U.S. Fish & Wildlife Service

Wetlands Mapper
Documentation and Instructions
Manual

U.S. Fish and Wildlife Service
Division of Habitat and Resource Conservation
Branch of Resource and Mapping Support

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Introduction

The U.S. Fish and Wildlife Service (Service) is the principal Federal agency providing information to the public and other agencies on the extent and status of the Nation's wetlands. The Service provides stewardship for the wetlands data that comprise the Wetlands Layer of the **National Spatial Data Infrastructure** and makes these data available via the Internet.

The U.S. Fish and Wildlife Service's strategic plan for digital wetland data is focused on the development, revision, and dissemination of wetlands data and information to Service resource managers and the public. The present goal of the Service is to provide the citizens of the United States and its Trust Territories with current geospatially referenced information on the status, extent, characteristics and functions of wetlands, riparian, deepwater and related aquatic habitats in priority areas to promote the understanding and conservation of these resources.

Updates to the Wetlands Mapper are in direct response to the need to integrate digital map data with other resource information to produce timely and relevant management and decision support tools.

This updated version of the Wetlands Mapper is designed to promote greater awareness of wetlands geospatial data applications and to deliver easy-to-use, map like views of America's wetland resources in a digital format. It has been developed in collaboration with the U.S. Geological Survey (USGS). This Federal partnership has yielded tremendous benefits in ongoing efforts to configure, improve and distribute the wetlands map information using newer technologies in digital mapping and web-serving capabilities.

Currently, the web site is serving wetlands data that cover over 45,000 quadrangles in a seamless ESRI File Geodatabase. This represents wetland map data for approximately 82 percent of the conterminous U.S.

The updated Wetlands Mapper is designed to provide reliable geographical information and direct users to other potential sources of information. It is not intended to provide legal or regulatory products. Unintended use of the information or products is discouraged. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

History and Summary of Changes

For the Service, an important goal is to improve the internet delivery of updated digital data to keep pace with growing demand for wetland resource information and enhance customer service. The Wetlands Mapper is the internet data discovery mechanism designed to promote greater awareness of wetlands map data applications and deliver easy to use, map-like views of the Nation's wetland resources.

This is the third iteration of wetlands data provided via computer connections to the public. Additional capabilities, improved access and explanatory information are continually under development. Users are requested to be aware that this site is expanding and changing.

The Wetlands Geodatabase is hosted in a File Geodatabase. Some of the benefits of a File Geodatabase are:

- Scale up to handle very large datasets.
- Provide excellent performance and scalability, for example, to support individual datasets containing well over 300 million features and datasets that can scale beyond 500 GB per file with very fast performance.
- Use an efficient data structure that is optimized for performance and storage. File geodatabases use about one third of the feature geometry storage required by shapefiles and personal geodatabases. File geodatabases also allow users to compress vector data to a read-only format to reduce storage requirements even further.

The updated Wetlands Mapper interface was developed with Adobe Flex. Flex is a highly productive, free open source framework for building and maintaining expressive web applications that deploy consistently on all major browsers, desktops, and operating systems.

Users will now have seamless access to ESRI[1] Maps and imagery with the updated Mapper release. The ESRI maps platform is utilized as a base map for the wetlands data, which brings location data to life by making it easier to visualize, understand, and analyze. ESRI Maps host rich map imagery and data as well as robust search, location, and routing services.

Several improvements have been made to the wetlands mapper on this web site. Some of these improvements include:

- Improved imagery
- Updated wetland attribute codes and decoder tools
- Enhanced map display and usability
- Improved documentation and instructions

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[1] Environmental Systems Research Institute, Inc. (ESRI)

This detailed ESRI imagery map presents satellite imagery for the world and high-resolution (1m or better) imagery for the United States. The map includes NASA Blue Marble: Next Generation 500m resolution imagery at small scales (above 1:1,000,000), i-cubed 15m eSAT imagery at medium-to-large scales (down to 1:70,000) for the world, and USGS 15m Landsat imagery for Antarctica. The map also includes i-cubed Nationwide Prime 1m or better resolution imagery for the contiguous United States, Getmapping 1m resolution imagery for Great Britain, and GeoEye IKONOS 1m resolution imagery for Hawaii, parts of Alaska, and several hundred metropolitan areas around the world. For current imagery contributors and dates, please visit this website:

http://resources.esri.com/help/9.3/arcgisonline/about/start.htm#contributors_wi.htm?

Map Creation and Mapper Display

Tips and Technical Information

- Features will display at a 1:144,448 scale or larger.
- As a function of the mapping display software, not all wetlands will be labeled until you zoom-in far enough for the polygon to hold the label inside it. Click on a polygon to obtain wetland attribute information.
- Linear wetlands are not displayed on the Mapper[2].
- Riparian data are available for areas in the western states of the conterminous U.S.
- Additional metadata are required when tracking multiple data contributors, overlapping geospatial data coverage and different time frames. To address these metadata needs, the Service has improved and redesigned the type of metadata available for the update Wetlands Mapper.

  Users can access the Federal Geographic Data Committee (FGDC) compliant metadata, as well as project-level metadata (for specific updated project areas) and "historic" metadata collected when the original mapping was completed. Supplemental metadata linked to individual polygon features in the database allow the incorporation of contributed data to the wetlands layer. This will be especially important as data are contributed to the database by other State, Federal and partner organizations.

- Other Wetlands Mapper developments provide access to more wetland information and offer expanded data delivery options for users. The Service added the capability to download wetland map data at 1:24,000 and 1:100,000 scale; scanned paper maps, metadata and download capability to the on-line services; historic mapping report information originally mapped by the Service in the lower 48 states.

About the Wetlands Maps

The Service's topical wetland and riparian maps are graphic representations of the type, size and location of the wetlands, deepwater or riparian habitats in the United States. These maps have been prepared from the analysis of high altitude imagery in conjunction with collateral data sources and field work. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site, may result in revision of the wetland boundaries or classification established through image analysis. The Service uses the Cowardin *et al.* (1979) definition of wetland. This definition is the standard for the agency and is the National Standard for wetland mapping, monitoring, and data reporting as determined by the Federal Geographic Data Committee in 1996.

For the purposes of adapting the wetland classification system to map form, a series of letter and number codes has been developed. These alpha-numeric codes[3] correspond to the classification

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[2] Linear features are not being distributed because their geospatial integrity cannot be easily verified or made compatible with the polygonal wetland data.

[3] Wetland Codes information available at: http://www.fws.gov/wetlands/Data/wetlandcodes.html

nomenclature that best describes the habitat. Examples of how these mapping codes work are shown below:

Lacustrine Aquatic Bed
NWI Map Classification Code: **L 2 AB G**
Lacustrine (**L**) Littoral (**2**) Aquatic Bed (**AB**) Intermittently exposed (**G**)
Other Names/Identifiers: Lake Edge, Aquatic Bed

Forested Wetland, Deciduous
NWI Map Classification Code: **P FO 1 C**
Palustrine (**P**) Forested (**FO**) Broad leaved deciduous (**1**)
Seasonally flooded (**C**)
Other Names/Identifiers: Hardwood Swamp

Wetlands Mapper Display Categories

For ease of viewing the map information, wetland types are displayed in groups of similar classifications (e.g. all freshwater emergent wetlands are displayed as a single color category). The display categories are shown in the table below. Wetlands descriptions, definitions and codes are explained further at http://www.fws.gov/wetlands/Data/wetlandcodes.html web page.

Display Color	Wetland Type	Map Code	Cowardin	General Description
R 0 G 136 B 55	Freshwater- Forested and Shrub wetland	PFO, PSS	Palustrine forested and/or Palustrine shrub	Forested swamp or wetland shrub bog or wetland
R 127 G 195 B 28	Freshwater Emergent wetland	PEM	Palustrine emergent	Herbaceous marsh, fen, swale and wet meadow
R 104 G 140 B 192	Freshwater pond	PUB, PAB	Palustrine unconsolidated bottom, Palustrine aquatic bed	Pond
R 102 G 194 B 165	Estuarine and Marine wetland	E2, M2	Estuarine intertidal and Marine intertidal wetland	Vegetated and non-vegetated brackish and saltwater marsh, shrubs, beach, bar, shoal or flat
R 1 G 144 B 191	Riverine	R	Riverine wetland and deepwater	River or stream channel
R 19 G 0 B 124	Lakes	L	Lacustrine wetland and deepwater	Lake or reservoir basin
R 0 G 124 B 136	Estuarine and Marine Deepwater	E1, M1	Estuarine and Marine subtidal deepwater	Open water estuary, bay, sound, open ocean
R 178 G 134 B 83	Other Freshwater wetland	Misc. types	Palustrine wetland	Farmed wetland, saline seep or other miscellaneous wetland

Software Requirements

A web browser and Adobe Flash[4] are required to access the Wetlands Mapper. Please visit the Adobe Flash Player website (http://www.adobe.com/products/flashplayer/) to download the latest version of the player.

- Under some circumstances, computer administrator rights may be required in order to install the player.
- The Wetlands Mapper has been tested with Microsoft Internet Explorer version 7 and 8, Mozilla Firefox version 3 and Google Chrome version 5.
- To view a generated map, Adobe Acrobat Reader is required. Please visit the Adobe website http://get.adobe.com/reader/ to download a free version of Adobe Reader[5].

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[4] Adobe Flash is a trademark from Adobe Systems Incorporated.
[5] Adobe Reader is a trademark from Adobe Systems Incorporated.

Mapper Interface
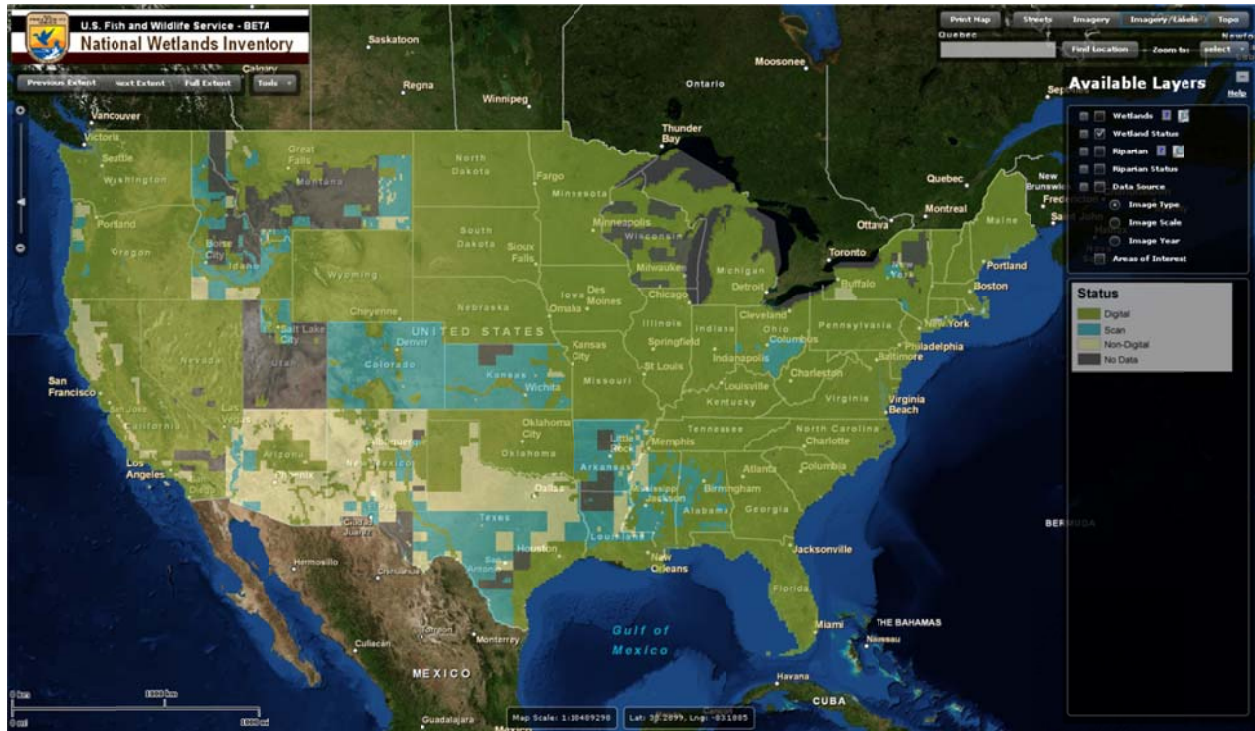
Selecting the Wetlands Mapper link from the National Wetlands Inventory website will display the Wetlands Mapper viewer in its default extent mode (lower 48 States), along with the default Wetlands Status layer. A minimum screen resolution of 1024 x 768 pixels or higher is recommended[6] to properly display the map and controls. An internet browser capable of supporting Adobe Flash is required.

Zoom Control

Use the zoom slider to zoom in or out (+ to zoom in, - to zoom out) or click the icons at the end of the slider. Other zoom control functions available are:

- Double-click to zoom - Double left-click mouse button to zoom in, and Ctrl + Double left-click to zoom out.
- Scroll wheel zooming - Use the scroll wheel on your mouse to zoom in and out of the maps.
- Keyboard zoom - Press the keyboard plus (+) key to zoom in, and the minus (-) key to zoom out.
- Area zooms - While holding the keyboard shift key, mouse left-click and hold to draw a box of an area to zoom to.
- Center - While holding the keyboard shift key, mouse left-click a location to center the map to it.
- Full screen - Press keyboard F11 to view the Mapper at full screen.

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[6] The Wetlands Mapper will best display with a 1280 x 960 or 1280 x 1024 pixels, depending on your display ratio.

Panning

This capability allows you to click (left-click and hold) and drag in the viewer area to move the map and view different areas. After you pan to an area, a short load time is necessary to render the image. The arrow keys on your keyboard can also be used to pan around the map.

Extent Buttons

- Full Extent – brings the viewer out to the default extent view. Use this function to zoom out to the full extent of the lower 48 States (CONUS).
- Previous Extent / Next Extent – steps backwards or forward through your extent navigation history.


Find Location

Use this box to enter a location to zoom to. Some options are:

- Address
- City, State
- State
- Zip Code
- Coordinates - Examples:
    - 31.9N, 81.2W
    - 31.9, -81.2
    - 31 55 10.7, -81 10 02
- Geographic feature (ex. lake Michigan, Potomac river, Appalachian mountains)

Zoom To Region

Use this control to zoom to one of the five available regions: CONUS, Alaska, Hawaii, Puerto Rico, and Pacific Trust Islands.
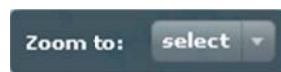
Base Map Type buttons

The following base map types are currently available on the wetlands Mapper:

- Streets - displays the road map view with labels.
- Imagery - displays satellite and aerial images.
- Imagery/Labels - displays a mixture of satellite and aerial images, and road maps with labels.
- Topo - displays a topographic base map[7].

Click on the desired base map type button to switch views to the desired base map type. Please allow a few seconds for the view to refresh.


Print Map button

Use this button to print the current map view. You will have the option to position and scale the map in the window provided to ensure the printed product will contain the desired area. Use the Panning and Zoom controls described above. Print options:

- Title- enter a title to be printed along with the map
- Remarks – enter remarks to be printed along with the map

Tools
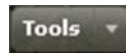
This button will display available tools:

- **Download Data button** - This button will open a new internet browser window and redirect you to the National Wetland's Inventory Data Download web page. There are two methods for downloading seamless wetlands data as viewed on the Wetlands Mapper. The Wetlands Data Extraction Tool uses the USGS topographic quadrangle names for area selection and extraction of data as shapefiles. You can also download data by State. Each State data download is available as either a compressed file Geodatabase or a Shapefile. You can view the Shapefiles by using ESRI's ArcExplorer free software[8], among others. Geodatabases require a full ESRI ArcDesktop license.
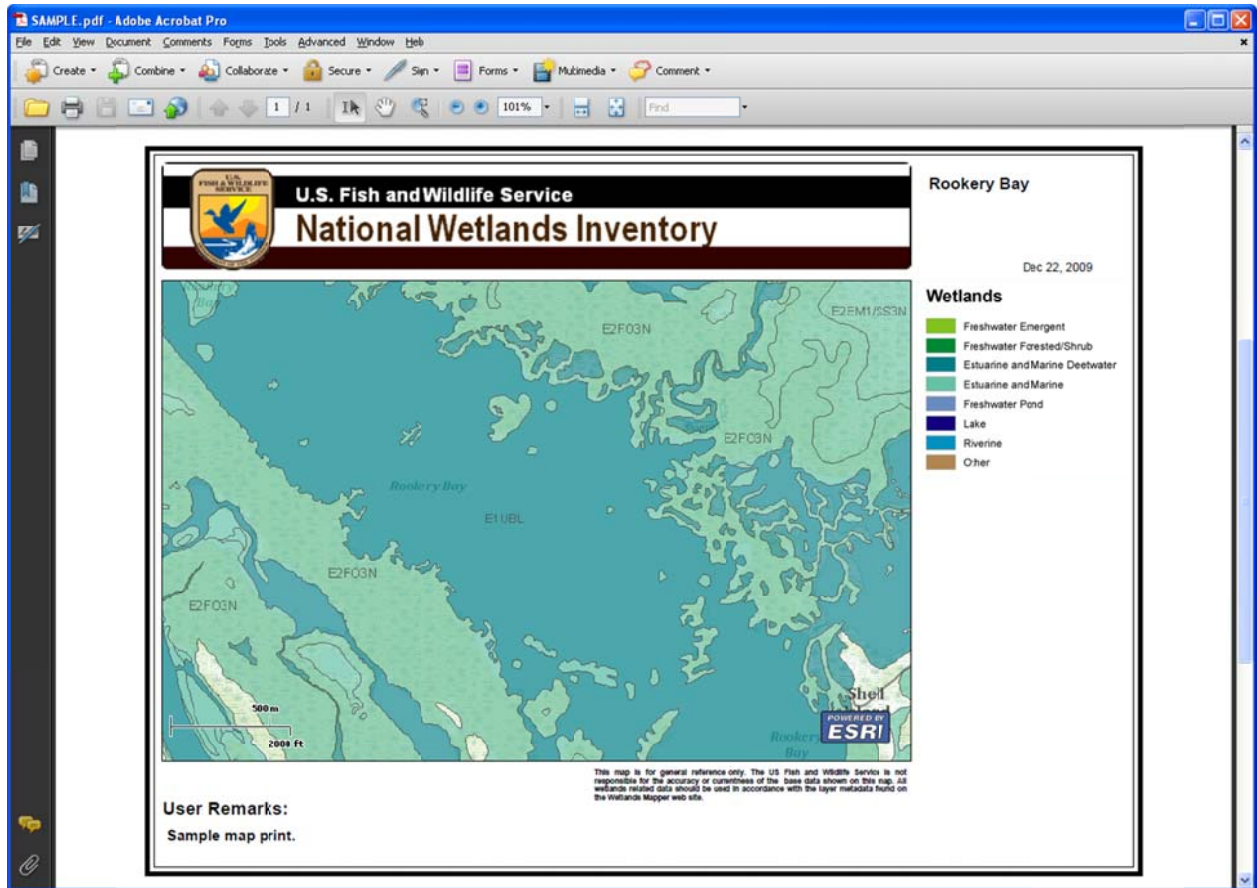

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[7] Base map developed by ESRI.
[8] http://www.esri.com/software/arcexplorer/download.html

Pressing **Submit** will generate an [Adobe PDF](#) document with a rendition of the previously displayed map. The generated map will be approximately .5MB. The generated PDF document can be saved and/or printed.

Example of generated PDF map:

- **Measure** – There are two measurement tools available: Polyline and Polygon. To measure a polyline, select the tool and start measuring by mouse left-clicking one or more times, and finish the measurement by mouse double left-clicking. Use the same procedure for Polygons. To clear the lines or polygon, close the Measurement tool popup window.
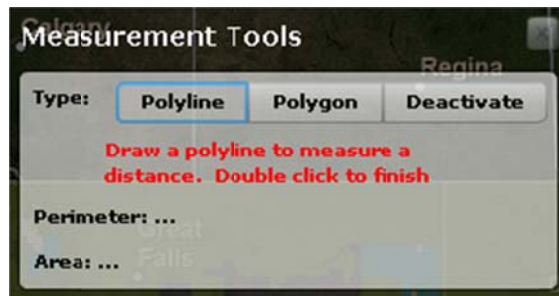
Available Layers

This control panel will allow you to select one or more data layers (left-click on the adjacent box) to be displayed over the base map[9]. Multiple layers can be displayed concurrently. Pressing on the ? button will open the Product Summary internet web page with information about the layer. Pressing on the 🔍 (zoom) button will zoom the map to the scale where the layer first becomes visible. Pressing on the ■ button will display a control for the layer's opacity. The **Help** link will open a web page with answers to Frequently Asked Questions and contact information. The ▬ button will minimize the Available Layers and Legends window. Press it again to maximize it. Layer descriptions:

- **Wetlands** - This data layer represents the extent, approximate location and type of wetlands and deepwater habitats in the United States. These data delineate the areal extent of wetlands and surface waters as defined by Cowardin *et al.* (1979). Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and near shore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, can go undetected by aerial imagery. By policy, the Service also excludes certain types of "farmed wetlands" as may be defined by the Food Security Act or that do not coincide with the Cowardin *et al*. definition. Contact the Service's Regional Wetland Coordinator for additional information on what types of farmed wetlands are included on wetland maps.
- **Wetlands Status**- This information provides the location, extent, and status of current wetland mapping projects.
- **Riparian** - This data layer represents the extent, approximate location and type of riparian habitats in the western United States. These data delineate the areal extent of riparian habitats as defined by *A System for Mapping Riparian Areas in the United States* (USFWS 2009). Certain riparian habitats may be excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect riparian habitats.
- **Riparian Status -** This information provides the extent, status, and approximate location of current riparian mapping projects.
- **Data Source** – This layer displays the types, scales and years of images used to map the wetlands in a given area.
- **Areas of Interest** - This layer highlights selected wetlands that exhibit unique or important ecological characteristics. It currently includes sites located throughout the United States. It includes Wetlands of International Importance (Ramsar sites) as well as selected State Natural Areas, National Parks and National Wildlife Refuges. Each site is marked with a geographic

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[9] Streets, Imagery, Imagery/Labels, or Topo.

location and includes a link to additional information about that particular wetland. Additional sites and information will be added in the future.

Legends

A legend corresponding to the selected layer(s) will be automatically displayed in this box. Additional legends will be appended to the previously selected layer. Use the scroll bar to move up and down the list of legends, if necessary.

Displaying Features Information

Clicking on a polygon will display a pop-up box containing information about the selected feature. This box also provides links to the various metadata documents. Please note that one of the layers containing polygon data must be selected to use this function. Clicking on the [X] at the top-right side of the pop-up will close it.
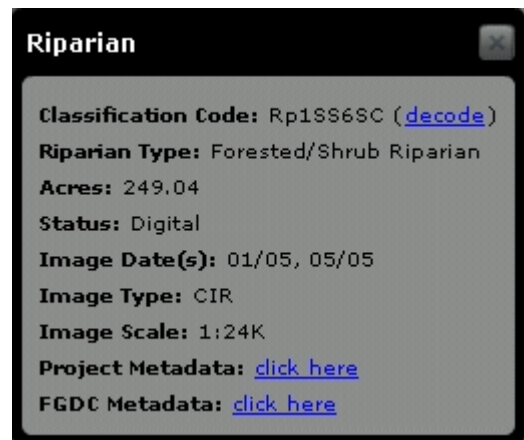
- **Classification Code** – series of letter and number combinations that have been developed to adapt the wetland and riparian habitat classification system to map form.
- **Wetland Type** – general description of the wetland or riparian type
- **Acres** – wetland area for the selected polygon measured in acres.
- **Status** – identifies the status of wetland or riparian mapping in that area
- **Image Date(s)** – date of imagery used to conduct the mapping in that area
- **Image Type**[10] – type of imagery used to conduct the mapping in that area
- **Image Scale** – scale of imagery used to conduct the mapping in that area
- **Project Metadata** – describes the content and other characteristics of the data. Selecting this link will display an internet browser page with the metadata for the selected layer.
- **Historic Map Info** – historic information about the wetland types, vegetation, regional and temporal conditions and geographic features.
- **FGDC Metadata –** link to the metadata web page.

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[10] The best imagery emulsion type from all the types used to delineate the wetlands for a given project area: CIR for Color Infrared, TC for Natural or True color, BW for Black and White, and Unknown.

Code Interpreters (decode)

This tool will instantly provide the detailed habitat descriptions for an area represented by the wetland or riparian code. Enter a wetland area's map code into the interpreter and obtain the classification of that wetland area as defined in Cowardin *et al* (1979).

Codes are a series of letter and number combinations that have been developed to adapt the national wetland and riparian classification systems to map form. These alpha-numeric codes correspond to the classification nomenclature that best describes the habitat (ex. PFO1A; also see example on page 6).

The Wetlands and Deepwater Habitats Classification Hierarchy is a map code legend that shows relationship of wetland systems (ex: estuarine), subsystems (ex: intertidal), and classes (ex: emergent wetland). Wetland habitat type definitions, descriptions and use the classification system can be found in *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, *et al*. 1979).

Other pertinent sources of information include:

- Data Collection Requirements and Procedures
- A System for Mapping Riparian Areas In The Western United States

Data Limitations and Uses

The Service's objective of mapping wetlands and deepwater habitats is to produce information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, can go undetected by aerial imagery.

By policy, the Service also excludes certain types of "farmed wetlands" as may be defined by the Food Security Act or that do not coincide with the Cowardin *et al*. definition. Contact the Service's Regional Wetland Coordinator for additional information on what types of farmed wetlands are included on wetland maps.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Disclaimer

The use of trade, product, industry or firm names or products is for informative purposes only and does not constitute an endorsement by the U.S. Government or the Fish and Wildlife Service. Links to non-Service Web sites do not imply any official U.S. Fish and Wildlife Service endorsement of the opinions or ideas expressed therein or guarantee the validity of the information provided.

Wetlands Geodatabase User Caution

The Wetlands Geodatabase is an ongoing effort consisting of data additions, updates, and other data modifications. All data layers utilized outside of the Wetlands Geodatabase or the Wetlands Mapper and supporting web services are only effective as of the date of extraction or delivery by the Wetlands Geodatabase Administrator. The Wetlands Mapper (http://www.fws.gov/wetlands/Data/Mapper.html) displays the current status of wetlands data available from the Service.

These spatial data are not designed to stand alone. They form topical overlays to the U.S. Geological Survey 1:24,000 or 1:25,000 scale topographic quadrangles or digital imagery. Note that coastline delineations were drawn to follow the extent of wetland or deepwater features as described by this project and may not match the coastline shown in other base maps. The map products were neither designed nor intended to represent legal or regulatory products.

Comments regarding the interpretation or classification of wetlands or deepwater habitats can be directed to the U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation or by following the feedback mechanism in the Information Quality Guidelines[11]. In addition, A Request for Entry of Corrected Map Data (see forms here: http://www.fws.gov/wetlands/Data/tools/forms.html) may also be submitted.

Help and Contact Information

For additional information, product summary information, and limitations please check the metadata at: www.fws.gov/wetlands/Data/Products.html and www.fws.gov/wetlands/Data/metadata.html. Information regarding Product Summary and Data Limitation and Uses is also available by contacting the Wetlands Team (Wetlands_Team@fws.gov). Answers to commonly asked questions can be found at http://www.fws.gov/wetlands/FAQs.html.

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[11] http://www.fws.gov/wetlands/_documents/gData/WetlandsMGDAddressingInformationQualityGuidelines.pdf