Predicting Wetland Score:
Is it Wet?
Is it Significant?

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In 1992, Ontario implemented a new policy to provide protection for wetlands in the province (OMNR, 1992). Under the new policy, all developments in or around wetlands must "have regard" for provincially significant wetlands.

Wetlands are "provincially significant" if they score high when evaluated using either the Northern (OMNR 1993a) or Southern (OMNR 1993b) Wetland Evaluation Manuals. The evaluation processes use more than 50 variables to score wetland significance.

Using the manuals to do a full wetland evaluation is a complex and costly process ($1,000/50 ha of wetland). A less costly pre-screening method for predicting wetland score would be a valuable tool for resource managers, planners, and developers.

Predicting Wetland Score

We collected data from completed evaluations to build models that will predict wetland score using a small number of easily measured variables.

Applied properly, these models can be used to pre-stratify wetlands, which will allow us to focus efforts and funds on wetlands that are most likely to be considered provincially significant. The models can also be used to plan around wetlands that score high, without a full field evaluation.

It is important to understand that these models have limitations. They do not replace the need to do full, on-site evaluations for individual wetlands. They cannot be used to determine a wetland score for use at Municipal Board Hearings, or in applying for a tax rebate.

Our approach in developing these models was to reduce the number of variables assessed while maintaining some confidence in the results. We eliminated over half the evaluation variables by removing all those that required a site visit. For example, *wetland size* is included because it can be estimated from recent aerial photography, while *rare species* is not included because it requires a site visit.

We then took a multiple regression approach using information from evaluated wetlands to see which set of variables best predicted the total score. The variables we used in the models are listed in **Table 1**. Separate analysis were done for southern wetlands (**Table 2**), and northern wetlands (**Table 3**).

An understanding of the Wetland Evaluation Manual is essential to generate realistic variable estimates. This understanding and knowledge is usually acquired through the five-day wetland evaluation course, and through field experience.

Using the Models

Follow these four steps to score a wetland using the models:

Step 1 Select the model series and model that is most applicable, given the availability of information on the wetland being tested.

Step 2 Determine the number of points that the wetland would score for each variable in the model, according to the procedure explained in the appropriate evaluation manual. For the SZ1LOG variable, determine the size of the wetland in hectares and calculate its natural logarithmic value.

Step 3 Multiply each score by the coefficient (see Table 2 and 3 for coefficient values) for that variable and sum the resulting scores.

Step 4 Add the score obtained from Step #3 to the constant. The resulting total is the wetland score predicted by the model.

Example

Working through the process using a southern Ontario example:

Assume we have sufficient information on paper to estimate all of the variable for Model S1B (see Table 2) for a small (14 ha) wetland. Using the data we have and the Wetland Evaluation Manual for Southern Ontario we estimate the scores for each of the variables needed.

SZ1LOG = 2.639
RTOT1 = 60
REC = 68
FLOOD = 70
OPWAT = 8
HPROX = 26
WPROX = 8

Using model S1B (see Table 2):

Predicted Scores = Constant + 32.58(SZILOG) + 1.424(RTOT1) + 2.002(REC) + 1.531(FLOOD) + 3.596(OPWAT) + 2.581(HPROX) + 6.494(WPROX)

Or using the values in this example:

23.297 + 32.850(2.639) + 1.424(60) + 2.002(68) + 1.531(70) + 3.596(8) + 2.581 (26) + 6.494(8)
= 587

This approach can be used for any of the models in Table 2 or Table 3. Which model you use, depends on the data you have available, and the degree of accuracy you require.

TABLE 1: VARIABLE NAMES: Variables used in each of the models presented in Table 2 & 3 and the section of the Evaluation Manual in which they are found.

VARIABLE	FULL NAME	MANUAL SECTION	
		Southern Manual	**Northern** Manual
SIZE1 SZ1LOG	Actual Wetland Size (ha)- use log transformation of this variable in the models		
	1. BIOLOGICAL COMPONENT		
WLTYPE	Wetland Type	1.1.2	1.1.2
SITE	Site Type	1.1.3	1.1.3
NOTYPE	Number of Wetland Types	1.2.1	1.2.1
HABDIV HABLOG	Diversity of Surrounding Habitat - use log transformation of this variable in the models	1.2.3	1.2.3
WPROX	Proximity to Other Wetlands	1.2.4	1.2.4
OPWAT	Open Water Types	1.2.6	1.2.6
	2. SOCIAL COMPONENT		
EVP	Economically Valuable Products (Total)	2.1	2.1
REC	Recreational Activities	2.2	2.2
AESTH	Landscape Aesthetics (Total)	2.3	2.3
EDTOT	Education and Public Awareness (Total)	2.4	2.4
HPROX	Proximity to Areas of Human Settlement	2.5	2.5
OWNER	Ownership	2.6	2.6
	3. HYDROLOGICAL COMPONENT		
FLOOD	Flood Attenuation (Total)	3.1	3.1
WST	Wetland Site Type	n.a.	3.2.1
TDWQ1	Downstream Water Quality Improvement (Total)	3.2	3.3
SEC	Shoreline Erosion Control	3.4	3.5
	4. SPECIAL FEATURES COMPONENT		
RTOT1	Rarity (Wetland Type)	4.1.1	4.1.1
AGE AGLOG	Ecosystem Age - use log transformation of this variable in the models	4.3	4.3
TOTAL	Total Wetland Score		

TABLE 2: SOUTHERN MODELS: Constants, coefficients and adjusted R^2 values for the two best sets of 8 variables for predicting total score. Two models, S1 & S2, are presented as the R^2 are very similiar and different offices may have different data set available. In each case we also reduced each model by one variable (the one contributing least to the prediction) down to the two "best" variables. Users can choose the model that fits their data and comfort level based on the adjusted R^2 value.

S1 MODELS

Model	Constant	SZ1LOG	RTOT1	REC	FLOOD	OPWAT	HPROX	WPROX	EDTOT	Adj R^2
A	35.462	33.442	1.299	1.693	1.533	3.582	2.141	6.316	1.751	**0.817**
B	23.297	32.850	1.424	2.002	1.531	3.596	2.581	6.494	-	**0.804**
C	77.151	33.112	1.461	2.094	1.370	3.476	2.191	-	-	**0.789**
D	131.674	30.628	1.473	2.181	1.333	3.045	-	-	-	**0.770**
E	168.414	32.578	1.527	2.194	1.113	-	-	-	-	**0.740**
F	224.745	41.130	1.733	1.222	-	-	-	-	-	**0.646**
G	234.384	47.808	1.718	-	-	-	-	-	-	**0.593**

S2 MODELS

Model	Constant	EVP	RTOT1	REC	FLOOD	OPWAT	SZ1LOG	EDTOT	HPROX	Adj R^2
A	78.867	2.140	1.346	1.748	1.356	3.249	22.468	1.744	1.815	**0.815**
B	124.301	2.064	1.327	1.749	1.329	2.917	21.052	2.129	-	**0.803**
C	124.020	2.139	1.484	2.147	1.312	2.820	19.350	-	-	**0.782**
D	143.866	4.105	1.430	2.365	1.416	2.818	-	-	-	**0.762**
E	176.203	4.444	1.482	2.371	1.211	-	-	-	-	**0.737**
F	249.201	5.460	1.689	1.373	-	-	-	-	-	**0.621**
G	267.515	6.394	1.662	-	-	-	-	-	-	**0.551**

TABLE 3: NORTHERN MODELS Constants, coefficients and adjusted R^2 values for the two best sets of 5 variables for predicting total score. Two models, N1 & N2, are presented as the R^2 are very similiar and different offices may have different data set available. In each case we also reduced each model by one variable (the one contributing least to the prediction) down to the two "best" variables. Users can choose the model that fits their data and comfort level based on the adjusted R^2 value.

N1 MODELS

Model	Constant	RTOT1	SZ1LOG	AESTH	OPWAT	OWNER	Adj R^2
A	350.387	1.939	38.248	-12.879	3.062	7.475	**0.691**
B	385.755	2.006	37.109	-10.716	3.073	-	**0.671**
C	436.669	2.275	37.469	-12.729	-	-	**0.627**
D	346.327	2.010	39.618	-	-	-	**0.571**

N2 MODELS

Model	Constant	SZ1LOG	NOTYPE	OPWAT	EDTOT	FLOOD	Adj R^2
A	215.172	34.888	4.163	5.142	3.257	0.704	**0.694**
B	267.043	32.554	5.069	3.990	2.616	-	**0.652**
C	286.579	34.915	4.535	3.877	-	-	**0.616**
D	322.230	35.702	5.072	-	-	-	**0.541**

Discussion and Limitations

In every case, the models explain 70 percent or more of the observed variation. The differing number of variables used and R^2 scores for the northern and southern models are simply an indication of the smaller sample size used to produce the northern models.

When using the models, remember that the calculated wetland scores are only estimates. They do not eliminate the need to do full, on-site evaluations for some individual wetlands.

Consider the following when using the models:

- These models will not identify wetlands that are provincially significant because they score 200 or more points on either the Biological or Special Features Components (see Appendix "B" in Wetland Evaluation Manuals).
- For these predictive models to generate meaningful estimates, the individuals using them must be skilled at using maps and aerial photographs to delineate wetland boundaries and identify features such as wetland type, site type and predominant vegetation forms. This skill is usually acquired through the five-day wetland evaluation course followed by field experience. A person without this background will be unable to generate realistic variable estimates.
- The predicted scores merely indicate a wetland's potential value. They cannot be used as proof of provincial significance for tax rebate purposes or as evidence at Ontario Municipal Board hearings. If an actual score is needed, **do not** use these models.

Users of these or any other models should always remember that models are not reality, and the results should always be used cautiously.

Ask these questions:

1. Can I afford to be wrong?

Choose a model with a R^2 value that fits your comfort level. If none are good enough, then do a full evaluation.

2. How can I reduce the chance of making an error?

Since wetlands scoring 600 or more points are considered Provincially Significant (see Appendix "B" in Wetland Evaluation Manuals) you could lower the score required for results from this model. Using 500 points as the cut-off would reduce the chance of making an error. As with Question #1, it depends on the comfort level required by the Resource Manager making the decision.

Potential Uses

Within these limitations, and used properly, these regression models can be a valuable planning tool that will improve the quality of land use decisions.

For example, the models can be used to pre-stratify wetlands to focus limited funds on those areas most likely to be provincially significant.

The models can be used to evaluate utility and transportation corridor options, or to identify wetland values as part of a Forest Management Plan.

The models can be used in many resource management applications to identify wetland areas one might wish to treat with special regard and "plan" around.

The key advantage of using these models is that a resource manager can get an indication of the significance of a wetland for a fraction of the cost of a full evaluation. This allows us to implement Ontario's Wetland Policy in a comprehensive, cost effective manner.

If you are interested in the statistical details behind the models presented here, we encourage you to read the NEST technical report TR-025 Chisholm *et al*. 1995. Please contact Chris Davies or John Parton at Northeast Science & Technology if you have any questions about the information provided here.

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