRB) of HSPA

Conservation Lands Within HSPA	TRB Acres (2014)	TRB Acres (2016)	TRB Acres (2017)
National Wildlife Refuge (NWR)	111,965.56	112,224.64	112,231.62
Wildlife Management Area (WMA)	143,933.45	143,584.53	143,558.18
Wetland Reserve Program (WRP)	136,869.81	142,188.63	147,355.95
Mitigation Banks (MB)	5,929.94	6,233.07	6,233.07
Totals:	398,698.75	404,230.87	409,378.83

Changes within Tensas River Basin (TRB) of HSPA

Conservation Lands Within HSPA	TRB Acres Change (2016 to 2017)	TRB Acres Change (2014 to 2017)
National Wildlife Refuge (NWR)	6.98	266.06
Wildlife Management Area (WMA)	-26.35	-375.26
Wetland Reserve Program (WRP)	5,167.32	10,486.15
Mitigation Banks (MB)	0.00	303.13
Totals:	5,147.96	10,680.07



Upper Atchafalaya River Basin (UARB) of HRP A

Conservation Lands Within HRP A	UARB Acres (2014)	UARB Acres (2016)	UARB Acres (2017)
National Wildlife Refuge (NWR)	17,614.20	17,611.82	17,611.82
Wildlife Management Area (WMA)	59,422.91	61,430.82	60,724.08
Wetland Reserve Program (WRP)	11,530.24	11,064.04	11,208.40
Mitigation Banks (MB)	2,726.21	3,571.00	3,571.00
Totals:	91,293.56	93,677.68	93,115.31

Changes within Upper Atchafalaya River Basin (UARB) of HRP A

Conservation Lands Within HRP A	UARB Acres Change (2016 to 2017)	UARB Acres Change (2014 to 2017)
National Wildlife Refuge (NWR)	0.00	-2.38
Wildlife Management Area (WMA)	-706.74	1,301.17
Wetland Reserve Program (WRP)	144.36	-321.83
Mitigation Banks (MB)	0.00	844.79
Totals:	-562.38	1,821.75

Lower Atchafalaya River Basin (LARB) of HRP A

Conservation Lands Within HRP A	LARB Acres (2014)	LARB Acres (2016)	LARB Acres (2017)
National Wildlife Refuge (NWR)	7,426.19	7,379.68	7,379.68
Wildlife Management Area (WMA)	1,474.09	1,474.09	1,474.09
Wetland Reserve Program (WRP)	0.00	0.00	0.00
Mitigation Banks (MB)	2,672.41	2,672.41	2,672.41
Totals:	11,572.68	11,526.18	11,526.18

Changes within Lower Atchafalaya River Basin (LARB) of HRP A

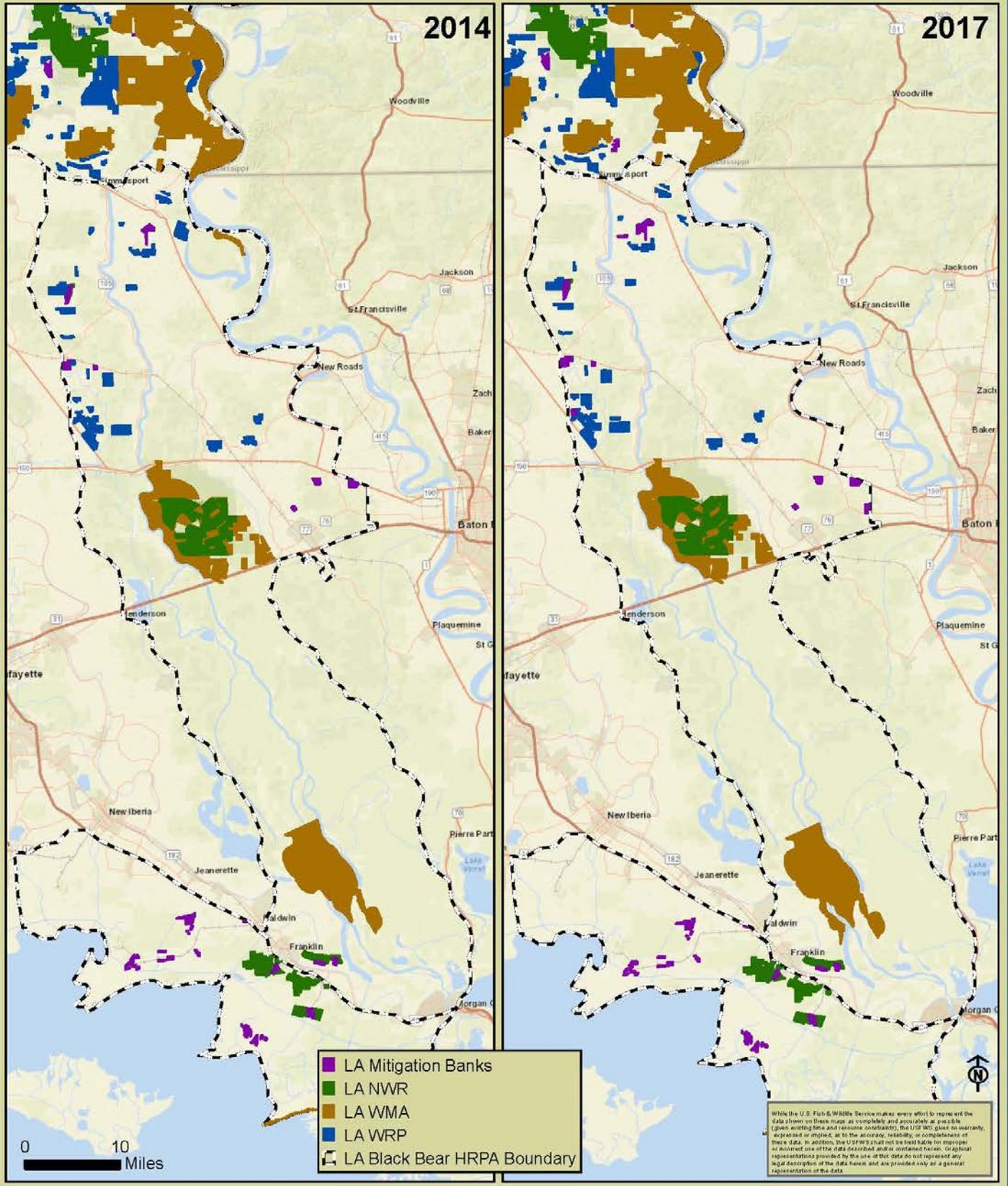
Conservation Lands Within HRP A	LARB Acres Change (2016 to 2017)	LARB Acres Change (2014 to 2017)
National Wildlife Refuge (NWR)	0.00	-46.51
Wildlife Management Area (WMA)	0.00	0.00
Wetland Reserve Program (WRP)	0.00	0.00
Mitigation Banks (MB)	0.00	0.00
Totals:	0.00	-46.51

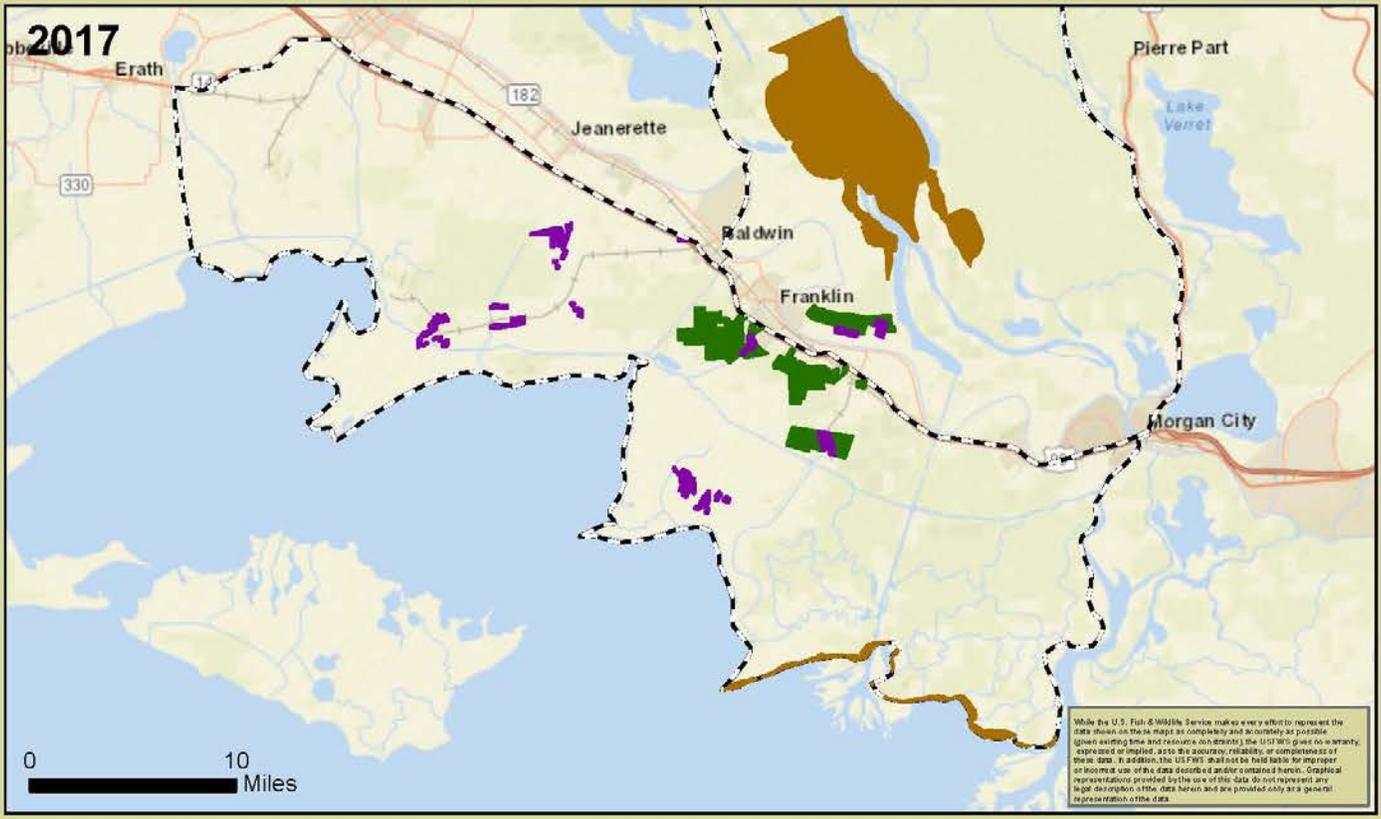
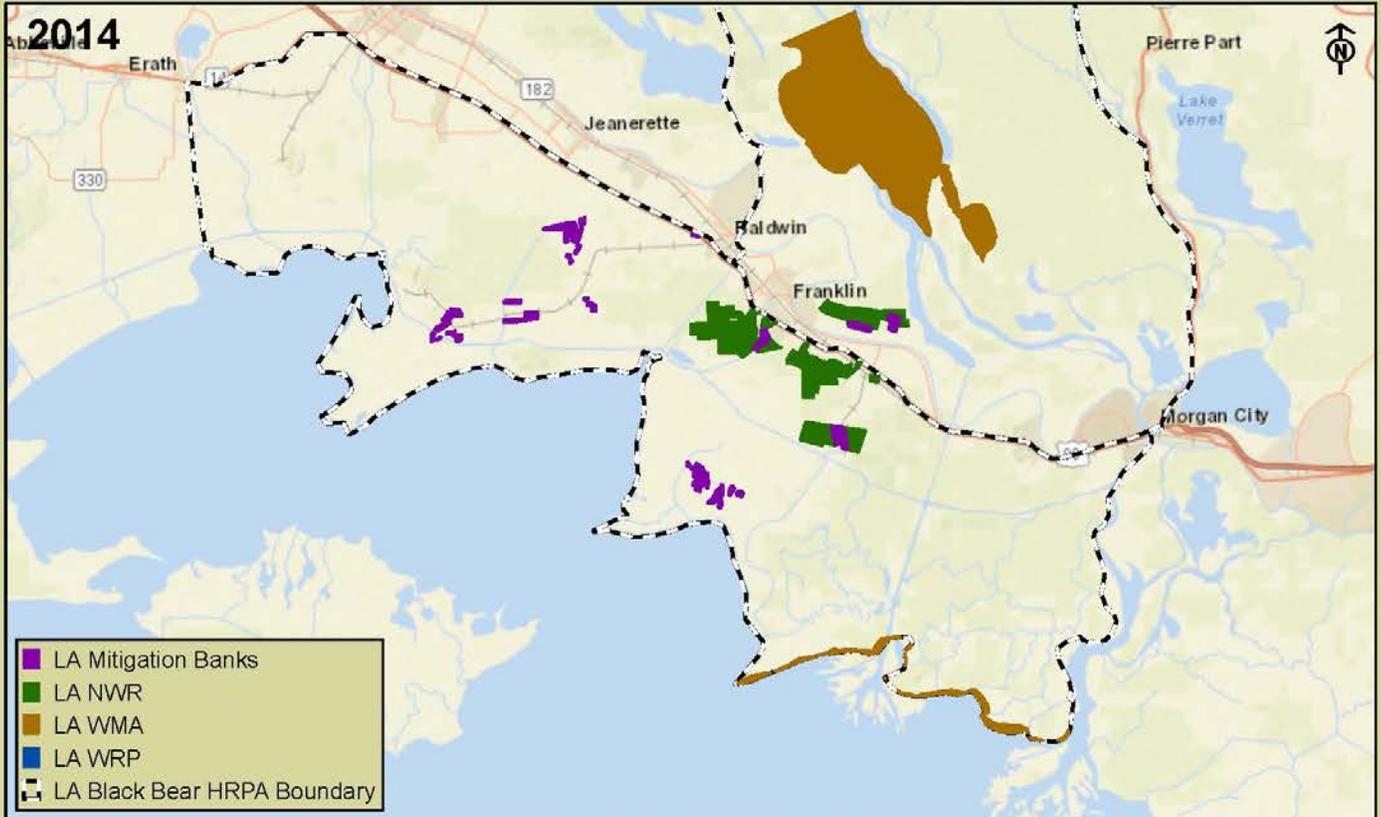


U.S. Fish & Wildlife Service

Louisiana Ecological Services

LA Black Bear Post Delisting Monitoring - Changes Within the HRP Upper Atchafalaya River Basin





Monitoring Change in Agricultural Land Uses using CropScope

2015 CropScope data for HRPB Basins

Crop	TRB 2015	UARB 2015	LARB 2015	Total Acres	Percent
Alfalfa	102.43	0.00	0.00	102.43	0.00%
Aquaculture	855.36	3,100.82	955.65	4,911.83	0.14%
No Data	0.00	0.00	2,692.46	2,692.46	0.07%
Barren	1,281.77	374.31	839.54	2,495.63	0.07%
Corn	145,666.71	12,478.51	14.67	158,159.90	4.37%
Cotton	56,018.45	1,262.67	0.00	57,281.13	1.58%
Dbl Crop Corn/Soybeans	0.00	0.00	0.00	0.00	0.00%
Dbl Crop Soybeans/Cotton	0.00	0.00	0.00	0.00	0.00%
Dbl Crop Soybeans/Oats	12.45	23.34	0.44	36.24	0.00%
Dbl Crop WinWht/Corn	0.00	0.00	0.00	0.00	0.00%
Dbl Crop WinWht/Cotton	0.67	0.00	0.00	0.67	0.00%
Dbl Crop WinWht/Sorghum	6.23	0.00	0.00	6.23	0.00%
Dbl Crop WinWht/Soybeans	12,866.29	10,488.69	3.11	23,358.09	0.64%
Deciduous Forest	1,907.38	1,142.46	1,973.91	5,023.75	0.14%
Developed/High Intensity	537.24	577.83	785.24	1,900.31	0.05%
Developed/Low Intensity	9,871.78	19,100.67	6,754.50	35,726.95	0.99%
Developed/Med Intensity	4,113.33	1,365.97	971.18	6,450.48	0.18%
Developed/Open Space	51,831.01	18,401.01	3,337.89	73,569.92	2.03%
Evergreen Forest	1,412.49	38.24	28.23	1,478.96	0.04%
Fallow/Idle Cropland	164,651.10	14,812.71	11,490.39	190,954.19	5.27%
Grass/Pasture	16,972.84	42,320.54	6,092.54	65,385.91	1.81%
Herbaceous Wetlands	8,832.90	16,115.13	148,779.28	173,727.31	4.80%
Herbs	0.22	0.00	0.00	0.22	0.00%
Misc Veggies & Fruits	0.00	0.00	0.00	0.00	0.00%
Mixed Forest	5,559.23	233.89	46.91	5,840.02	0.16%
Oats	1,763.75	0.00	0.00	1,763.75	0.05%
Open Water	79,190.28	81,707.60	22,303.38	183,201.27	5.06%
Other Crops	0.00	0.00	0.00	0.00	0.00%
Other Hay/Non Alfalfa	12,271.23	1,402.07	6.45	13,679.75	0.38%
Peaches	0.44	0.00	0.00	0.44	0.00%
Peanuts	0.00	0.00	0.00	0.00	0.00%
Peas	4.89	0.00	0.00	4.89	0.00%
Pecans	1,597.23	8.23	0.00	1,605.45	0.04%
Pop or Orn Corn	511.07	0.00	0.00	511.07	0.01%
Rice	23,314.16	9,378.62	503.28	33,196.06	0.92%
Rye	37.13	0.00	0.00	37.13	0.00%
Shrubland	4,958.23	6,606.95	426.13	11,991.31	0.33%
Sod/Grass Seed	4.16	36.91	3.34	44.41	0.00%
Sorghum	21,821.71	5,334.74	1.33	27,157.79	0.75%
Soybeans	685,269.07	116,016.95	3,433.21	804,719.22	22.22%
Spring Wheat	0.00	0.00	0.00	0.00	0.00%
Sugarcane	235.49	63,448.67	33,132.20	96,816.36	2.67%
Sunflower	3.78	0.00	0.00	3.78	0.00%
Sweet Potatoes	2,766.91	0.00	0.00	2,766.91	0.08%
Winter Wheat	10,895.24	2,272.55	45.79	13,213.59	0.36%
Woody Wetlands	727,666.26	772,793.71	121,380.34	1,621,840.30	44.78%
Total	2,054,810.95	1,200,843.78	366,001.38	3,621,656.11	100.00%

2016 CropScope data for HRPB Basins

Crop	TRB 2016	UARB 2016	LARB 2016	Total Acres	Percent
Alfalfa	680.36	0.00	0.00	680.36	0.02%
Aquaculture	468.19	2,919.74	668.42	4,056.34	0.11%
No Data	0.00	0.00	2,692.46	2,692.46	0.07%
Barren	1,052.50	482.05	506.73	2,041.28	0.06%
Clover/Wildflowers	7.74	0.00	0.00	7.74	0.00%
Corn	243,515.86	12,388.37	5.34	255,909.57	7.07%
Cotton	67,356.24	1,202.58	0.00	68,558.82	1.89%
Dbl Crop Corn/Soybeans	100.28	0.00	0.00	100.28	0.00%
Dbl Crop Soybeans/Cotton	0.00	0.00	0.00	0.00	0.00%
Dbl Crop Soybeans/Oats	6.89	129.17	0.00	136.07	0.00%
Dbl Crop WinWht/Corn	0.00	0.00	0.00	0.00	0.00%
Dbl Crop WinWht/Cotton	0.00	0.00	0.00	0.00	0.00%
Dbl Crop WinWht/Sorghum	0.00	0.00	0.00	0.00	0.00%
Dbl Crop WinWht/Soybeans	2,699.17	1,616.76	0.00	4,315.93	0.12%
Deciduous Forest	1,550.55	875.43	2,678.62	5,104.61	0.14%
Developed/High Intensity	518.74	594.20	807.66	1,920.60	0.05%
Developed/Low Intensity	10,030.85	19,302.20	6,780.97	36,114.02	1.00%
Developed/Med Intensity	3,355.24	1,314.81	982.72	5,652.76	0.16%
Developed/Open Space	52,301.55	18,346.30	3,231.49	73,879.34	2.04%
Evergreen Forest	707.98	18.67	47.13	773.79	0.02%
Fallow/Idle Cropland	162,749.38	16,467.89	12,340.00	191,557.27	5.29%
Grass/Pasture	14,786.62	40,439.40	6,010.75	61,236.77	1.69%
Herbaceous Wetlands	8,641.10	14,582.87	154,806.59	178,030.56	4.92%
Herbs	0.00	0.00	0.00	0.00	0.00%
Millet	49.79	0.00	0.00	49.79	0.00%
Misc Veggies & Fruits	0.00	0.00	0.00	0.00	0.00%
Mixed Forest	5,402.29	224.07	10.67	5,637.02	0.16%
Oats	1,919.34	0.00	0.00	1,919.34	0.05%
Open Water	78,269.43	82,022.56	21,110.54	181,402.53	5.01%
Other Crops	0.00	0.00	0.00	0.00	0.00%
Other Hay/Non Alfalfa	19,161.30	1,213.73	2.89	20,377.92	0.56%
Peaches	12.90	0.00	0.00	12.90	0.00%
Peanuts	0.00	0.00	0.00	0.00	0.00%
Peas	0.22	0.00	0.00	0.22	0.00%
Pecans	1,339.24	3.56	0.00	1,342.80	0.04%
Pop or Orn Corn	0.00	0.00	0.00	0.00	0.00%
Rice	31,747.67	9,791.52	361.75	41,900.94	1.16%
Rye	0.00	0.00	0.00	0.00	0.00%
Shrubland	4,387.78	6,383.61	302.14	11,073.53	0.31%
Sod/Grass Seed	55.94	0.67	0.22	56.83	0.00%
Sorghum	15,755.88	4,557.99	0.22	20,314.09	0.56%
Soybeans	590,096.47	116,246.62	2,036.31	708,379.39	19.56%
Spring Wheat	0.00	0.00	0.00	0.00	0.00%
Sugarcane	362.20	74,039.92	34,465.89	108,868.01	3.01%
Sunflower	276.98	0.00	0.00	276.98	0.01%
Sweet Corn	9.12	0.00	0.00	9.12	0.00%
Sweet Potatoes	2,513.11	0.67	0.00	2,513.78	0.07%
Winter Wheat	58.68	218.55	0.22	277.45	0.01%
Woody Wetlands	732,863.37	775,459.89	116,151.65	1,624,474.91	44.85%
Total	2,054,810.95	1,200,843.78	366,001.38	3,621,656.12	100.00%

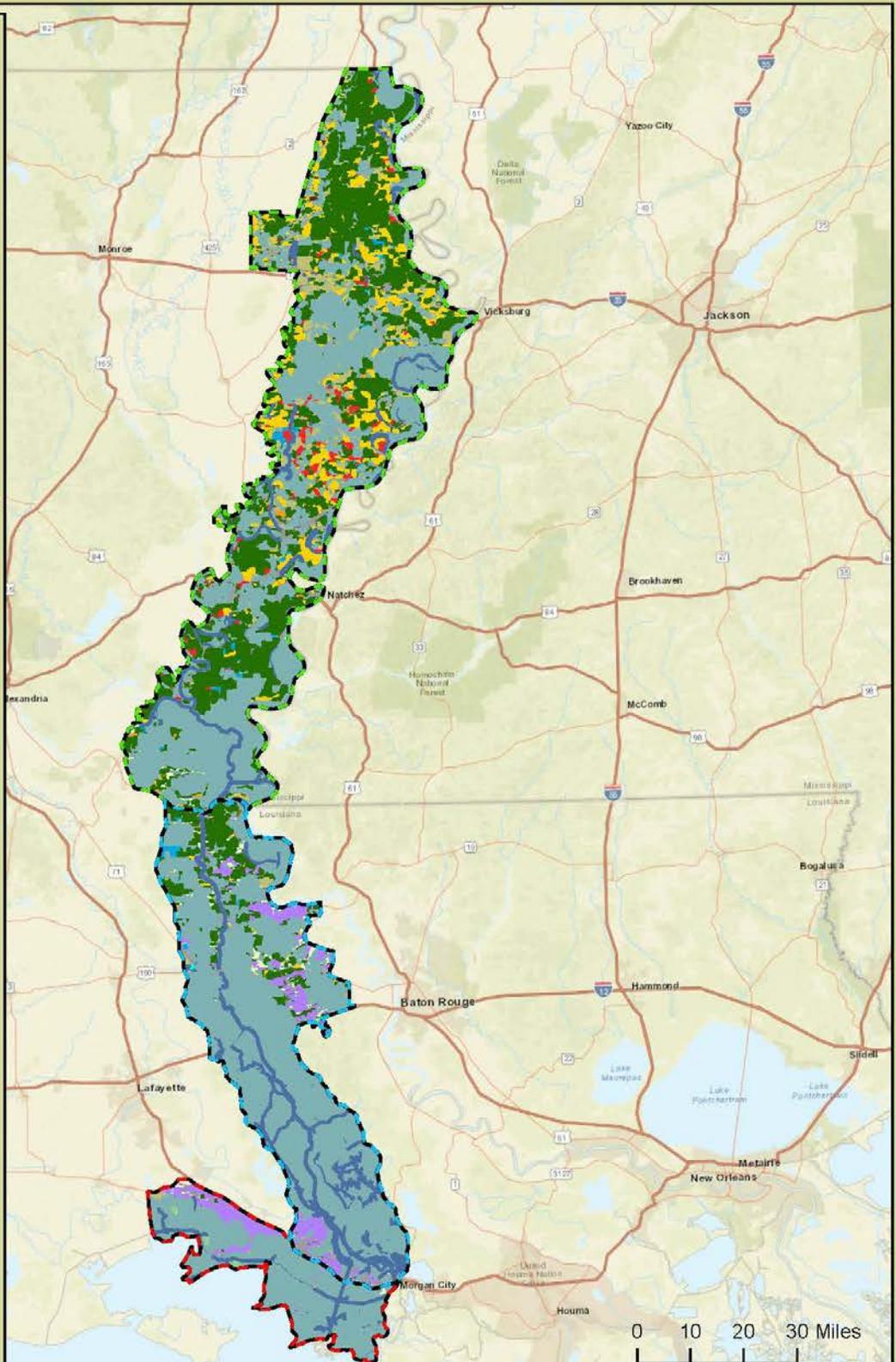


HRPA Units

- TRB
- UARB
- LARB

2016 USDA Crops

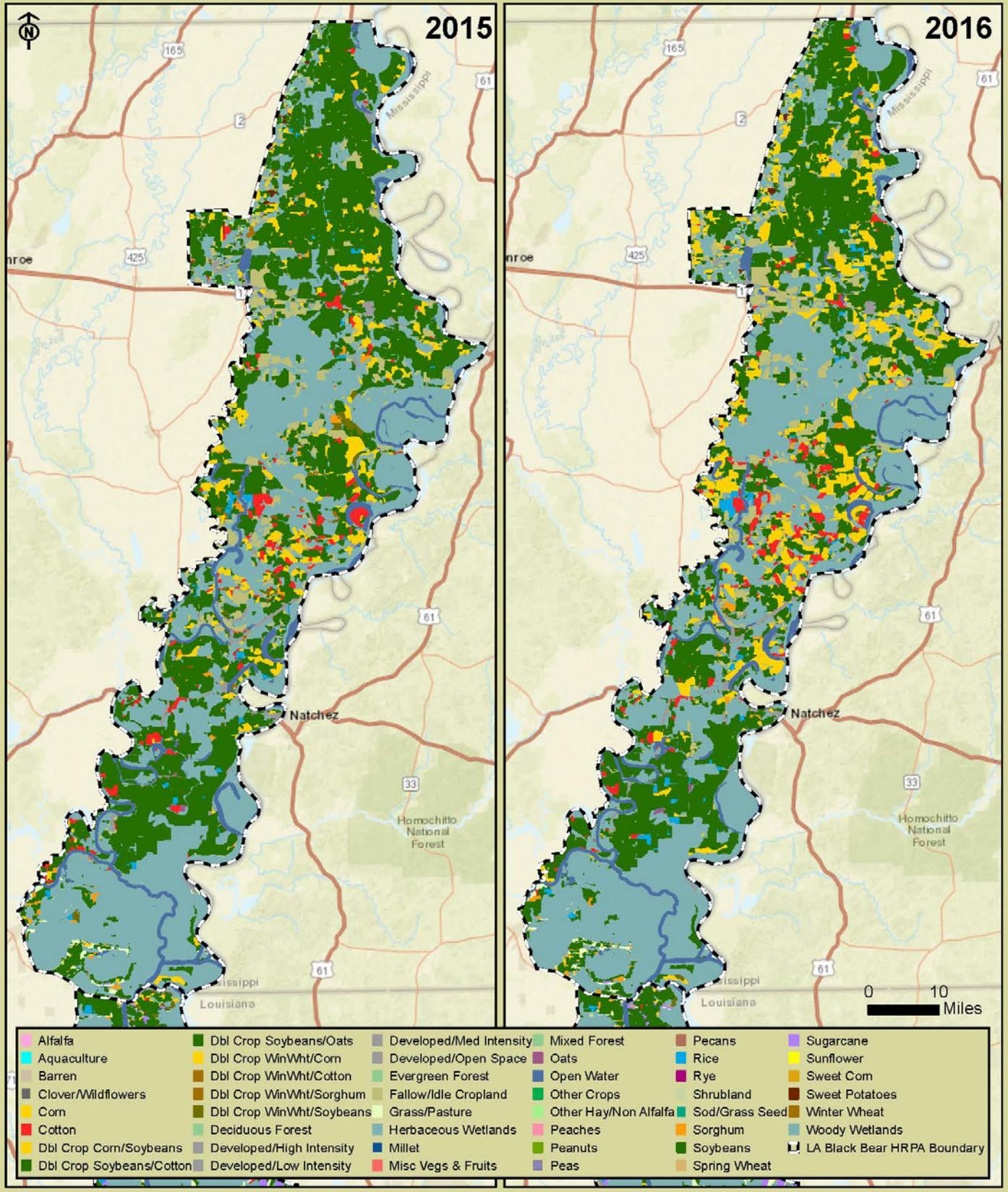
- Alfalfa
- Aquaculture
- Barren
- Clover/Wildflowers
- Corn
- Cotton
- Dbl Crop Corn/Soybeans
- Dbl Crop Soybeans/Cotton
- Dbl Crop Soybeans/Oats
- Dbl Crop WinWht/Corn
- Dbl Crop WinWht/Cotton
- Dbl Crop WinWht/Sorghum
- Dbl Crop WinWht/Soybeans
- Deciduous Forest
- Developed/High Intensity
- Developed/Low Intensity
- Developed/Med Intensity
- Developed/Open Space
- Evergreen Forest
- Fallow/Idle Cropland
- Grass/Pasture
- Herbaceous Wetlands
- Millet
- Misc Veggies & Fruits
- Mixed Forest
- Oats
- Open Water
- Other Crops
- Other Hay/Non Alfalfa
- Peaches
- Peanuts
- Peas
- Pecans
- Rice
- Rye
- Shrubland
- Sod/Grass Seed
- Sorghum
- Soybeans
- Spring Wheat
- Sugarcane
- Sunflower
- Sweet Corn
- Sweet Potatoes
- Winter Wheat
- Woody Wetlands

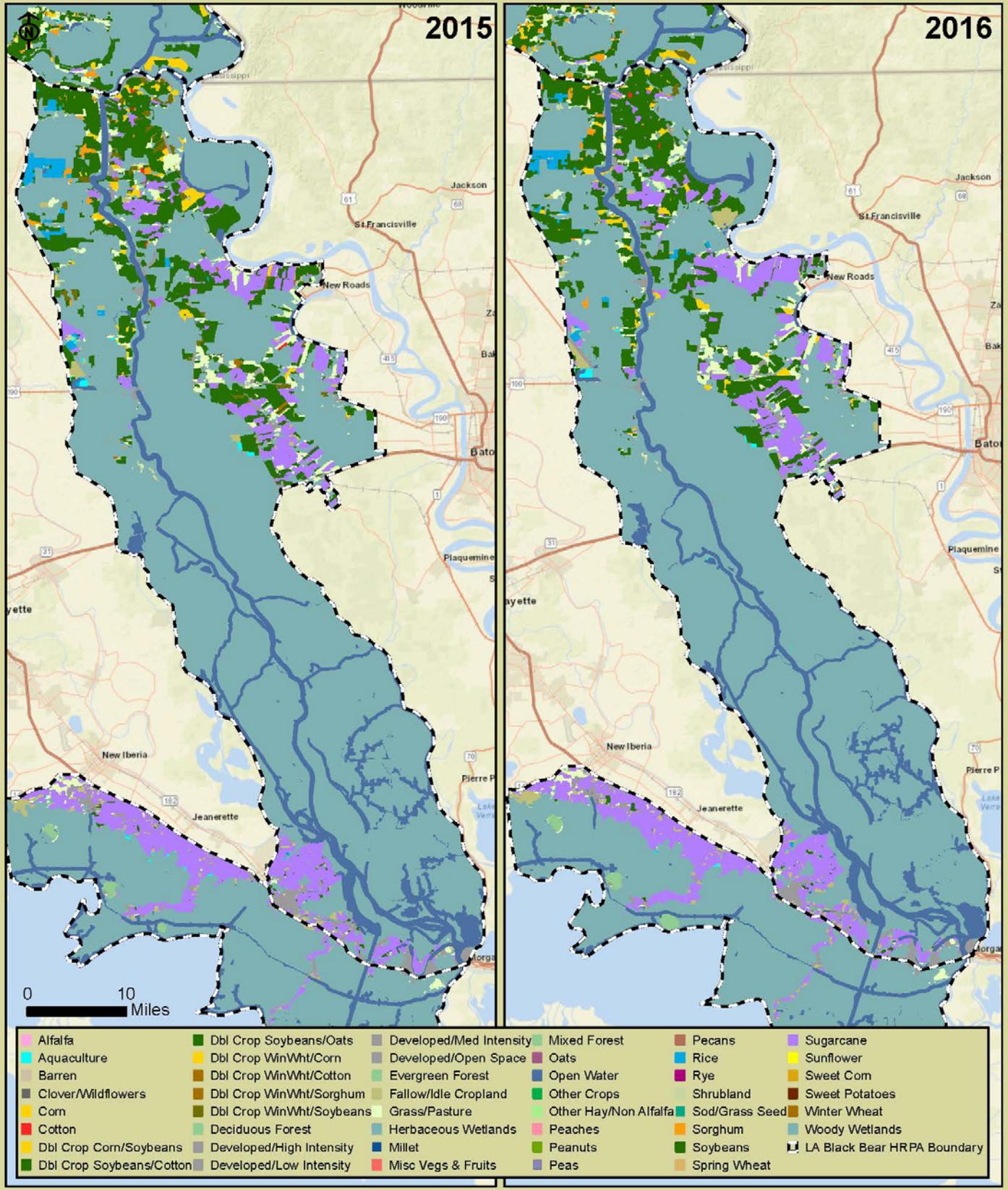


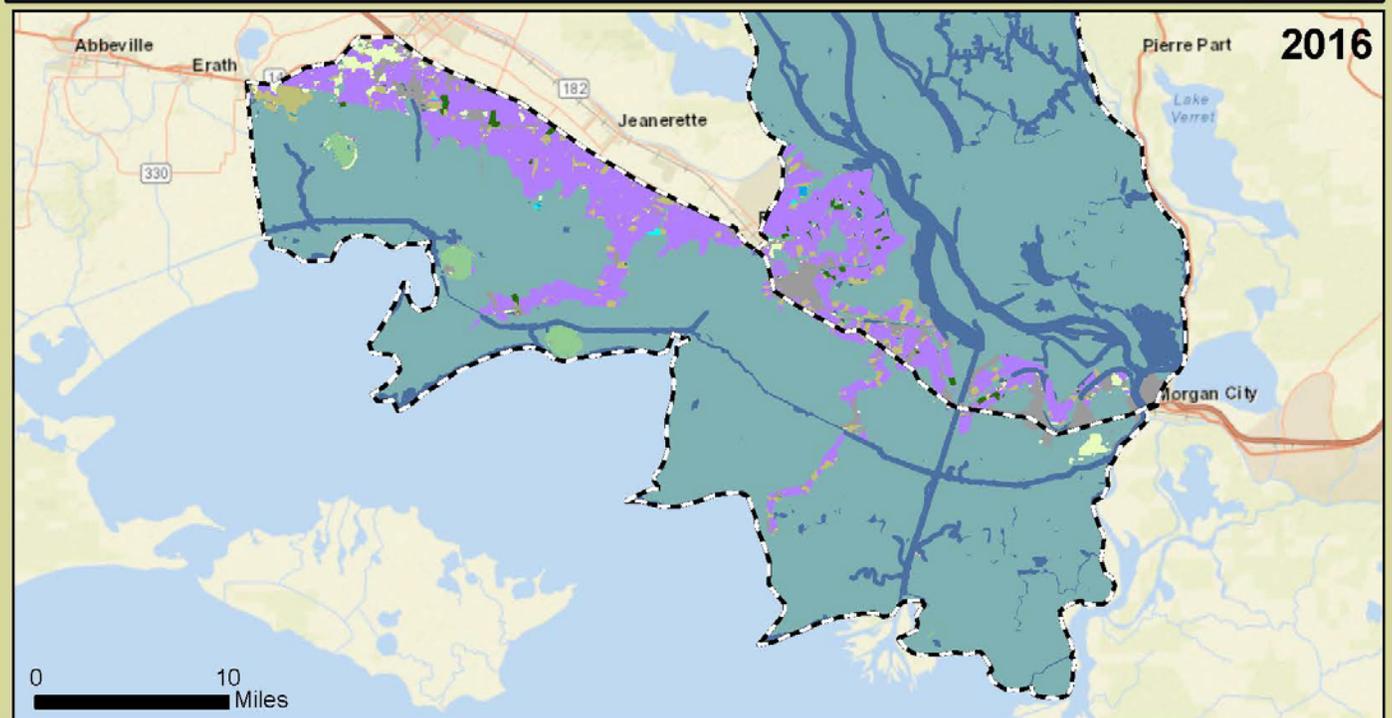
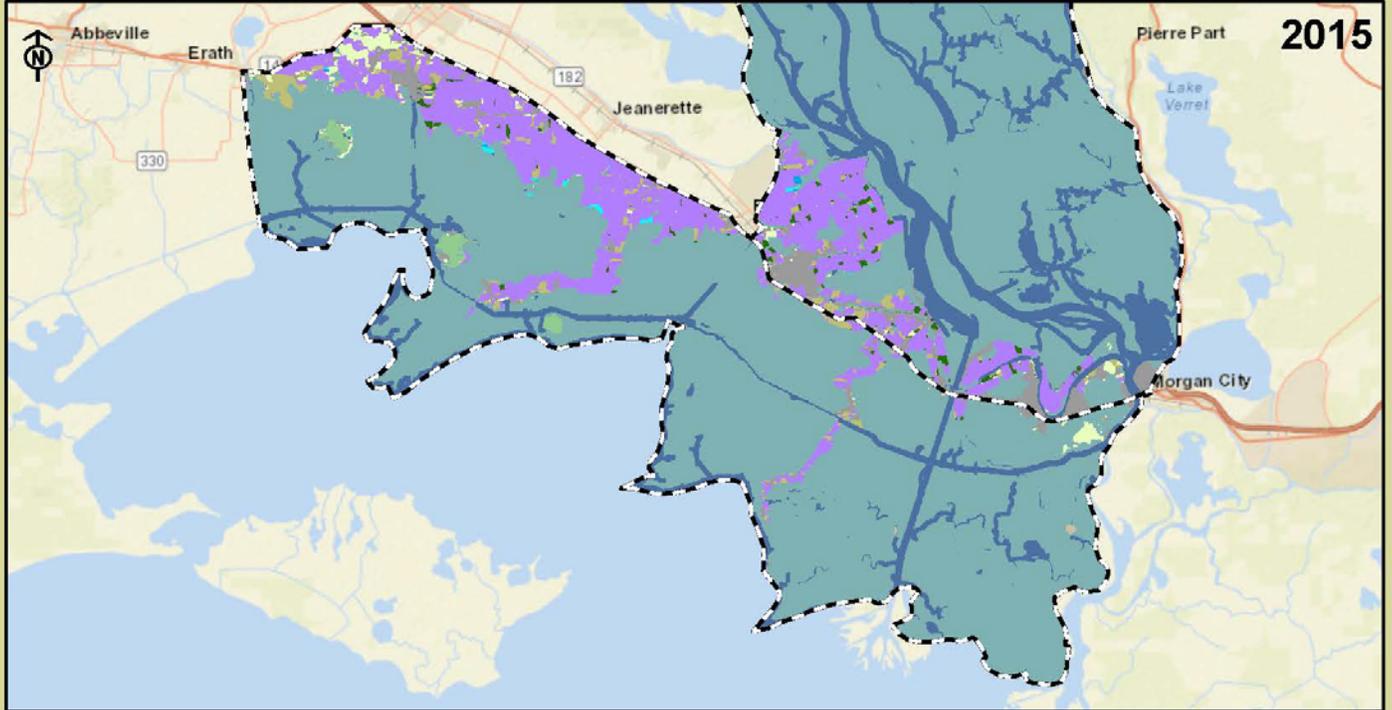
Data Source: USDA CropScape
<http://nassgeodata.gmu.edu/CropScape>

2015 to 2016 Changes in CropScope data for HRPAs Basins

Crop	TRB 2015 to 2016	UARB 2015 to 2016	LARB 2015 to 2016	HRPA 2015 to 2016	HRPA 2015 to 2016 Change
Alfalfa	577.92	0.00	0.00	577.92	0.016%
Aquaculture	-387.18	-181.08	-287.23	-855.49	-0.024%
No Data	0.00	0.00	0.00	0.00	0.000%
Barren	-229.28	107.74	-332.81	-454.35	-0.013%
Clover/Wildflowers	7.74	0.00	0.00	7.74	0.000%
Corn	97,849.15	-90.14	-9.34	97,749.67	2.699%
Cotton	11,337.79	-60.09	0.00	11,277.70	0.311%
Dbl Crop Corn/Soybeans	100.28	0.00	0.00	100.28	0.003%
Dbl Crop Soybeans/Cotton	0.00	0.00	0.00	0.00	0.000%
Dbl Crop Soybeans/Oats	-5.56	105.83	-0.44	99.83	0.003%
Dbl Crop WinWht/Corn	0.00	0.00	0.00	0.00	0.000%
Dbl Crop WinWht/Cotton	-0.67	0.00	0.00	-0.67	0.000%
Dbl Crop WinWht/Sorghum	-6.23	0.00	0.00	-6.23	0.000%
Dbl Crop WinWht/Soybeans	-10,167.11	-8,871.93	-3.11	-19,042.16	-0.526%
Deciduous Forest	-356.83	-267.02	704.72	80.86	0.002%
Developed/High Intensity	-18.50	16.38	22.42	20.29	0.001%
Developed/Low Intensity	159.07	201.53	26.47	387.06	0.011%
Developed/Med Intensity	-758.10	-51.16	11.54	-797.72	-0.022%
Developed/Open Space	470.54	-54.71	-106.40	309.42	0.009%
Evergreen Forest	-704.51	-19.56	18.90	-705.17	-0.019%
Fallow/Idle Cropland	-1,901.72	1,655.18	849.61	603.08	0.017%
Grass/Pasture	-2,186.22	-1,881.13	-81.79	-4,149.14	-0.115%
Herbaceous Wetlands	-191.80	-1,532.26	6,027.31	4,303.25	0.119%
Herbs	-0.22	0.00	0.00	-0.22	0.000%
Millet	49.79	0.00	0.00	49.79	0.001%
Misc Veggies & Fruits	0.00	0.00	0.00	0.00	0.000%
Mixed Forest	-156.94	-9.82	-36.24	-203.00	-0.006%
Oats	155.58	0.00	0.00	155.58	0.004%
Open Water	-920.86	314.96	-1,192.84	-1,798.73	-0.050%
Other Crops	0.00	0.00	0.00	0.00	0.000%
Other Hay/Non Alfalfa	6,890.07	-188.34	-3.56	6,698.17	0.185%
Peaches	12.45	0.00	0.00	12.45	0.000%
Peanuts	0.00	0.00	0.00	0.00	0.000%
Peas	-4.67	0.00	0.00	-4.67	0.000%
Pecans	-257.99	-4.67	0.00	-262.66	-0.007%
Pop or Orn Corn	-511.07	0.00	0.00	-511.07	-0.014%
Rice	8,433.52	412.90	-141.53	8,704.88	0.240%
Rye	-37.13	0.00	0.00	-37.13	-0.001%
Shrubland	-570.45	-223.34	-123.99	-917.78	-0.025%
Sod/Grass Seed	51.77	-36.25	-3.11	12.41	0.000%
Sorghum	-6,065.84	-776.75	-1.11	-6,843.70	-0.189%
Soybeans	-95,172.60	229.67	-1,396.90	-96,339.83	-2.660%
Spring Wheat	0.00	0.00	0.00	0.00	0.000%
Sugarcane	126.71	10,591.25	1,333.69	12,051.65	0.333%
Sunflower	273.20	0.00	0.00	273.20	0.008%
Sweet Corn	9.12	0.00	0.00	9.12	0.000%
Sweet Potatoes	-253.80	0.67	0.00	-253.13	-0.007%
Winter Wheat	-10,836.56	-2,054.00	-45.57	-12,936.13	-0.357%
Woody Wetlands	5,197.12	2,666.18	-5,228.69	2,634.61	0.073%







Alfalfa	Dbl Crop Soybeans/Oats	Developed/Med Intensity	Mixed Forest	Pecans	Sugarcane
Aquaculture	Dbl Crop WinWh/Corn	Developed/Open Space	Oats	Rice	Sunflower
Barren	Dbl Crop WinWh/Cotton	Evergreen Forest	Open Water	Rye	Sweet Corn
Clover/Wildflowers	Dbl Crop WinWh/Sorghum	Fallow/Idle Cropland	Other Crops	Shrubland	Sweet Potatoes
Corn	Dbl Crop WinWh/Soybeans	Grass/Pasture	Other Hay/Non Alfalfa	Sod/Grass Seed	Winter Wheat
Cotton	Deciduous Forest	Herbaceous Wetlands	Peaches	Sorghum	Woody Wetlands
Dbl Crop Corn/Soybeans	Developed/High Intensity	Millet	Peanuts	Soybeans	LA Black Bear HRPAs Boundary
Dbl Crop Soybeans/Cotton	Developed/Low Intensity	Misc Vgs & Fruits	Peas	Spring Wheat	