Texas Prairie Wetlands Project (TPWP) Performance Monitoring

Relationship to Gulf Coast Joint Venture (GCJV) Habitat Conservation:

Priority Species: Wintering waterfowl species in the Texas portion of the Chenier Plain (TxCPIA), Laguna Madre (LMIA), and Texas Mid-Coast Initiative Areas (TMCIA).

Planning Objective: To implement land use and conservation practices on private land to make substantial contributions of flooded agricultural land and moist-soil habitats to meet foraging requirements for target numbers of waterfowl during fall and winter.

Type of Monitoring: Habitat

Monitoring Metric: Acres of flooded agricultural lands and moist-soil habitats

Monitoring Objective: Estimate the acres of flooded agricultural lands and moist-soil habitats during fall and winter periods [i.e., early (16 Aug–31Oct), mid (1 Nov–15 Jan), late (16 Jan–31 Mar)] in the GCJV TxCPIA, LMIA, and TMCIA, and use these estimates in combination with TPWP enrollment data to assess performance (e.g., percent of project acres flooded, percent of units with water, and flooded TPWP acres as a percent of total flooded habitat) of enrolled TPWP sites.

Brief Methodology: Satellite imagery (e.g., Landsat TM 5, Landsat ETM+ 7, Spot 4/5) is inventoried for each Landsat scene (Figure 1), time period [i.e., early (16 Aug–31 Oct), mid (1 Nov–15 Jan), late (16 Jan–31 Mar)], and relevant initiative area. Preference is given to cloud-free images nearest the mid-point of each period (Early: ~21 Sep; Mid: ~7 Dec; Late: ~20 Feb) when selecting imagery for processing. The image mosaic is preprocessed and classified using ERDAS IMAGINE (ERDAS Inc., Norcross, GA) software. The GCJV coastal marsh and permanent water exclusion mask is applied to the image mosaic to restrict the classification to only those areas that may contain agricultural-based or moist-soil habitats. An unsupervised classification is used to separate the masked composite image into land/water classes. Results from the unsupervised classification are reviewed and erroneous data manually recoded to the correct class. Classification errors associated with the exclusion mask are calculated and applied to produce a final estimate of seasonal surface water habitat for each initiative area. Shapefiles of project boundaries for individual TPWP sites are intersected with the final seasonal surface water classification to assess performance of TPWP sites.

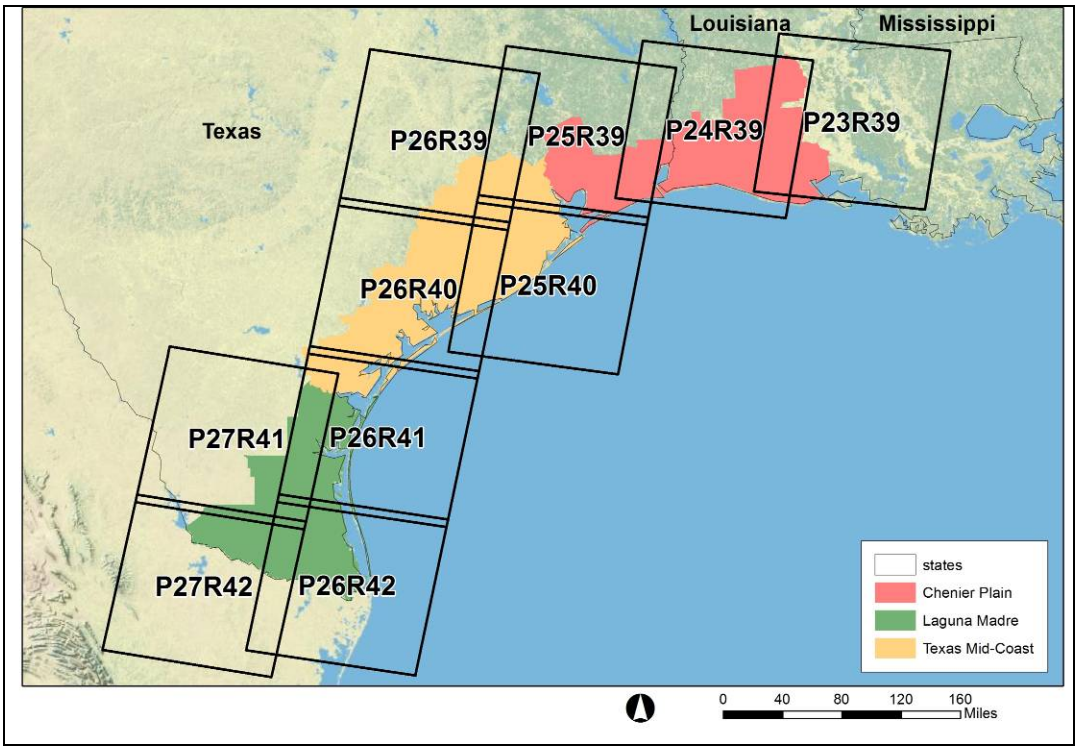

Figure 1. Coverage of Landsat TM scenes within the GCJV Chenier Plain, Laguna Madre, and Texas Mid-Coast Initiative Areas.

Monitoring Responsibilities:

Data Collection: GCJV Remote Sensing and GIS Analysts acquire satellite imagery from the U.S. Geological Survey Earth Resources Observation and Science Center. Ducks Unlimited (DU) staff at the Southern Regional and Texas Gulf Coast offices maintain and annually update the TPWP polygon dataset. Annual updates to the TPWP dataset include addition of polygons and associated attributes for projects completed since June 30 of the previous year but prior to July 1 of the current year.

Data Compilation and Analysis: GCJV Remote Sensing and GIS Analysts compile and classify satellite imagery and calculate TPWP performance metrics.

Report Development: GCJV Remote Sensing and GIS Analysts compile results into tables for distribution to the GCJV Biological Team Leader.

Report Distribution: The Biological Team Leader reviews results, prepares report, and distributes the report and tables to the TPWP Committee and delivery staff.

Timing and Frequency:

Data Collection: Depending upon availability of cloud-free Landsat TM satellite imagery, data are collected and processed annually for three fall and winter periods [i.e., early (16 Aug–31Oct), mid (1 Nov–15 Jan), late (16 Jan–31 Mar)]. GCJV Remote Sensing and GIS Analysts receive the updated TPWP dataset from DU staff by 31 Mar, annually.

Data Analysis: Classification of **s**atellite imagery for the fall and winter periods of the current year is initiated at the end of each period (e.g., scenes for early winter are compiled and classified beginning 1 Nov). Results are compiled and delivered to the GCJV Biological Team Leader by 30 Apr, annually.

Report Development: Data, tables, and graphs for GCJV use are updated by early August, annually. The summarized information is delivered to the TPWP Committee and TPWP delivery staff at their annual meeting, held in late summer.

Detailed Methodology:

Satellite imagery (e.g., Landsat TM 5, Landsat ETM+ 7, Spot 4/5) is inventoried for each Landsat scene (Figure 1), time period [i.e., early (16 Aug–31 Oct), mid (1 Nov–15 Jan), late (16 Jan–31 Mar)], and relevant initiative area. For classifications prior to 2011, Landsat TM 5 and in some cases Landsat ETM+ 7 will be used. When necessary, Spot 4/5 will be substituted for gaps in Landsat TM coverage (e.g., recent termination of Landsat TM 5). Following its launch (estimated January 2013), it is expected that Landsat 8 will be the preferred source of imagery. Imagery is selected to develop seamless image mosaics for GCJV initiative areas for each period. Preference is given to cloud-free images nearest the mid-point of each period (Early: ~21 Sep; Mid: ~7 Dec; Late: ~20 Feb). Cloud-free imagery may occasionally be available for only portions of an initiative area. In cases when areas for which cloud-free imagery is unavailable do not exceed 5% of the total classifiable area (i.e., unmasked area) within an initiative area, the estimate of seasonal waterfowl habitat derived from available imagery is extrapolated to areas of the initiative areas for which imagery is unavailable. If greater than 5% of the classifiable area is unavailable, seasonal waterfowl habitat is not estimated for that initiative area and time period.

Table 1. Scenes classified for each GCJV initiative area.

Initiative area	Scenes
Chenier Plain	P25R39, P24R39, P23R39
Laguna Madre	P27R41, P27R42, P26R41, P26R42
Texas Mid-Coast	P25R39, P25R40, P26R39, P26R40, P26R41

The image mosaic is preprocessed and classified using ERDAS IMAGINE (ERDAS Inc., Norcross, GA) software. Preprocessing involves creating a composite image that includes Landsat TM bands 1-5 and 7, the ratio between Landsat TM bands 5 and 2 (Alesheikh et al. 2007), and the tasseled cap transformation wetness band (Crist and Cicone, 1984; Crist and Kauth 1985; Scott et al. 2003). The GCJV coastal marsh and permanent water exclusion mask (Y:\Mark_Projects\Water Mask\docs\Coastal Marsh and Permanent Water Mask - Version Final.doc) is applied to the image mosaic to restrict the classification to only those areas that may contain agricultural-based or moist-soil habitats. An unsupervised classification is used to separate the masked composite image into land/water classes. Results from the unsupervised classification are reviewed and erroneous data manually recoded to the correct class.

Classification errors associated with the exclusion mask are calculated and applied to produce a final estimate of agricultural-based and moist-soil waterfowl habitat (i.e., seasonal surface water) for each initiative area.

The CPIA and TMCIA have small areas that are not covered by the Landsat scenes listed in Table 1. The scenes overlapping these areas (i.e., Path 23 Row 40, Path 25 Row 40, Path 27 Row 40) are excluded from classification because the acreage within them that is available for classification as potential seasonal surface water (i.e., not covered by the exclusion mask) is insignificant to the overall landscape estimates for those initiative areas.

Path 23 Row 40 is located in the southeastern portion of the CPIA. This scene contains only 1,607 classifiable acres within the CPIA, accounting for only 0.0003% of the total classifiable acres in the CPIA. Path 25 Row 40 contains the southern half of Bolivar Peninsula in the southwest portion of the CPIA. This scene contains about 9,782 classifiable acres within the CPIA, which accounts for only 0.002% of the total classifiable acres in the CPIA. An earlier classification of this area suggests the potential bias resulting from exclusion of Path 25 Row 40 from the CPIA image mosaic is small. Specifically, seasonal surface water for this area was classified using imagery for Path 25 Row 40 that was acquired on 9/4/2008. Climatological data suggested the preceding month (August 2008) was particularly wet with 8-12 inches of rainfall (PRISM Climate Group). Thus, seasonal surface water estimated from this image would likely be near the high end of potential waterfowl habitat available in this portion of Path 25 Row 40. Classification of this image revealed only 40 acres of seasonal surface water in this portion of Path 25 Row 40, providing evidence that potential bias resulting from exclusion of this scene is low.

Path 27 Row 40 (not shown in Figure 1) covers a small portion of the TMCIA. This scene contains 3,398 classifiable acres within the TMCIA, and accounts for only 0.0004% of the total classifiable acres in the TMCIA.

Estimates of seasonal surface water availability and TPWP enrollment data are entered into pre-formatted tables depicting a series of metrics for evaluating overall performance of the TPWP as well as performance of individual TPWP sites (See Appendices 1 and 2 for examples).

Data and Report Archival

Y:\Monitor

- Contains a readme.doc file that describes directories and the files within them.

Y:\Monitor\TPWP

- Contains compiled data (Excel spreadsheets), reports, tables, and graphs relating to the performance (e.g., percent of enrolled acres flooded and percent of units containing water) of TPWP sites within the GCJV region.

Monitoring Related Issues to Consider:

Potential biases from the use of imagery from different satellites (Landsat vs. Spot).

Analysis excludes TPWP sites that are under the Mask or outside the initiative area.

References:

Alesheikh, A. A., A. Ghorbanali, and N. Nouri. 2007. Coastline change detection using remote sensing. International Journal of Environmental Science and Technology 4:61-66.

Crist E.P., and R. C. Cicone. 1984. A physically-based transformation of thematic mapper data – the TM tasseled cap. Photogrammetric Engineering and Remote Sensing 50:343-352.

Crist E. P., and R. J. Kauth. 1985. The tasseled cap de-mystified . Photogrammetric Engineering and Remote Sensing 52:81-86.

PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, Accessed 19 October 2011.

Scott J. W., L. R. Moore, W. M. Harris, and M. D. Reed. 2003. Using the landsat 7 enhanced thematic mapper tasseled cap transformation to extract shoreline. U.S. Geological Survey Open-File Report OF 03-272.

Appendix 1. Example performance metrics for one of the Texas GCJV initiative areas, metrics will be calculated for current and expired enrollments.

Texas Prairie Wetlands Project Flooding Performance of Current Enrollment [1,2]

		Laguna Madre Area[3]					
Year/Period[4]	Satellite Image Acquisition Date(s)	TPWP Enrollment (ac)[1,2]	TPWP Flooded Acres	% of Project Acres Flooded[5]	% of Units w/Water[6]	Total Flooded Acres[7]	Flooded TPWP Acres as % of Total Flooded Habitat
2011/12		19,000					
Early	Aug 29-Sep 7		12,000	63.2%	87.0%	94,000	12.8%
Middle	Nov 11-17		14,000	73.7%	90.0%	98,000	14.3%
Late	Dec 21-Jan 22		18,000	94.7%	97.0%	103,000	17.5%

[1] Excludes all enrolled acres that fall under the GCJV's mask of permanent, forested, and estuarine wetland classes, which affects XX acres and all or portions of YY units.

[2] Includes all units constructed before XX date of any given year, excluding those whose enrollment period expired prior to March 31st of the given year.

[3] Areas are generally defined as south of Corpus Christi Bay (Laguna Madre), Corpus Christi Bay to Galveston Bay (Tx MidCoast), and Galveston Bay to Louisiana state line (Tx Chenier Plain).

[4] Periods are defined as August 16-October 31 (early), November 1-January 15 (middle), and January 16-March 31 (late).

[5] Calculated by dividing total flooded acres on TPWP sites by acreage of total TPWP enrollment available for analysis.

[6] Calculated by dividing number of TPWP units with water by total number of units available for analysis.

[7] Estimated for GCJV "agricultural/moist-soil" habitats, with other habitats excluded by mask of permanent, forested, and estuarine wetland classes.

Prepared by Gulf Coast Joint Venture Office [date]

Appendix 2. Example of reporting currently enrolled units with no detectable flooding performance..

Texas Prairie Wetlands Project: Currently Enrolled Units with No Detectable Flooding Performance[1,2]

Time Period(s) Assessed This Year	Consecutive Years W/out Performance	Unit #	Project #	Landowner	Construction Completion Date
Early, Middle, & Late	2	10	TX0374	Hall, George	Jul-99

[1] Excludes all or portions of XX units representing YY enrolled acres that fall under the GCJV's mask of permanent, forested, and estuarine wetland classes.

[2] Includes all units constructed before Xxdate of any given year, excluding those whose enrollment period expired prior to March 31st of the given year.

Prepared by Gulf Coast Joint Venture Office
[date]