Developing a National Standard for Challenges to the National Wetland Plant List

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Background

- Wetland rating categories represent the range of estimated probabilities (expressed as frequency of occurrence) of the species occurring in wetland vs. nonwetland across the entire range of the species (Reed 1988).

- Five categories:
  - Obligate (OBL) >99%
  - Facultative wetland (FACW) 67-99%
  - Facultative (FAC) 34-66%
  - Facultative upland (FACU) 1-33%
  - Upland (UPL) <1%

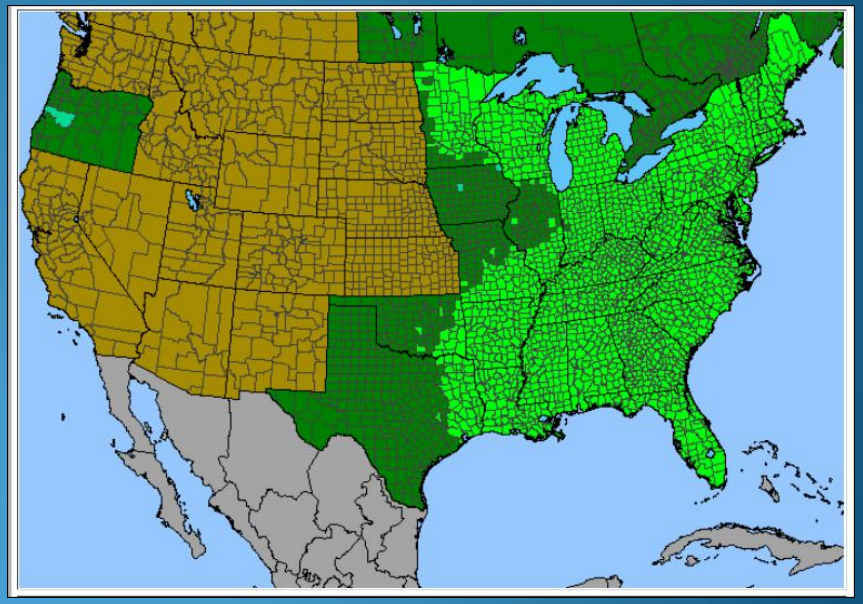


Figure 1. Range of Acer *rubrum L.* (Kartesz, 2009)

Objectives:

- The NTCWV and the NP of the NWPL developed data collection and analysis methods for challenges to the NWPL.

- To test these methods in a 12 digit HUC in Salisbury, NH using
  - *Acer rubrum L.*
  - public input during 2012 NWPL update ranged from OBL to FAC

- To compare results produced by
  - A traditional frequency formula
  - A weighted frequency formula
  - A Bayesian model


(Kartesz, 2009)

GIS Methods

- Used NH GRANIT LCD (UNH 2006) and NWI (USFWS 2009) to divide the watershed into :
  - probable upland
  - probable wetland
  - areas where *A. rubrum* does not naturally occur
- Generated random coordinates
- Sampled 60 coordinates
  - 30 in upland
  - 30 in wetland

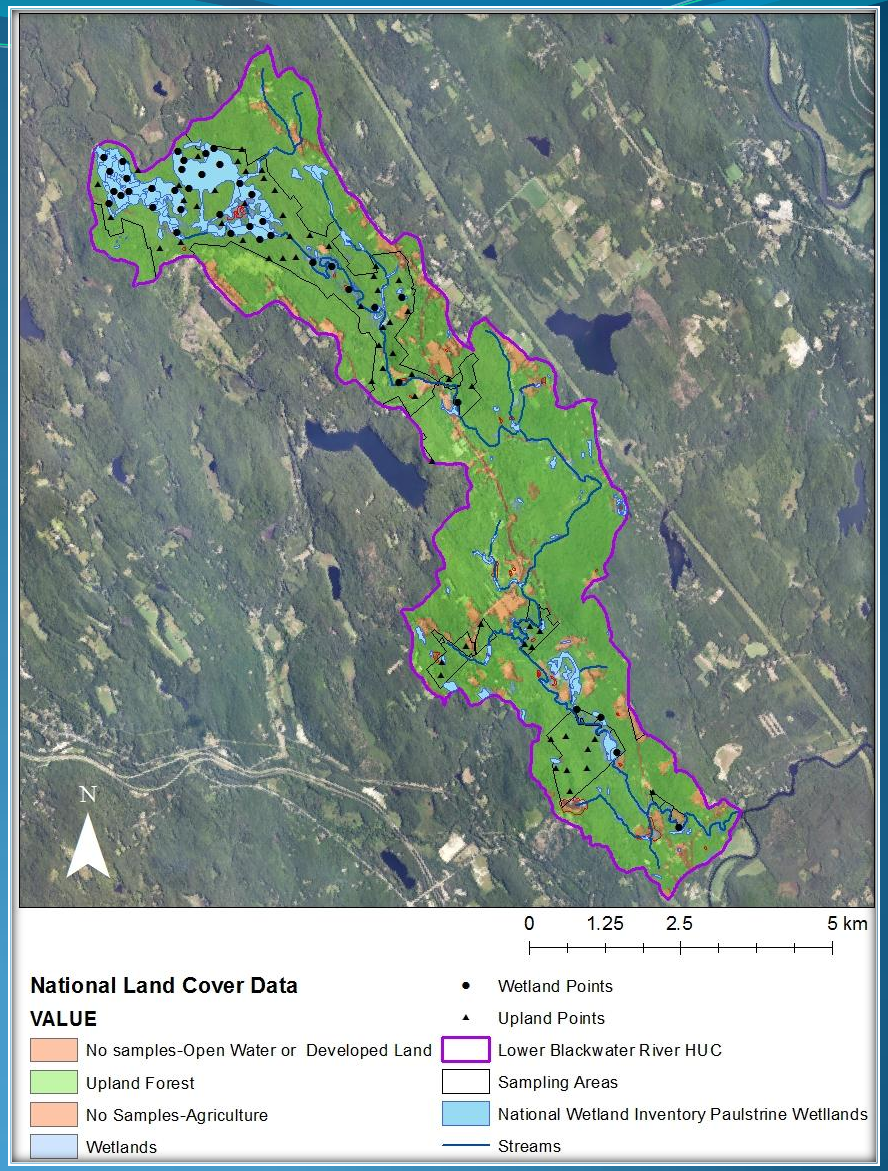


Figure 2. Random coordinates generated in mapped upland and mapped wetland in the Lower Blackwater River HUC, near Salisbury NH.

Field Methods

100 m Transect Placement Guidelines

- At each coordinate we ran a 100m transect in a random direction.

- Transects were located entirely in upland or wetland.

- Each transect represented one plant community.

(Kartesz, 2009)

Vegetation Sampling

100 m Point Intercept Sampling-


(Kartesz, 2009)

- Every meter we recorded the presence/absence of:
  - *A. rubrum,* target species
  - Five others, as present
  - 1 hit/species/meter mark
- Every 25 m we recorded the presence/absence of:
  - Hydric soil indicators
  - Wetland hydrology indicators

Data Summary:

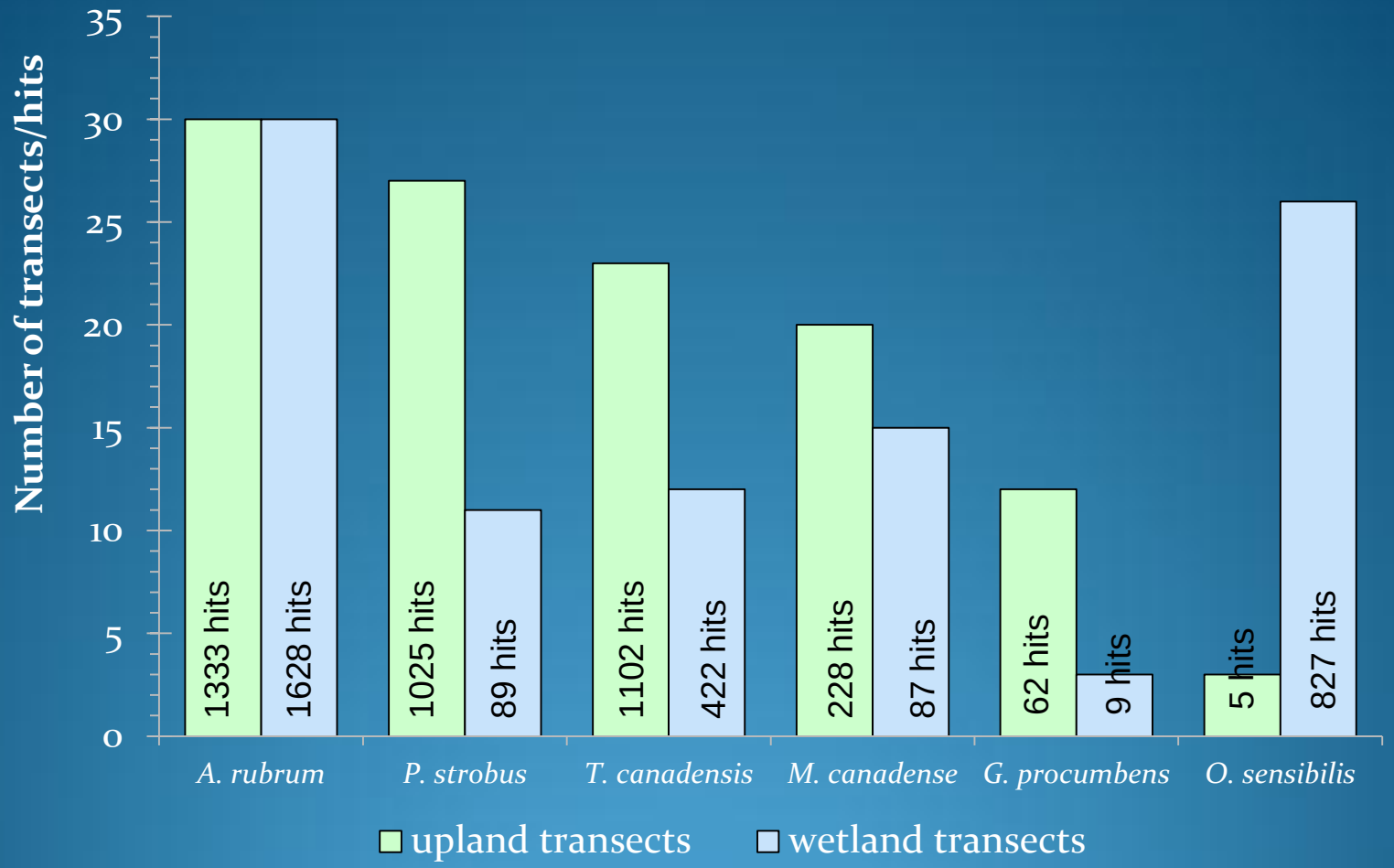


Figure 2. Comparison of the number of "hits" for six plant species on upland and wetland transects. These data were used to calculate wetland frequency. Vegetation sampling was conducted in the Lower Blackwater River HUC, near Salisbury NH.

Data Analysis: Traditional Wetland Frequency

- The hits from each transect type were tallied.
- The number of wetland hits was divided by the total number of hits.

- $F_{wetland\_A.\ rubrum}$= # wetlands hits/total # hits* 100
  - 1628 wetland hits/(1333 upland hits +1628 wetland hits)
  - 1628/(1333 + 1628) *100= 54.98%

(Kartesz, 2009)

Data Analysis: Weighted Wetland Frequency

- *T. canadensis* $\hat{p}_{\text{wetland transects}}$= 12wet/(12 wet + 23 up) =0.34
- *T. canadensis* $\hat{p}_{\text{upland transects}}$= 23 up/(12 wet + 23 up) =0.66
- *T. canadensis* $\hat{p}_{\text{wetland hits}}$= 422 wet/(422 wet + 1102 up) =0.28
- *T. canadensis* $\hat{p}_{\text{upland hits}}$ = 1102 up/(422 wet + 1102 up) =0.72

- $F_{\text{weighted}} = \left[\hat{p}_{\text{wetland hits}}/\hat{p}_{\text{wetland transects}}\right] \Big/ \left(\frac{\hat{p}_{\text{wetland hits}}}{\hat{p}_{\text{wetland transects}}}\right) + \left(\frac{\hat{p}_{\text{upland hits}}}{\hat{p}_{\text{upland transects}}}\right)$

- $F_{T.\ canadensis} = (0.28/0.34)/[(0.28/0.34)+(0.72/0.66)]^{*}\ 100 = 42.43\%$

(Kartesz, 2009)

Data Analysis: The Bayesian Model

- Model quantified the probability that the wetland frequency of *A. rubrum* is consistent with each of the five indicator status rating categories (OBL-UPL), given the NH frequency data.

$$\Pr(B \mid A) = \frac{\text{prior} \times \text{likelihood of species behavior}}{\sum \text{prior} \times \text{likelihood of species behavior}}$$

- Flat prior

- Likelihood function modeled the behavior of each category using 51,039 frequency observations (NRCS, 2003).

- Model produced a probability value for each wetland rating category


(Kartesz, 2009)

Results:

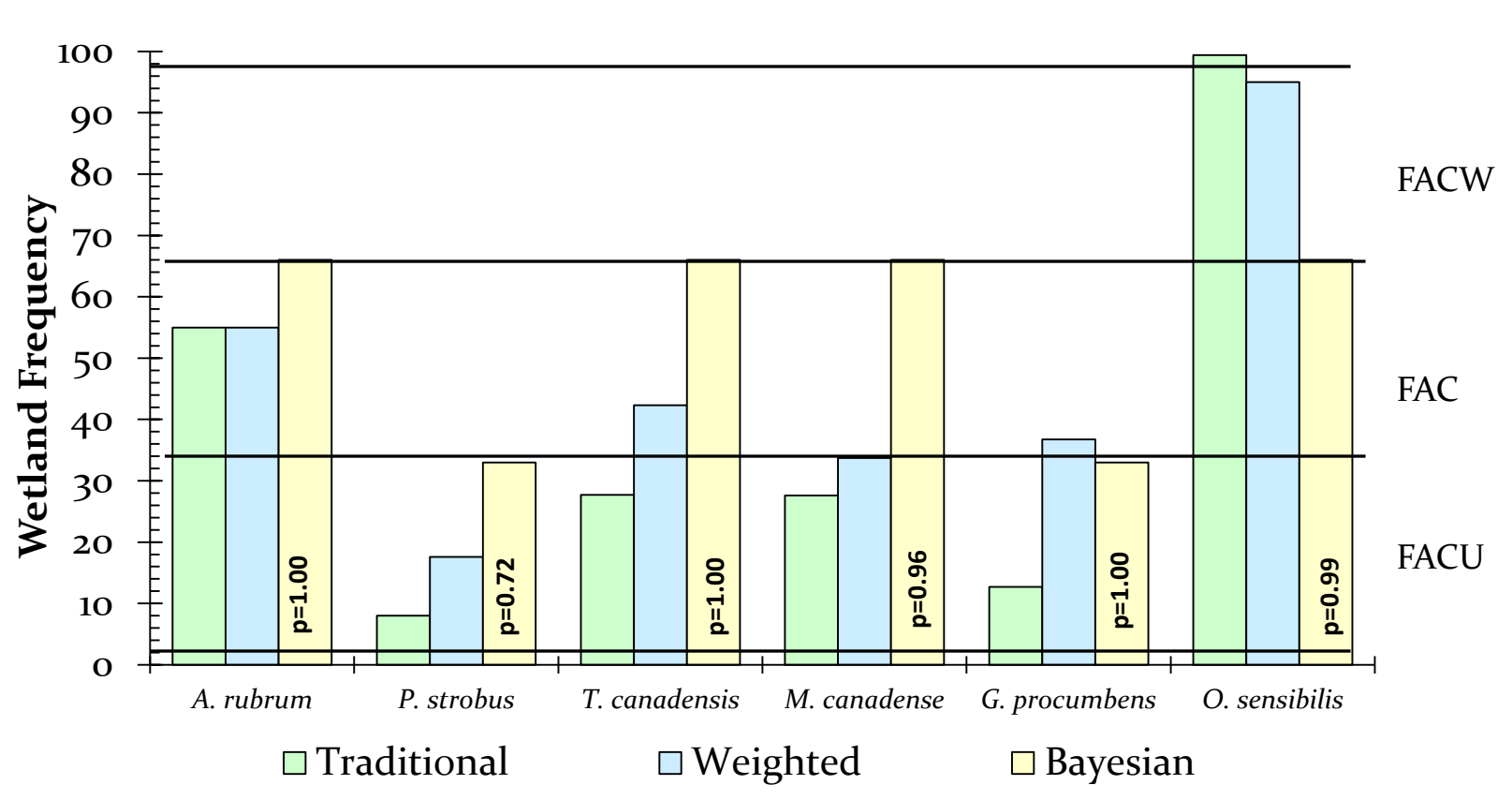


Figure 4. Comparison of the wetland frequencies of six species in the Lower Blackwater River HUC, Salisbury, NH. Frequencies were calculated using a traditional formula, a weighted formula, and a Bayesian model.

Patterns in the data:


(Kartesz, 2009)

- Formulas agreed on the frequency of *A. rubrum* and *P. strobus* – species for which:
  - Large numbers of transects
  - Large number of hits
  - Normal distributions


(Kartesz, 2009)

- When formulas disagreed:
  - Large differences in transect types
    O. sensibilis- 26 wetland and 3 upland
  - Few hits/transect
    M. canadense <10 hits on 24 of 35 transects

- Watershed type- *T. canadensis*

Lessons Learned

- **Design works well for:**
  - **Generalists** –large plants, widely distributed across landscape, easily sampled like *A. rubrum, P. strobus, T. canadensis*.


(Kartesz, 2009)

- **Design needs to be adjusted for:**
  - **Disturbance responders**-like *O. sensibilis* – sampling in urban/suburban disturbed areas?

  - **Biological challenges-** like *M. canadense*- species that may occur in wetlands, but may not be functioning as hydrophytes

  - **Growth forms-** sampling methodologies designed for vines and herbs, like *G. procumbens* with small leaf area index


(Kartesz, 2009)

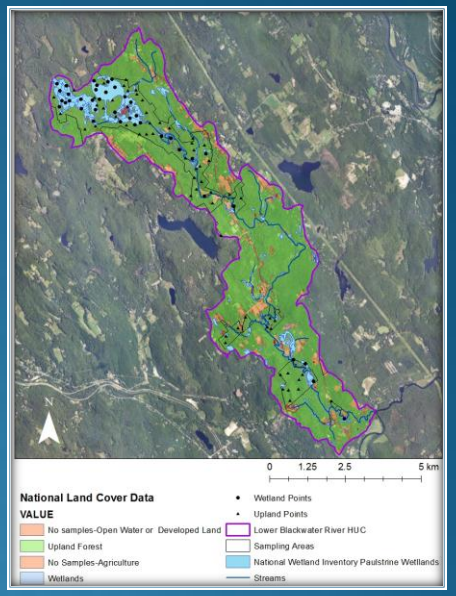
Recommendations for Challenges to the National Wetland Plant List

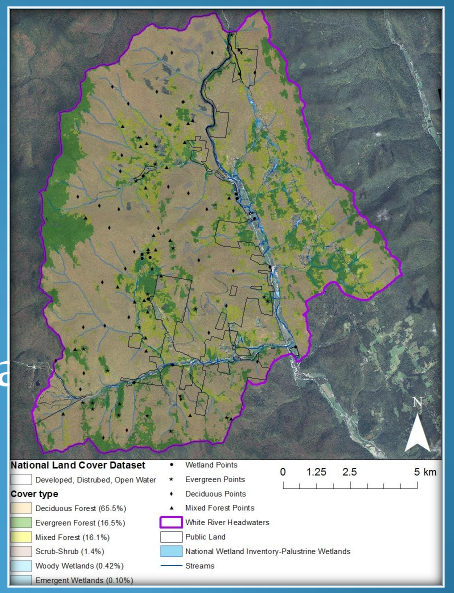
- 30 upland and 30 wetland transects when wetlands represent a relatively large percentage of the landscape.

- A minimum of 10 transects for the underrepresented landscape type.

- Most confidence in Bayesian model combined the NH frequency data with a likelihood function and produced probability value.

- Sampling methods may need to be a for different types of species.





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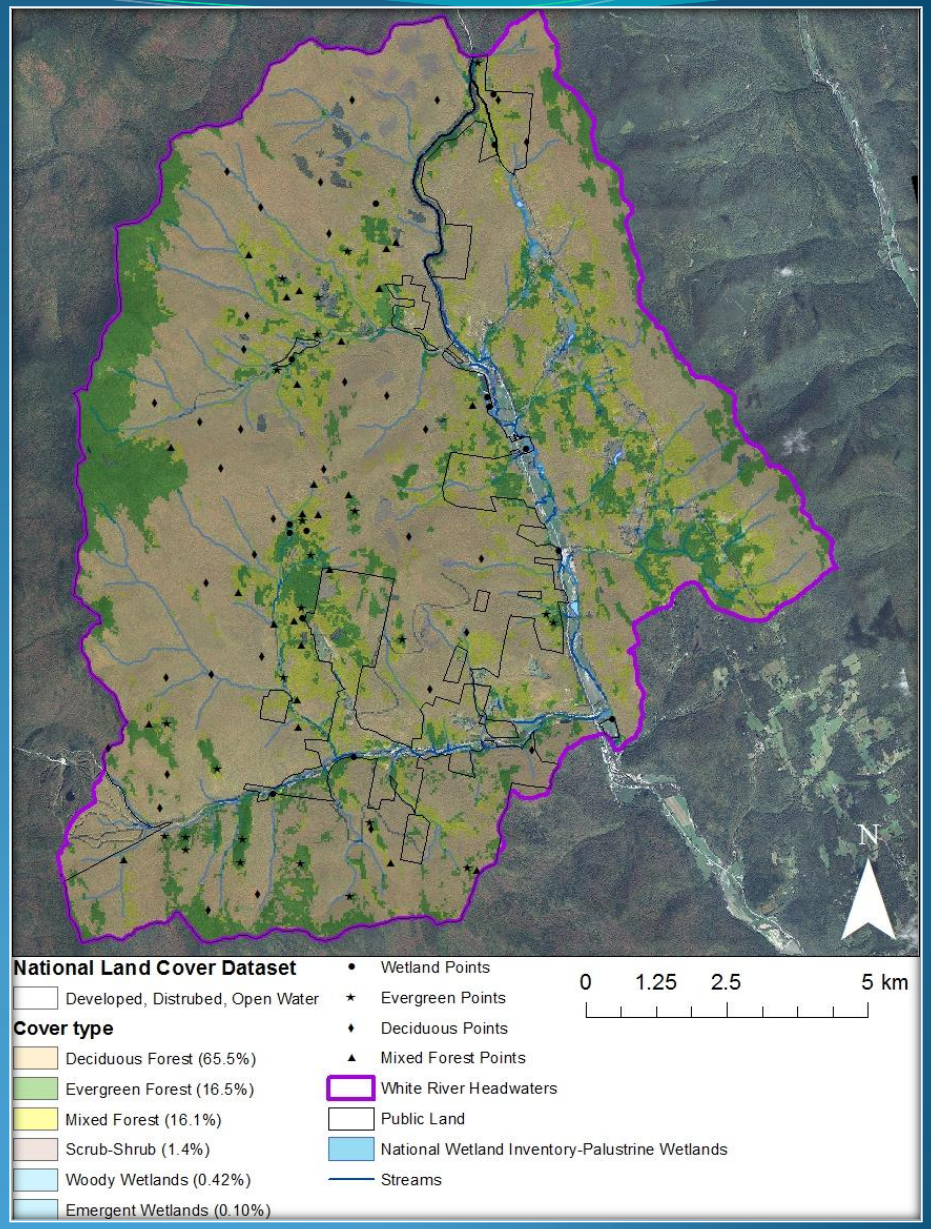
What's Next?

2012 Objectives:

- To sample plant frequency by land cover class, in watersheds where wetlands represent a small percentage of the landscape.

- To develop a method to predict wetland frequency by combing field data and GIS analyses.

- To compare the wetland frequency of *T. canadensis* in u-shaped and v-shaped watersheds.



Setting the Likelihood Function

Table 1. List of species whose frequency data was used to model the wetland frequency of the FACU, FAC, and FACW indicator rating categories. Wetland frequency was calculated from data collected by the NRCS on 525 wetland and 525 upland transects in Denali National Park, AK.

FACU	FAC	FACW
Anemone parviflora	*Anemone richardsonii*	*Arctagrostis latifolia*
Calamagrostis canadensis	*Chamerion latifolium*	*Betula nana*
Cassiope tetragona	*Poa arctica*	*Empetrum nigrum*
Cornus canadensis	*Rubus arcticus*	*Equisetum pratense*
Delphinium glaucum	*Salix arctophila*	*Hedysarum alpinum*
Equisetum arvense	*Salix polaris*	*Ledum decumbens*
Mertensia paniculata	*Sanguisorba canadensis*	*Petasites frigidus*
Pyrola asarifolia	*Trientalis europaea*	*Senecio triangularis*
Shepherdia canadensis	*Trisetum spicatum*	*Vaccinium caespitosum*
Viburnum edule	*Viola langsdorfii*	*Vaccinium uliginosum*

Setting the Likelihood Function

- 10 FACW species, 10 FAC species, and 10 FACU species
- 525 wetland and 525 upland transects in Denali, National Park.
- 51,039 frequency observations
- OBL and UPL categories were set using descriptions from the literature (Environmental Laboratory 1987).

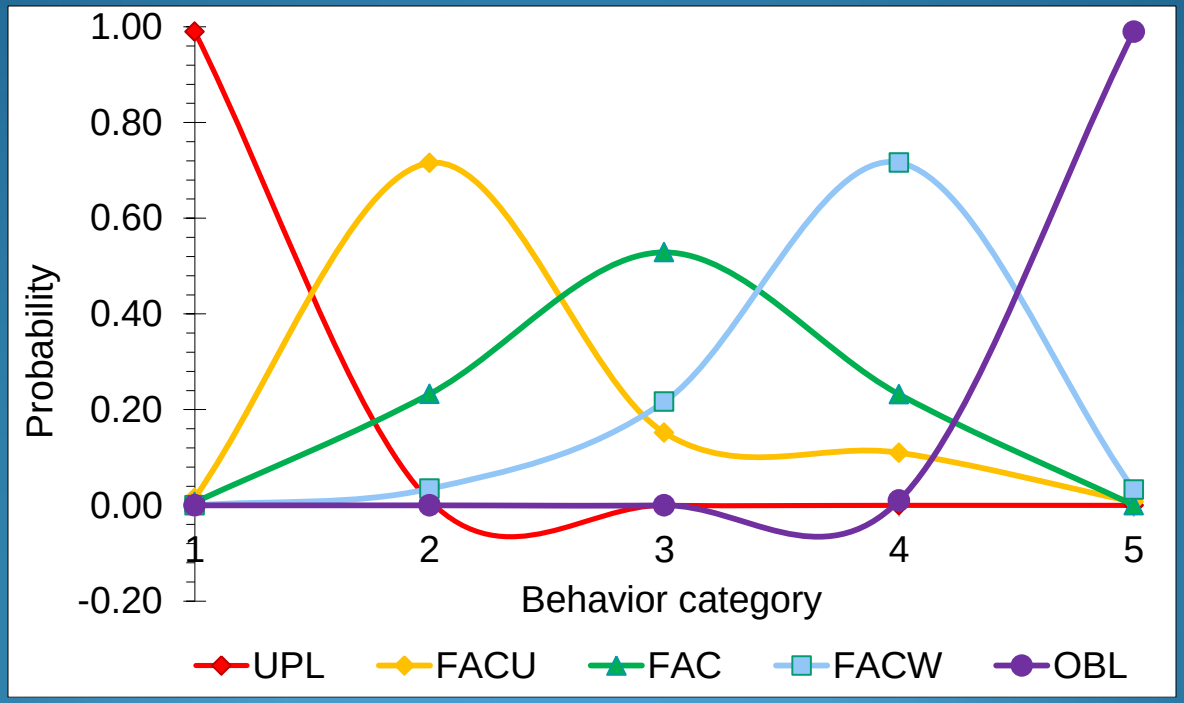


Figure 3. Distribution patterns of five wetland indicator rating categories that make up the likelihood function for the Bayesian model.