

Preplanning for Comprehensive Conservation Plans (CCP) Spatial Baseline (GIS) Data on National Wildlife Refuges



Southwest Region
National Wildlife Refuge System
NWR Remote Sensing Lab, Division of Planning

Data collection is an important step in the pre-planning process, when developing Comprehensive Conservation Plans (CCP) for National Wildlife Refuges (NWR). During this step data from a NWR is collected and formatted for use in the CCP. In Region 2 many of the NWRs lack the baseline data required to complete this process. To overcome this shortfall the Planning Division is utilizing remote sensing and GIS analysis to generate much of the pre-planning data needed to complete CCPs. This document gives a general overview of the process used by the Region 2 Planning Division to generate spatial baseline data on NWRs and briefly describes GIS data generated through this process.

The outline below defines the general workflow and process for standard spatial baseline data production on NWRs in Region 2 (**Figure 1.0**). It is broken up in to three phases: **Planning, Production** and **Deliverables**. The NWR Remote Sensing Lab, located in the Division of Planning, is responsible for the production of all data produced using this process. For a detailed explanation of the methods and procedures used to generate these data please refer to the *USFWS R2 NWR Spatial Data Structure and Guidelines* and the *USFWS R2 NWR Vegetation Mapping Hand Book*. Not included in this description are more complex and detailed remote sensing and GIS analyses used by the Lab. These methods address problems specific to individual NWR needs and fall outside standard spatial baseline data production.

Planning

1. **Site Visit:** The NWR is contacted and a site visit conducted to assess scope of the project and to identify any special data needs or analysis. At this time a meeting is held with refuge staff to give an overview of the data production process and to address access, equipment and staffing concerns that can affect the workflow of the project.
2. **Land Cover Assessment:** During the site visit a list of vegetative classes, existing on the NWR, are generated. This is done through field recon, usually in cooperation with local or regional plant experts. Vegetation classes are defined to the Alliance level of the National Vegetation Classification Standard (NVCS). (For more information on NVCS go to:



http://www.fgdc.gov/standards/status/sub2_1.html or see **attachment *** in the *R2 NWR Spatial Data Structure Guidelines*). The use of NVCS may not be completely applicable to the needs of all National Wildlife Refuges and may be supplemented with other classification systems in addition to NVCS when appropriate.

3. **Data Mining:** Before data production begins a data mining exercise is completed. Federal, state and local land management agencies, as well as universities are contacted and informed of our activities. Any data they may have relative to baseline data generation efforts on the NWR are requested. This done to eliminate duplication of efforts and to explore cost and data sharing when appropriate.
4. **Imagery Acquisition:** Once the scope of the project is defined, imagery appropriate to its spatial, spectral, and temporal resolution are acquired (In most cases two image sets are needed: historic and contemporary). Given the size of most NWRs in Region 2 and the level information being generated, digitally ortho-rectified color infrared photography is most often utilized. To produce these data a resource photo acquisition flight is first scheduled with the Regional NWR Aviation Management Group. Resource photos (9X9 color infrared) are collected at the spatial and temporal resolution requested. Once the film is processed, the color prints are delivered to the NWR Remote Sensing Lab where they are digitally scanned, ortho-rectified, color balanced and mosaiced to a spatial resolution of 1-meter. The ortho-rectification process is also completed using historic photography. When the type or scale of the analysis is appropriate, Landsat ETM/TM, SPOT or IRS (pan) imagery is acquired.

Production

1. **Abiotic Feature Delineation:** Once the image acquisition and processing is complete, data production begins. Generation of abiotic features into a GIS is completed first. C-size plots of the NWR, using the digital ortho- photography as a background, are sent to the NWR. Refuge staff delineate specific features on the maps before returning them to the Remote Sensing Lab to be digitized and attributed. This process is iterative and requires a steady dialog between the NWR and Remote Sensing Lab staff. When it is possible GIS staff on the NWR may complete these tasks.
2. **Image Processing:** To generate vegetative polygons, automated image processing techniques are applied to the acquired imagery. These polygons are correlated to specific land-cover (vegetation types) found on the imagery.
3. **Sample Sets:** Based on the information gathered from the initial site visit a statistically appropriate sampling methodology is used to select a number of



polygons for ground-truthing. The ground-truthing data will provide information necessary for the image classification and accuracy assessment process used in the generation of the vegetation map.

4. **Fieldwork:** Fieldwork is conducted to collect the vegetation data selected for sampling. GPS equipment is used to navigate to specific polygons on the NWR. Polygons are qualitatively assessed to the Alliance level of the NVCS. Abiotic data that could not be generated through on screen digitizing methods is also collected using GPS equipment and input into a GIS database.
5. **Image Classification:** Ground-truth data collected in the field is input and utilized in image classification procedures. Image classification is completed through an integration of automated image processing techniques, photo interpretation and application of ancillary data. A portion of the ground-truth data is withheld from the classification process and used to generate error matrices to assess the overall and individual class accuracy of the vegetation classification.
6. **Final Data Production:** Federal Geographic Data Committee (FGDC) compliant metadata is produced for all spatial baseline (GIS) data, once production is complete. Data are formatted to standard naming and directory conventions copied to CDs and provided to the NWR.

Deliverables

1. **Second Site Visit:** Second site visit is conducted to present the data generated to the NWR staff. Time is taken to upgrade or install appropriate GIS software and demonstrate data applications. If a copy of ArcView 8.x is not available one will be paid for and provided by the Planning Division. The site visit is usually conducted over a period of 1-2 days.
2. **Training:** To ensure NWRs possess the skills necessary to utilize the spatial baseline (GIS) data produced; the Planning Division provides funding to enroll a NWR staff member in **TEC7114** 'GIS Design for Refuge Management' course at NCTC. To further assist Region 2 participants taking this course, Division of Planning Remote Sensing Lab staff have become permanent members of the instructor cadre for this course.



Time Line

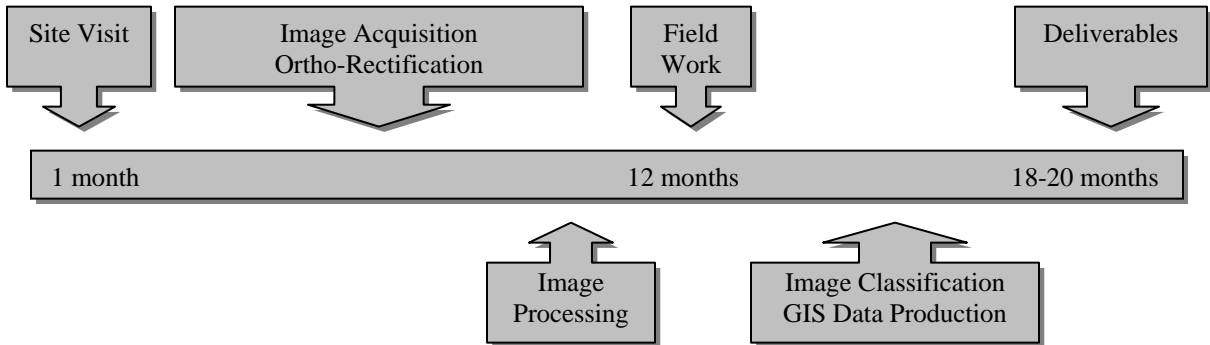


Figure 1.0. Timeline depicts general workflow and procedures used to produce spatial baseline on a NWR in Region 2. Please note that the timeline depicts a general workflow and does not take into account specific environmental and project variables that can affect the process.

SPATIAL BASELINE (GIS) DATA

Listed below are general descriptions of the standard spatial (GIS) baseline data produced and provided to NWR in Region 2. A single description may include more than one GIS database. For a complete list of the standard data layers provided see **Attachment 1**. Not included in this list are datasets or analysis specific only to individual refuges. For a comprehensive description of the data listed below please refer to the Data Dictionary Chapter in the *USFWS R2 NWR Spatial Data Structure and Guidelines*.

Vegetation:

Vegetation data delineates vegetative communities to the Alliance level or greater of the National Vegetation Classification System (NVCS) with a minimum-mapping unit of .5 acres for most NWRs in the region. The NVCS system may be modified and cross-walked to better support management needs when necessary.

Historic Land Use Assessment:

Database identifies and delineates historical land use through the classification or interpretation of ortho-rectified historic aerial photography or satellite imagery to the Anderson Level I and II classification system.



Historic Land Cover Assessment:

Assessment delineates vegetation to the appropriate physiognomic level of the NVCS through the classification or interpretation of ortho-rectified historic aerial photography or satellite imagery. The Anderson Level I and II classification system is applied to areas that are non-vegetated.

Management Units:

Data includes agricultural fields, moist soil units, food plots, fire management units grazing units etc... As a general rule, these are areas that are intensively managed and that have land cover and vegetative characteristics that are well documented and predictable.

Public Use Layers:

Should include boundaries delineating hunt units, trails tour loops, and other recreational use areas. An individual data layer will represent each use type.

Transportation:

Includes all roads on the NWR and access roads off the NWR will be digitized from recent ortho-rectified photography. The Department of Transportation (DOT) data for federal funded roads projects will be included. TIGER for all primary and secondary roads in the county(s) intersecting the NWR will be provided.

Facilities:

Database includes all structures identified during the Real Property Inventory survey, to include: headquarters, visitor center, residence boat ramps, picnic areas, dams, gates, water control structures signs etc...

Hydrology:

Data includes USGS National Hydrologic Data (NHD) for the hydraulic units intersecting the NWR (1:100,000 scale). The hydrologic data from the TIGER data set will be included for the county(s) the NWR resides. Hydrologic features digitized at a finer scale from current ortho-rectified photography will be provided fro areas within the NWR.

Open Water:

All areas of open water will de delineated from recent ortho-rectified photography.



Archeological:

Known areas of archeological significance will be recorded as point or polygon data. Areas that have been surveyed for signs of archeological evidence will be defined.

Utilities:

Data will include point locations for all oil and natural gas wells, as well pipelines, power-lines and other utility related facilities crossing the NWR.

Soils (Natural Resources Conservation Service, (NRCS)):

If available from NRCS, digital soils data will be included. The data will be clipped to a 1-kilometer buffer to the outside of the refuge boundary.

National Wetlands Inventory (NWI):

If available for refuge or adjacent lands, digital NWI data will be included.

Refuge Boundary:

A digital refuge boundary will be provided. This will include all tracts owned or managed by USFWS and land acquisition boundaries when applicable.

County Boundary:

A digital county boundary will be provided for all counties intersecting refuge land.

State Boundary:

A digital boundary data for the state the refuge lies within will be provided.

Photo Index:

Center point data for resource photography will be provided as an attributed data set if available. Points will be attributed and linked to the appropriate digital photos.



IMAGERY DATA LAYERS

Ortho-Rectified Imagery:

A 1-meter resolution color infrared ortho-rectified image derived from the most recent set of color photography will be provided to the NWR.

Historic Ortho-Rectified Imagery:

When available and necessary historic ortho-rectified imagery will be provided.

Digital Ortho Quadrangles (DOQ):

DOQs produced by the USGS or the Texas Ortho Imagery Program will be mosaiced together and color balanced to an area encompassing the entire refuge.

Scanned Aerial Photography:

Digital CIR ortho-rectified aerial photography will be provided. The imagery will be linked to a digital photo index proved in a shape file format (See GIS DATA LAYERS, Photo Index:).

IRS Imagery:

IRS (5 meter GSD, panchromatic) imagery will be provided when other high-resolution imagery is not available. Imagery will be merged and color balanced to an area encompassing the entire refuge.

Landsat TM and ETM:

Landsat 5,7 TM and ETM data will be provided to the refuge. The refuge will receive all 7 or 8 bands of data for the region surrounding the refuge. The imagery will be merged and color balanced if the refuge lies across more than one continuous image.

Digital Raster Graphics (DRG) 1:24k/100k:

Merged DRGs will be provided for all 1:24k or 1:100k USGS topographic maps that intersect the refuge boundary.

Digital Elevation Model (DEM):

USGS 30 meter, merged DEMs will be provided for all quadrangles intersecting the refuge. If higher resolution elevation is available it will provided in substitution.



DEM Models:

A DEM, shaded relief, aspect and slope model encompassing the entire refuge will be provided.

HARD COPY MAP PRODUCTS**Vegetation Map:**

A map representing refuge vegetation at the NVCS alliance level or greater will be provided at the appropriate or requested scale.

Management Unit Map:

A map depicting management units (agriculture, moist soil units, etc.) will be provided at the appropriate or requested scale. High resolution DOQ or IRS imagery will be used as the background image.

Public Use Map:

A map depicting public use (hunt units, closed zones, observation towers, etc.) will be provided at the appropriate or requested scale. High resolution DOQ or IRS imagery will be used as the background image.

Other Maps as needed:

As needed, other data layers will be used to produce maps to meet NWR needs.



DATA STANDARDS

Please refer to the *USFWS R2 NWR Spatial Data Structure and Guidelines* for a more detailed description of NWR R2 standards.

GIS File Format - GIS data will be provided in ArcGIS Geo-Database format.

Imagery File Format - Format- imagery will be provided in ERDAS Imagine *.img and/or Geo-TIF file formats and will be provided in SID compressed format when necessary. The format may vary relative to the capabilities of the end user.

Projections - UTM, NAD83, GRS80 will be the standard projection for all data produced. The UTM zone will be that which the entire or the majority of the data lies within.

Meta Data - All data released will be accompanied with complete FGDC compliant meta-data in *.xml and *.html formats.



Attachment 1 (R2 Spatial (GIS) Database / Imagery)

Inventory/GIS Layers	'county' substitute with full county name	'lit' substitute with official three letter refuge litteral
	'state' substitute with full state name	'quad' substitute USGS quad name
	'path' substitute WRS path number	'row' substitute WRS row number
NWR Specific Data Sets		
Cadastral		
lit_bnd	Representative NWR boundary adjusted to fit most recent merged ortho photography.	
Cultural Resources		
lit_arc	Locations of known archeological sites on the NWR	
lit_arc_survey	Areas that have been surveyed for cultural resources on a NWR.	
Facilities		
lit_fac	General facilities layer for NWR linked to RPI database	
Hydro		
lit_h2o_surface	Areas of surface water on NWR	
lit_drainage	Defines major or important surface drainages on a NWR	
Index Grids		
lit_USGS_24k_index	USGS 1:24000 map index grid intersecting NWR	
lit_photo_index_date	Photographic index of individual ortho rectified areial photography	
Land Use Land Cover (LULC)		
lit_amu	NWR agricultural management unit boundaries and associated data	
lit_gmu	NWR grazing management unit boundaries and associated data	
lit_fm	NWR fire management unit boundaries and associated data	
lit_fire_perimeter_date	NWR fire management unit boundaries and associated data	
lit_hist_lu	NWR historic land use	
lit_msu	NWR moist soil unit management unit boundaries and associated data	
lit_nwi	National Wetlands Inventory data developed on NWR	
lit_veg_date	NWR vegetation mapped to the Alliance level of the NVCS	
lit_veg_hist_date	Historic NWR vegetation mapped to the Formation level of the NVCS	
Public Use		

lit_hmu	NWR hunt mangement unit bounbaries and associated data					
lit_public_use_road_trail	Public use roads on NWR					
lit_public_use_point	Pounts of public use on NWR					
Transportation						
lit_gate	Gate and cattle guard locations on NWR					
lit_road	NWR roads and important access roads off NWR					
Utilities						
lit_mine	Inventory of all mining locations on NWR (oil/gas wells)					
lit_utility	Inventory of all known utility lines on NWR					
National Data Sets						
NHD, USGS						
lit_nhd	Contains hydrologic line features for HUC intersecting NWR					
lit_nhdpt	Contains hydrologic point features for HUC intersection NWR					
TIGER						
county_bnd	County boundary clipped from tiger2000 data					
county_road_all	Roads data taken from Tiger2000 data by county and includes all roads					
county_road_prim	Roads data taken from Tiger2000 data by county and includes only primary roads					
county_road_sec	Roads data taken from Tiger2000 data by county and includes only secondary roads					
state_road_rail	Railroads data taken from Tiger2000 data by county					
state_road_prim	Roads data taken from Tiger2000 data by state and includes only primary roads					
DOT						
lit_dot_road	Roads data from department of transportation 2000 survey on NWR					
lit_dot_park	Parkinglot data from department of transportation 2000 survey on NWR					
NRCS						
county_nracs_soil	Soil cllsification information from SURGO clipped to county(s) the NWR intersects					
lit_nracs_soil	Soil cllsification information from SURGO clipped to NWR boundary					
USFWS - Regional Datasets						
R2_bnd	Region 2 boundary and internal state boundaries					
R2_NWR	NWR boundaries for Region 2 merged					

R2_station	Region 2 station locations merged								
R2 eco_regions	Boundary file of eco-regions in Region 2								
Imagery Layers									
Ortho Rectified Photography									
ortho_lit_line_photo#_date	Individual ortho rectified images								
lit_ortho_date	Merged and color balanced ortho rectified image								
Satellite Imagery									
path_row_tm_date	Entire Landsat TM image by WWRll path and row								
lit_irs_date	IRS imagery clipped to NWR by date acquired								
DEM									
lit_dem	DEM imagery containing full extent of NWR								
lit_relief	Shaded relief generated from DEM containing full extent of NWR								
lit_slope	Slope model generated from DEM containing full extent of NWR								
DRG									
lit_drg	Merged DRG for all 1:24000 quads that intersect the NWR boundary								
quad_drg_7-5	Individual 7.5' DRGs that intersect the NWR boundary								