Wetland Mapping

Matthew J. Gray
University of Tennessee

Wetland Mapping in the United States

National Wetlands Inventory
U.S. Fish and Wildlife Service is the principle federal agency that provides information on the status of U.S. wetlands.

Established in 1974 to produce maps of wetlands in priority areas only
(coastal areas, MAV, prairie potholes, playas of SGP, Central Valley)

Emergency Wetlands Resources Act (1986)

Map all U.S. wetlands by 2001 (95%, WI, NM, MT) and provide an estimate of the extent of wetlands every 10 years (1986-1997)

Digitize all wetlands by September 2004 (40% remain, Southwest)

Provide citizens of U.S. and territories with current geospatial data on all wetlands and deepwater habitats

www.nwi.fws.gov

State Wetland Losses

53% in Lower US

Most % Loss:
• Arkansas = 91%
• California = 91%
• Ohio = 90%
• Iowa = 89%

Most Total Loss:
• Florida = 3.6 mil ha.
• Louisiana = 2.2 mil ha.
• Illinois = 2.1 mil ha.
• Kentucky = 1.3 mil ha.
• Louisiana = 3.2 mil ha.

Midwest “Breadbasket” Region!
Rates of Wetland Loss

Early 1900s: 490,000 ha per year ⇔ 1.1% per year
1950–70s: 185,000 ha per year ⇔ 0.4% per year
1980s: 116,000 ha per year ⇔ 0.25% per year
1990s: 23,700 ha per year ⇔ 0.1% per year

Smoky Mountain National Park = 211,000 ha

So, the equivalent to approximately 11% of Smoky Mountains National Park is being lost each year!

Every 9 years, total wetland area equivalent to the park size is lost!

(However, better news now!!)

Current Status of Wetlands in the Conterminous United States
National Wetlands Inventory

43.6 million ha (107.7 mil. ac; 95% FW)
Net Gain of 77,730 ha!!
12,900 ha Annually (1998 – 2004, 0.2% gain)

Gains:
- Freshwater Pond Acreage increased 12.6% (281,500 ha)
- Creation of Artificial Ponds (PAB, PUB)
- Forested Wetland Acreage increased 1.1%

Losses:
- Estuarine Emergent Wetlands declined –0.7%
- Freshwater Scrub-Shrub declined –4.9%
- Freshwater Emergent –0.5%

Coastal Erosion, Succession, Urbanization, Deforestation

Caveat: 0.6% of Land Mass Surveyed

Wetland Mapping in the United States

Wetlands Mapper
http://wetlandsfws.er.usgs.gov/

Analysis of high altitude imagery in conjunction with collateral data sources (NRCS Soils Maps) and field work

60% of Wetlands Digitized
• Inherent error is expected!
32% of NWI Wetlands Visited
• Accuracy is not <10 m

Ground truthing is necessary for accurate estimates of wetland and deepwater acreage and to ensure correct classifications

Not intended to provide regulatory or legal products!

Hardcopy maps can be purchased from TWRA

Good for Vicinity Maps
Wetland Mapping Techniques

1) Remote Sensing from aerial photographs or infrared satellite images.
2) Ground truthing with a GPS receiver.
3) Ground truthing with scaled or geo-referenced map, compass, and measuring tape (distance).

Ocular estimation or pace

Determining the Wetland Edge

- Secure aerial image (DOQQ)
- Divide wetland in quadrants
- Establish at least one transect per quadrant
  - Midway distance; perpendicular to contour gradient
- Transect lower end: permanent water or cardinal azimuth
- Transect upper end: upland
- Establish plots:
  - 5 m apart = herbaceous/vine
  - 10 m apart = shrub
  - 20 m apart = forested
  - Closer if necessary

Linear Wetlands?

What Plot Size & Measures of Dominance?

- Herb – Herbaceous and woody plants <3.2 ft tall
- Percent Horizontal Cover (1 m²)
- Shrub – Woody > 3.2 ft tall, <3.0 inches DBH
- Density (100 m²)

Tree – Woody plants >3.0 inches DBH
- Density (400 m²)
- Vine – Woody vines >3.2 ft tall
- Density (40 m²)

If too dense to count, use percent horizontal cover instead of density.
Determining Wetland Classification

- Within each quadrant, establish one plot per subclass
- Center of Zone

What Plot Size?

- Herbaceous or Substrate:
  - 1-m² Plot (estimate, quadrants)
- Shrub and Trees:
  - Shrubs = 100-m²
  - Trees = 400-m²
  - 5 m (20 ft) >30%

Remote Sensing Wetlands

1) Topographic Maps
   - www.topozone.com

2) Digital Raster Graphic (DRGs)
   - Geo-referenced raster images of a scanned USGS topographic maps
   - www.tngis.org

3) Digital Orthophoto Quadrangle (DOQQs)
   - ArcGIS 9.1

Quantifying Landscape Structure

Remote Sensing

- Desire Current Aerial Photos?
- Geocorrection
  - 6–10 GCPs
  - USGS 7.5-min. Quadrangle Maps
  - ERDAS® and ArcGIS

- Low Altitude Aerial Images
  - FSA Offices
  - Summer or Winter Crop Digs
  - 9–12 Slides

- Farm Service Agency Flights
  - 2X / year over Agricultural Areas
Quantifying Landscape Structure
Remote Sensing
Mosaicked Images

Digitized in ERDAS
Feathered Overlying Pixels
Exported to Esri®ArcGIS
Georeferenced Landscape

Quantifying Landscape Structure
Remote Sensing
Clean and Classify Polygons (FSA Farm Folders) and Build Coverages in Esri®ArcGIS

Analyze Area and Landscape Structure with FragStats®Arc or ESRI® Spatial Analyst

Estimating Wetland Area

**Mapped: Option 1**

- Geographic Information System (GIS) and Mapping Software (ARCGIS 9.1)

**Mapped: Option 2**

- "Old-school Method"

  - Delineate wetlands on a scaled field map.
  - Transcribe field map to a transparency.
  - Equate scale on the field map to graphing paper.
  - Estimate area via counting the number of squares on graphing paper covered per wetland type.

Lab Exercise in 276 AE