Note: In 2008, IDFG was awarded another grant to revise the prototype landscape-scale wetland assessment tool and demonstrate its application in real wetland planning and restoration scenarios (Phase II). The following factsheet reflects the work done in Phase I. Some information on Phase II can be found at the end of this factsheet. Now completed, Phase II is used to identify and prioritize degraded wetlands for restoration, as well as minimally disturbed wetlands to conserve. For more information about Phase II, please contact the Idaho Department of Fish and Game.

Idaho Department of Fish and Game Landscape Assessment

The landscape assessment tool developed by the Idaho Department of Fish and Game (IDFG) applies metrics identified as most suitable for assessing wetland condition to evaluate wetland condition in northern and southern Idaho. Starting with a list of over 70 candidate landscape metrics, IDFG applied a five-part screening process in which it evaluated each metric based on several criteria. For instance, based on the current literature and expert judgment, IDFG assessed whether each metric is ecologically relevant for a given study area in Idaho. IDFG applied statistical techniques to evaluate the relationship between the candidate metric's predictions of wetland condition and field measurements of wetland condition ranked relative to a reference standard. As a result of this process, IDFG developed two landscape prioritization models, one calibrated to assess wetland conditions in the northern study site and the other in the southern study site. IDFG's landscape assessment tool is readily replicated by GIS personnel in other resource agencies for the purpose of developing GIS tools for assessing wetland condition that are calibrated to local environmental conditions and patterns of disturbance.

OVERVIEW

Lead developer(s): Idaho Department of Fish and Game (IDFG).

Year developed: The tool was initially developed in 2010 and will be completed in 2012.[1]

Geographic area: A region in Idaho's northern panhandle composed of 12 HUC-8 watersheds and a region in southwestern Idaho composed of seven HUC-8 watersheds (Fig. 1).[2]

Resource types: Wetlands and streams.[2]

Restoration/conservation: Restoration (reestablishment and rehabilitation), creation, enhancement, preservation/protection, and acquisition without preservation/protection.[1]

Stakeholders: IDFG conservation work, wetland compensatory mitigation providers.[1]

Current status: The tool was applied to assess wetland condition in two regions of Idaho in 2010

Updated: 5/7/2012

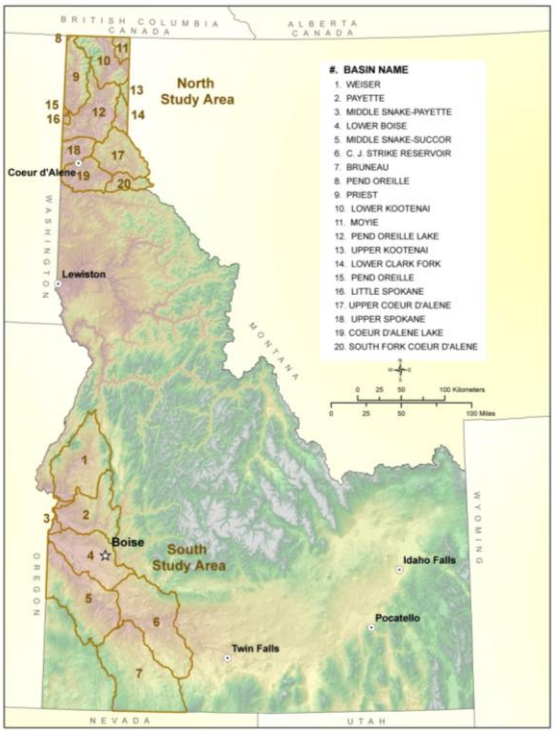

Figure 1. IDFG applied its landscape assessment tool to assess wetland condition in Idaho's northern panhandle region as well as a region in southwestern Idaho. Used with permission of IDFG.

as part of Phase 1 of tool development, with three additional case studies since completed. Phase 1 is now completed and a final report was made available in 2012. In 2008, IDFG was awarded another grant to revise the prototype landscape-scale wetland assessment tool and demonstrate its application in real wetland planning and restoration scenarios (Phase 2). The tool is now used to improve IDFG decisionmaking under the Idaho Wetland Conservation Plan.[1]

PRIORITIZATION ANALYSIS

Determination of input factors/weightings: To identify input factors/weightings for its model, IDFG first compiled a list of as many spatial layers as possible that could potentially serve as indicators of wetland condition based on a review of existing models and existing spatial data for Idaho (e.g., percentage urban coverage, population density, etc.; see Table 1). IDFG then applied the Analytical Tools Interface for Landscape Assessments (ATtILA) tool[3] (an ArcView 3.x extension) to these layers to calculate landscape metrics for 20,158 total wetlands.[2]

Using statistical analysis, IDFG then correlated each of these landscape datasets with four different field-based data sources for wetland sites throughout the study areas to evaluate how well each metric correlated with on-the-ground wetland conditions. These field data included:

- Streams, rivers, and lakes included in the Idaho Department of Environmental Quality (IDEQ)'s Beneficial Use Reconnaissance Program (BURP) dataset.
- Riparian and aquatic habitat maintained by the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO).
- Wetland sites and plant communities, including ecological indicators, maintained in the IDFG Idaho Conservation Data Center databases.
- An IDFG-developed rapid wetland assessment applied to ensure adequate representation of a variety of wetland environments across the landscape.

Those metrics that passed a five-part screening process, which included criteria such as ecological relevance, range of values, and significance of correlation with field conditions, were considered most predictive of wetland condition (Table 1). Additionally, metrics found to be negatively correlated with wetland condition (e.g., elevation) were used to calculate an "index of environmental vulnerability" for each wetland.[2]

Landscape prioritization tool(s):

Wetland Condition Tool: For each wetland polygon in its north and south study sites, IDFG combined metrics found to be most predictive of wetland condition with the "index of environmental vulnerability" to assign each wetland one of four condition classes ranging from minimally disturbed (rank = 1) to completely disturbed (rank = 4).[2]

Prioritization objectives assessed:

- Wetland condition

Table 1. IDFG's landscape assessment model used 19 metrics, in addition to an index of environmental vulnerability, to predict wetland condition in the northern study site.

Factor used in analysis	Data source(s)

North region		
Percentage agricultural land use		NLCD[5]
Percentage natural grassland		
Percentage cropland		
Percentage pasture		
Percentage urban		
Percentage stream length within 30m of urban land use		NHD; NLCD[5]
Percentage stream length within 30m of urban land use		
Percentage agricultural land use on slopes ≥ 9%		NLCD[5]; NED
Density of 4-lane highways		TIGER 2000 (1:100,000)[6]
Density of 2-lane highways		
Length of 4-lane highways within 30m of streams		TIGER 2000 (1:100,000)[6]; NHD
Length of 2-lane highways within 30m of streams		
Number of 4-lane highway/stream crossings		
Number of 2-lane highway/stream crossings		
Nitrogen loading		N/A
Phosphorus loading		N/A
Population density		N/A
Density of wells (#/km^2)		N/A
Percentage likely grazed by livestock		NLCD; BLM; ICBEMP
Index of environmental vulnerability	Mean elevation	NED (30m)
	Mean precipitation	UM NTSG total precipitation data (1980-1997, 18-year mean, 1 km resolution)[4]
	Mean slope	NED (30m)
	Percentage forest	2001 NLCD
	Percentage stream length adjacent to natural land	Streamnet (IDFG 2008, 1:100,000)
	Percentage stream length within 30m of natural land	Streamnet (IDFG 2008, 1:100,000)
South region		
Percentage agricultural land use		NLCD[5]
Percentage cropland		
Percentage pasture		
Percentage urban		
Percentage human land use		
Percentage stream length adjacent to agricultural land use		NLCD[5]; NHD
Percentage stream length within 30m of agricultural land use		
Percentage stream length within 120m of agricultural land use		
Percentage stream length adjacent to cropland		
Percentage stream length within 30m of cropland		
Percentage stream length within 120m of cropland		
Percentage stream length adjacent to pasture		
Percentage stream length within 30m of pasture		

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Percentage stream length within 120m of pasture		
Percentage stream length adjacent to pasture		
Percentage stream length adjacent to urban land use		
Percentage stream length within 30m of urban land use		
Percentage stream length within 120m of urban land use		
Percentage stream length adjacent to human land use		
Percentage stream length within 30m of human land use		
Percentage stream length within 120m of human land use		
Percentage stream length adjacent to natural grassland		
Percentage stream length within 30m of natural grassland		
Percentage stream length within 120m of natural grassland		
Density of interstate freeways		TIGER 2000 (1:100,000)[6]
Length of roads within 30m streams		TIGER 2000 (1:100,000)[6]; NHD
Length of county, city roads within 30m of streams		
Number of road/stream crossings		
Number of county, city road/stream crossings		
Nitrogen loading		N/A
Phosphorus loading		N/A
Area of wetland		NWI
Stream density		NHD
Density of canals, ditches (km/km^2)		NHD
Density of wells (#/km^2)		N/A
Percentage likely grazed by livestock		BLM; ICBEMP; NLCD[5]
Index of environmental vulnerability	Mean elevation	NED (30m)
	Mean precipitation	UM NTSG total precipitation data (1980-1997, 18-year mean, 1 km resolution)[4]
	Mean slope	NED (30m)
	Area of wetland	NWI
	Stream density	Streamnet (IDFG 2008, 1:100,000)

NED = United States Geological Survey National Elevation Dataset; NLCD = National Land Cover Dataset; UM NTSG = University of Montana Numerical Terradynamic Simulation Group; BLM = Bureau of Land Management; ICBEMP = Interior Columbia Basin Ecosystem Management Project; NWI = United States Fish and Wildlife National Wetlands Inventory; TIGER = Topologically Integrated Geographic Encoding and Referencing (system)

Watershed Condition Tool: IDFG ranked individual HUC-12 watersheds using an analysis for which metrics were selected based on literature review and professional judgment alone (Table 2). Because watershed reference data were unavailable, no field-based calibration of metrics, as was done for IDFG's wetland condition tool, was completed. IDFG summed all metrics and ranked each HUC-12 in terms of six condition classes ranging from "minimally disturbed" (rank = 1) to "completely disturbed" (rank = 6).[2]

Prioritization objectives assessed:

- Watershed condition

Factor used in analysis	Data source
ATtILA Landscape metrics	
Total terrestrial area	NLCD[5]
Percentage cropland	
Percentage pasture	
Percentage all agricultural land use	
Percentage forest	
Percentage man-made barren	
Percentage natural barren	
Percentage natural grassland	
Percentage shrubland	
Percentage urban	
Percentage user-defined class	
Percentage wetland	
Percentage all natural land use	
Percentage all human land use	
Percentage agricultural cropland on slopes ≥ 10%	NLCD[5]; NED
Percentage agricultural pasture on slopes ≥ 10%	
Percentage any agricultural on slopes ≥ 10%	
ATtILA Riparian metrics	
Percentage stream length adjacent to agricultural land use	NLCD[5]; NHD
Percentage stream length within 30m of agricultural land use	
Percentage stream length within 120m of agricultural land use	
Percentage stream length adjacent to cropland	
Percentage stream length within 30m of cropland	
Percentage stream length within 120m of cropland	
Percentage stream length adjacent to pasture	
Percentage stream length within 30m of pasture	
Percentage stream length within 120m of pasture	
Percentage stream length adjacent to urban land use	
Percentage stream length within 30m of urban land use	
Percentage stream length within 120m of urban land use	
Percentage stream length adjacent to human land use	
Percentage stream length within 30m of human land use	
Percentage stream length within 120m of human land use	
Percentage stream length adjacent to natural grassland	
Percentage stream length within 30m of natural grassland	
Percentage stream length within 120m of natural grassland	
ATtILA Human stressor metrics	
Density of 4-lane highways	TIGER 2000 (1:100,000)[6]
Density of 2-lane highways	
Density of interstate freeways	

Length of roads within 30m of streams	TIGER 2000 (1:100,000)[6]; NHD
Length of 4-lane highways within 30m of streams	
Length of 2-lane highways within 30m of streams	
Length of county, city roads within 30m of streams	
Number of road/stream crossings	
Number of 4-lane highway/stream crossings	
Number of 2-lane highway/stream crossings	
Number of county, city road/stream crossings	
Nutrient loading	N/A
Phosphorus loading	N/A
Population density (population count/km^2)	N/A
Percentage change in total population	N/A
Percentage impervious cover	NLCD[5]
ATtILA physical characteristic metrics	
Area of wetland	NWI
Stream density	NHD
Topographic position of wetland	NED
Desktop GIS-derived metrics	
Density of canals, ditches (km/km^2)	NHD
Density of wells (#/km^2)	N/A
Percentage of land likely grazed by livestock	NLCD[5]; BLM; ICBEMP
Pollutant discharge	EPA; ICBEMP
Railroads	TIGER 2000 (1:100,000)[6]
Recreation access and navigation improvements	BLM; IDPR
Recent timber harvest	USGS; Northwest ReGAP project; NatureServe
Toxic element concentration	EPA; ICBEMP
Utility corridors	ICBEMP
Dairies	IDWR
Dams and reservoirs	IDWR; NHD
Dredge spoils or other solid waste disposal	EPA
Effluent discharge (from industrial or energy facility that alters thermal regime)	EPA
Groundwater pumping: ex-urban development	IDWR
Mining	IDL; USGS; IDEQ

Prioritization products: IDFG provides maps illustrating assessment results for wetland condition at both the wetland and watershed level (Fig. 2).

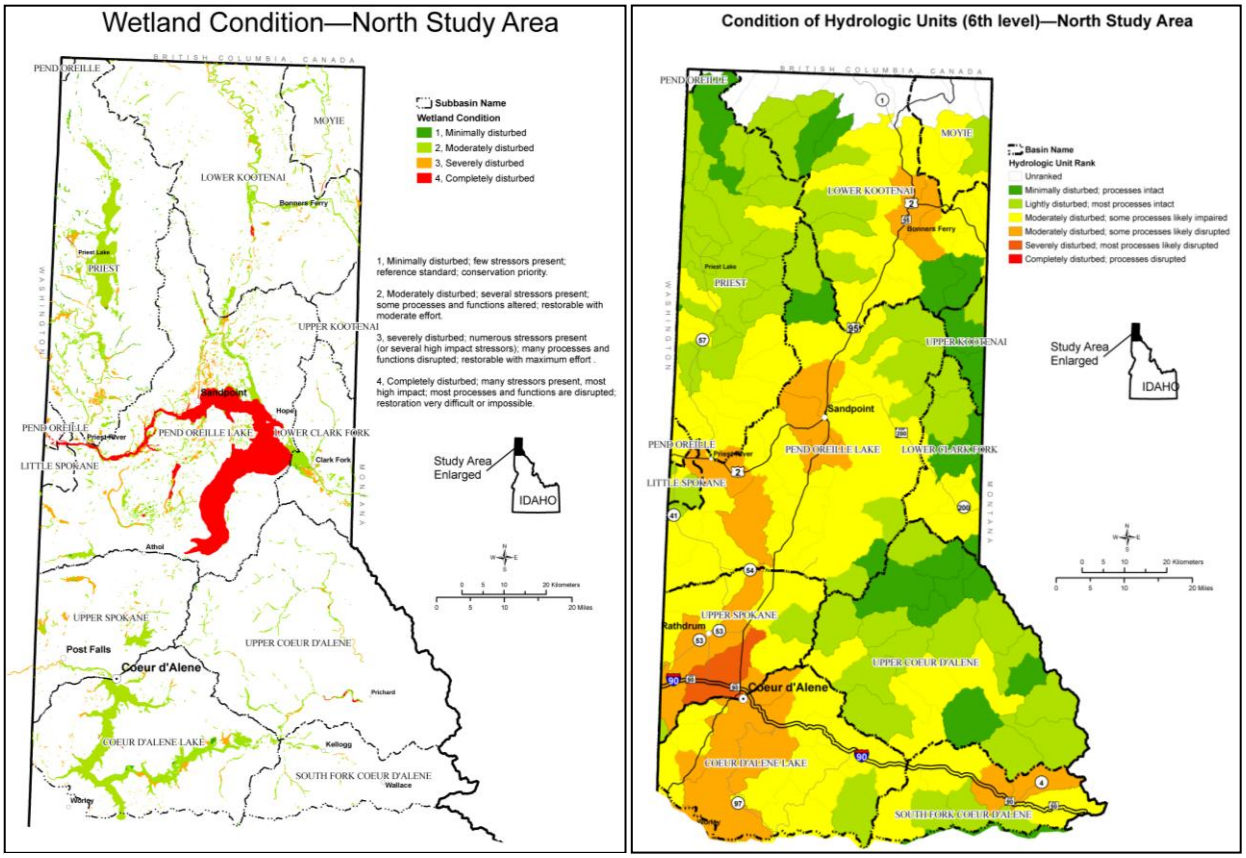

Figure 2. In the north study site, IDFG's landscape assessment tool ranked individual wetland polygons (left) and HUC-12 watersheds (right) in terms of overall landscape disturbance. A similar analysis was also completed for the southern study site. Used with permission of IDFG.

IMPLEMENTATION

Regulatory/non-regulatory programs:

- The tool could be used to improve the effectiveness of Section 404 wetland and stream compensatory mitigation.[1]
- Revisions to Idaho's state wildlife action plan will include information from the tool.[1]
- The tool could potentially be used to guide funding decisions of Idaho's Habitat Improvement Grant (HIG) program.[1]
- The tool could inform the development of Total Maximum Daily Load (TMDL) plans.[1]

Transferability:

- Staff with experience in spatial analysis could readily develop their own tool by reapplying the methods IDFG used to produce the IDFG tool.[1]

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- The case study approach that IDFG used to develop the tool provides good example applications that support the tool's transferability.[1]

Data gaps:

- Out-of-date land cover data: some data have not been updated in more than ten years in areas that have since experienced rapid urbanization.[1]
- Out-of-date wetland layers: wetland data used in the model are not accurate or recent enough to be used to locate wetlands in the field.[1]
- Some land development spatial data can be difficult to keep up-to-date (e.g., wind development data).[1]
- A lack of some potentially important indicators of wetland condition that would have been useful in the analysis, including data for beaver presence, herbicide or pesticide use, non-native species abundance, nutrient loading, off-highway vehicle use, recreational and boating impacts, and sediment accumulation.[2]

Barriers:

- Many staff members that work on the tool are seasonal and have limited time to contribute to developing it – this is an even larger issue than budget constraints. Occasionally IDFG has funding available that could be used to hire more staff but the state has a cap placed on the number of staff members that IDFG (and other state agencies) can have. This limits staff resources available to develop the tool.[1]
- IDFG's ability to maintain updated data for the landscape assessment tool is fundamentally limited by available resources/staff.[1]

Future goals:

- Make outputs from the tool available in an online interactive map.[1]
- Further calibrate the tool using rapid assessment/intensive data.[1]
- Increase collaboration with water quality programs.[1]
- Disseminate the tool to other agencies or conservation organizations.[1]
- Support the establishment of a statewide wetland monitoring program with the tool fully incorporated into statewide monitoring and assessment methods.[1]
- According to an IDFG representative, one barrier to achieving future goals might be IDFG's current dependence upon EPA grants. So far, EPA has served as the major source of funding for the tool but should not be depended upon for long-term funding.[1]
- Another obstacle is state funding for IDFG. Idaho traditionally has not supported conservation extensively, with IDFG funded through licenses and federal funding alone.[1]

UPDATE – PHASE II

In Phase II, IDFG built a statewide raster-based (30 m^2 pixel) landscape integrity model to predict wetland condition. Existing spatial layers of stressors known to directly and indirectly affect wetland condition were used, including land use (e.g., urban, agriculture, forestry, etc.), development (e.g., roads, railroads, utilities, mining, industrial sites, dairies, recreation sites, etc.), and hydrologic alteration (e.g., density of canals, wells, reservoirs, etc.). A map showing the potential distribution of wetland and riparian habitats in Idaho was also created. This raster layer was built by compiling all existing wetland, riparian, and hydrographic maps (e.g., land

cover, National Wetlands Inventory, National Hydrographic Dataset, etc.). This layer was combined with the landscape integrity model to create a landscape-scale wetland assessment tool for Idaho. Site level field-generated rapid assessments of wetland condition were used to test accuracy of landscape-scale assessment results. The wetland assessment tool correctly predicted condition of field assessed wetlands 63% of the time. The tool's real-world application was demonstrated in 5 case studies of wetland conservation and restoration planning with governmental and non-governmental partners, including:

- Development of a wetland and riparian restoration strategy for the Boise and Payette River basins (partner Trout Unlimited);
- Identification of important wetland and riparian resources to inform land-use planning in the Upper Salmon River basin (partner City of Stanley);
- Prioritization of potential wetland protection and restoration sites in the Upper Snake River region which is undergoing urban development (partner Teton Regional Land Trust);
- Condition assessment and distribution of spring and vernal pool habitats in southern Idaho to inform revision of the State Wildlife Action Plan (partner IDFG, Wildlife Diversity Program);
- Conservation prioritization of wetland complexes as part of the Statewide Comprehensive Outdoor Recreation and Tourism Plan (partner Idaho Department of Parks and Recreation - http://parksandrecreation.idaho.gov/sites/default/files/uploads/documents/SCORTP/Draft%20SCORTP%20Wetland%20Prioritization%20Plan%20-%202012.pdf).

[1] Interview on 12/15/2011 with Chris Murphy, Wetland Ecologist, Idaho Department of Fish and Game.
[2] Idaho Department of Fish and Game. 2010. Development of a landscape-scale wetland condition assessment tool for Idaho.
[3] ATtILA was developed by the EPA Landscape Ecology Branch and is available for download at: http://www.epa.gov/nerlesd1/land-sci/attila/index.htm
[4] UM NTSG precipitation data available from: www.daymet.org/default.jsp
[5] NLCD data are available from: http://www.mrlc.gov/nlcd_multizone_map.php
[6] TIGER roads/railroads data available from: www.census.gov/geo/www.tiger/