National Technical Committee for Wetland Vegetation
Annual Meeting-Hanover, NH
11 October 2012

Rules of Thumb: bends, random headings, shifting from preselected random point to another point in the field, landownership

Challenge Study 2011-2012-*Presented by Jennifer Gillrich*

Slide 1: Field sampling procedures

Challenge Study 2011

- *Acer rubrum* L. distributed fairly evenly throughout 12-digit HUC
- Generated potential transect locations (points) in uplands and wetlands
- Navigated to each point if species is absent search a 100m radius circle
- If species is still absent, throw out that point
- Discarded points=planted stands, clear cuts, pastures

Challenge Study 2012

- Distribution of *Tsuga canadensis* (L.) Carr. Is non-random in 12-digit HUC
- Generated potential transect locations (points) by USGS land cover classification
- Navigated to each point-if species is absent search a 100m radius circle
- If species is still absent, searched closest preferred habitat (Hardin et al. 2001)
- If species is still absent-throw out the point
- Discarded points= planted stands, herbaceous wetlands, deciduous forest

Slide 2: Transect Placement Guidelines

Challenge Study 2011

- Transects laid out using general guidelines and BPJ
- Minimized bends
- 10% of transects were bent
    - 3 of 30 wetland transects
    - 3 of 30 upland transects
- Maximum 2 bends/transects

Challenge Study 2012

- Transect direction chosen from four lists of randomly generated headings (e.g. 1-90 degrees, 91-180 degrees)
- Increased bends
- 55.0% of transects were bent
    - 11 of 12 wetland transects
    - 22 of 48 upland transects
- Maximum of 4 bends/transects

Slide 3: Very few mapped wetlands

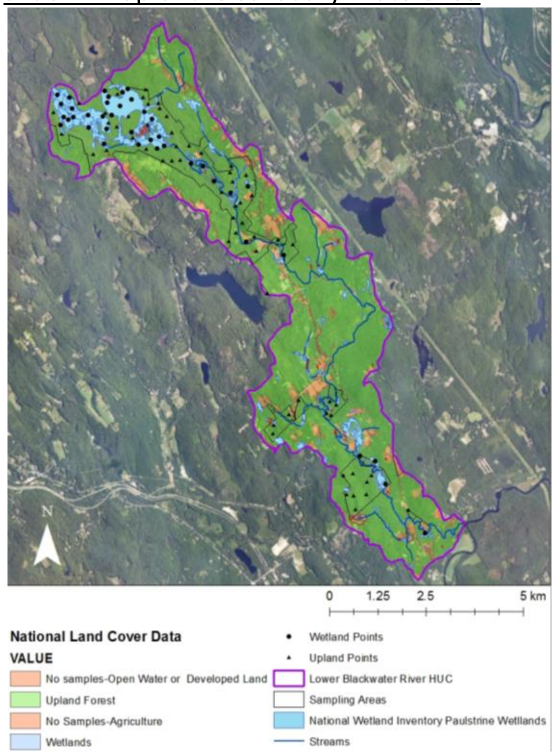
Challenge Study 2011

- Wetlands ~10% of the HUC
- 40 potential transect locations generated in wetlands
- 2 wetland points were actually upland
- 1 wetland point discarded-*A. rubrum* was absent
- Data were collected from 30 wetland transects

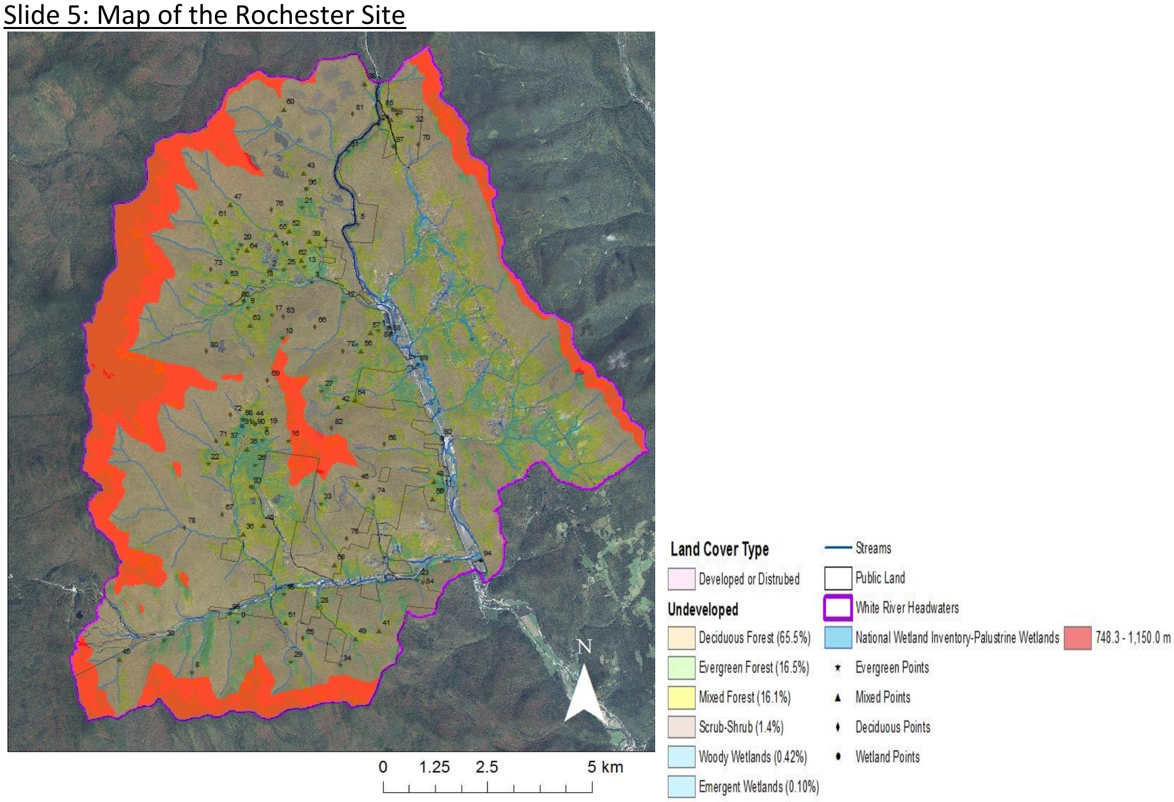
Challenge Study 2012

- Wetlands ~1.0% of the HUC
- 15 potential transect locations generated in wetlands
- 3 wetland points were actually upland
- 5 wetland points discarded *T. canadensis* was absent
- We sampled five unmapped wetlands near upland points
- Data were collected from 12 wetland transects.

Slide 4: Map of the Salisbury Watershed



Slide 5: Map of the Rochester Site

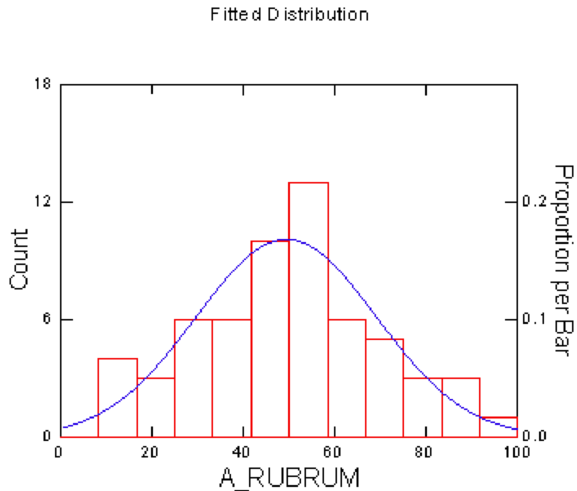


*Red areas on map are high elevations where hemlock doesn't occur

- Concern: Seems like the whole sample design is bias because we only sampled one side and 1/3 of the watershed is not being looked at
    - Sampling was on the west side due to where public property was
    - Hemlock was not found at the higher elevations of the watershed so we walked down in elevation until we found hemlock
        - This occurred mainly of the eastern side of the watershed

Slide6:

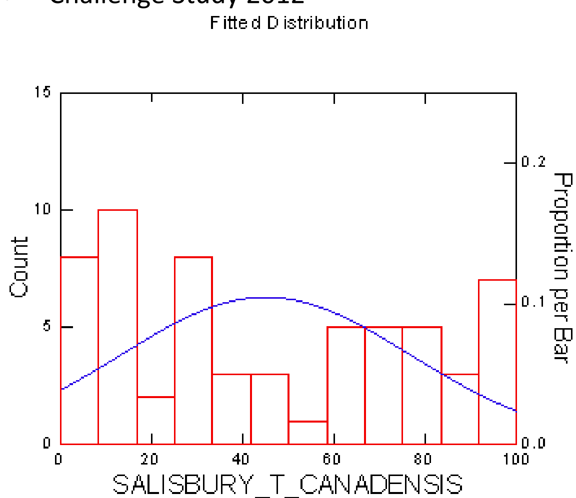
- Challenge Study 2011



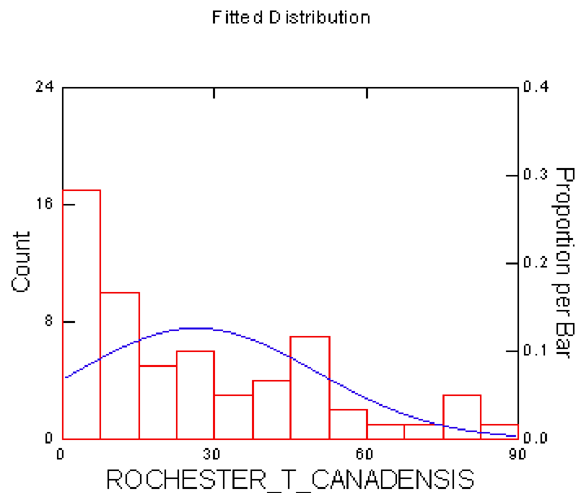
Salisbury, NH Shapiro-Wilk Statistic = 0.984 & Shapiro Wilk p-value=0.609

- Last year we assumed we would have normally distributed data and this was not the case.

- Challenge Study 2012



Salisbury, NH Shapiro-Wilk Statistic = 0.904 & Shapiro Wilk p-value=0.000



Rochester, VT Shapiro-Wilk Statistic = 0.873 & Shapiro Wilk p-value=0.000

Slide 7: 100m transect sampling

- When first 50m of the transect is compared to the second frequency is significantly different
  - 2011 (Salisbury) *A. rubrum* (p= 0.015)
  - 2012 (Rochester) *T. canadensis* (p=0.052)
  - 2012 (Salisbury) *T. canadensis* (p=0.310)
- No difference in variance
  - 2011 (Salisbury) *A. rubrum* (p=0.904)
  - 2012 (Rochester) *T. canadensis* (p=0.909)
  - 2012 (Salisbury) *T. canadensis* (p=0.949)

Slide 8: How confident are we?

FAC-Salisbury, NH

- 95% CI= 34.5-50.7% m=8.1
- 90% CI = 35.8-49.4% m =6.8
- 85% CI= 36.6-48.6% m= 6.0
- 80% CI=37.3-47.9% m=5.3

FACU-Rochester, VT

- 95% CI=15.6-22.7%, m=6.1
- 90% CI=16.5-26.7% m=5.1
- 85% CI=17.2-26.0% m=4.4
- 80% CI=17.6-25.6% m=4.0

Discussion from the Rules of Thumb Presentation

- Salisbury and Rochester were case studies
  - Trying to get out all the wrinkles so this is a 2 week exercise in the field for challengers
  - $10,000 is an issue for people
  - Many species may be resolved before actually getting to the challenge procedure
- Concerns
  - 100m is a very large transect and concern it's an unreasonable size
    - We used the transect approach because of issues with cover estimation and how they are subjective from person to person.
      - Also 100m transect is the statistical standard
    - 100m gives higher frequency data to work with and to put it in the Bayesian model
    - We did look to reduce the transect size down to 50m and found the variance was the same in both 50m sections but the frequency was not which means the 100m transect is necessary

            - Maybe we could adopt some sort of plot size to reduce down these transects
                - Plot size may be better with presence and absence and there would be fewer rules with bends and all
            - An alternative would be frequency, visit a point and if the species is there its present and if not absent
                - Points may be simpler and not as expensive
            - We need a scientifically sound method
    - Current methodology is not going to work for every species
        - Every species is going to have a different distribution. This method will work for common species but what about others?
        - During the review, the committee will modify sampling technique based on species
        - This method will also not work in vernal pools or riverine systems
            - In these cases we would shift to points
- Suggestions
    - Methodology
        - Perform on a regional scale instead of local
            - If done in multiple regions, will be able to have a national indicator
            - Most committee members are not in favor with the watershed approach
            - Need to appropriately stratify and ratchet down sampling
        - First step is to determine the species range
            - Could find this information from heritage programs, herbaria, etc.
                - Could line this information up with hydric soil GIS layers and NWI maps
            - Challengers should bring together as much information on the species occurrence and then narrow down the technique based on where the species is located within the landscape
        - Another idea for a method would be to just do a walk (a specific distance) and record when you see the species that is being challenged
        - All members agree we shouldn't be using a single watershed for the sampling and one design doesn't fit all
        - Need a very clear protocol for users to understand exactly what to do
            - Before they go out in the field and spend money, the committee will review their proposal and give advice and feedback that is constructive
- Possible Challenge Species
    - Species that are currently on the list to be challenged
        - A spilt species in FL where the two have different habitats
        - A rare plant in W. TX
        - A rare plant from CA
            - Rare species will be taken care of with heritage data
        - Black spruce may be coming in from AK
        - 55 more were just discovered on the website
            - Currently sorting through this list
    - Loblolly Pine
        - Multiple genetic varieties so people can plant entire sites with seedlings that can withstand wet or dry conditions

        - This species has been planted so widely therefore it should not be used in wetland determinations
            - This wouldn't only include loblolly but also species like sweetgum where it grows in both habitats (focus for "non-use species" should be on planted species not those that are highly opportunistic otherwise all invasives should be discounted; however excluding invasives by actually be a reasonable approach)
    - Do we want to identify species to give them a null rating? What's the difference of keeping them FAC?
        - We have already discounted cottonwood in the AW and in floodplains in the WMVC in the regional supplements
        - When species are proposed, make the recommendations to the challenger with the information we already know and give it this meaningless rating (FAC/null) providing them a reliable rationale
    - A goal of the committee is take on controversial species before they are proposed so let's tackle it now
        - It would be much easier if the federal agencies could take these challenges on
            - Would headquarters be on board?
            - We could most likely find a little bit of money each year but it could become very costly and that's where it should be an interagency effort
        - Maybe the task at this time is to identify the problem species and try to get funding for a year or two
- Summary
    - Salisbury and Rochester are excellent examples and we have opened the door to frequency
    - Our committee is going to work on the new study design and to get funding to start sampling species
        - Maybe we can start working on a species that we can link to the database

<u>Challenge Study 2012</u>-*Presented by: Jennifer Gillrich*
Slide 1: <u>Objective</u>

- To quantify wetland frequency of *Tsuga canadensis* (L.) Carr. (Eastern Hemlock) in two 12-digit HUCs:
    - Lower Blackwater River, Salisbury NH
        - U-shaped, gently sloping basin
        - Mapped wetlands represent ~10.0% of watershed area
    - White River Headwaters, Rochester VT
        - V-shaped, steeply sloping watershed
        - Mapped wetlands represent ~1.0% of watershed area

Slide 2: <u>Methods</u>

- Randomly generated 100 potential transect locations using Arc Map 10.0 in each HUC
- Sampled 60 transects in each HUC using point-line intercept methods:
    - 12 wetland transects (20%)
    - 48 upland transects (80%)
- Recorded transect origins, end points, and bends using a handheld GPS device
- Presence/absence data were recorded at each meter mark

- 1 hit/point

Slide 3: Data Analysis

1. Traditional wetland frequency formula
   a. $F_{traditional}$= # wetland hits/total # hits* 100
2. Weighted wetland frequency formula:
   a. $$F_{weighted} = \frac{[p_{\text{wetland hits}} / p_{\text{wetland transects}}]}{\frac{[p_{\text{wetland hits}}]}{p_{\text{wetland transects}}} + \frac{[p_{\text{upland hits}}]}{p_{\text{upland transects}}}} * 100$$
3. Bayes' Theorem describes the probability of parameter B occurring given that A is observed:
   a. $$\Pr(\text{indicator status behavior}) = \frac{\text{prior X likelihood of species behavior}}{\sum \text{prior X likelihood of species behavior}}$$

Slide 4: 2012 Results

Figure 1. Wetland frequency of *Tsuga canadensis* L. (Carr.) in two 12-digit HUCs. Wetland frequency was calculated using a traditional frequency formula, a weighted formula and a Bayesian model. Error bars represent the margin of error for a 95% confidence interval.

Slide 5: Summary

- The traditional wetland frequency underestimated the frequency of *T. canadensis* in wetlands, the underrepresented landscape position
- Bayesian model and weighted wetland frequency formula agreed in both HUCs. The wetland frequency of *T. canadensis* was:
  - FAC in Salisbury, the gently, sloped U-shaped HUC $F_{weighted}$ = 42.6%
  - FACU in Rochester, the steeply, sloped V-shaped HUC $F_{weighted}$ = 21.6%
- The wetland frequency of *T. canadensis* may vary with watershed shape and slope

Slide 6: Graphs –Graphs are the same as in the presentation above

Slide 7: 100m transect sampling

- When first 50m of the transect is compared to the second, frequency is significantly different
  - 2011 (Salisbury) *A. rubrum* (p=0.015)
  - 2012 (Rochester) *T. canadensis* (p=0.052)
  - 2012 (Salisbury) *T. canadensis* (p=0.310)
- No difference in variance
  - 2011 (Salisbury) *A. rubrum* (p=0.904)
  - 2012 (Rochester) *T. canadensis* (p=0.909)
  - 2012 (Salisbury) *T. canadensis* (p=0.949)

Slide 8: How Confident are we?

- FAC-Salisbury, NH
  - 95% CI = 34.5-50.7% m=8.1
  - 90% CI= 35.8-49.4% m=6.8
  - 85% CI= 36.6-48.6% m=6.0
  - 80% CI= 37.3-47.9% m=5.3
- FACU-Rochester, VT

    - 95% CI=15.6-22.7% m=6.1
    - 90% CI= 16.5-26.7% m=5.1
    - 85% CI=17.2-26.0% m=4.4
    - 80% CI=17.6-25.6% m=4.0

Discussion:

- If you had to look at a species a different way other than watersheds, what would you look at besides u and v?
- Need a balanced design to have an equal number of wetlands and uplands
    - How do we distinguish different watersheds? Ex: coastal plain, piedmont, etc.
    - Out west most species aren't necessarily found throughout the watershed and comes down to having a good vegetation map

Selection of sampling sub-committee to coach Challengers on issues (3-5 people)
Putting the Bayesian model into perspective:

Use of the Bayesian Model-*Presented by: Jennifer Gillrich*

Slide1 –Graph depicting traditional and weighted frequencies for *T. canadensis* in Salisbury, NH and Rochester, VT

- *T. canadensis* in Salisbury, NH has a traditional frequency under (FACU) the margin of error for a 95% CI and a weighted frequency above (FAC) the margin of error
- *T. canadensis* in Rochester, VT has a traditional and weighted frequency both under (FACU) the margin of error for a 95% CI

Slide2 -Graph depicting traditional and weighted frequencies for *M. canadense* in Salisbury, NH and Rochester, VT

- *M. canadense* in Salisbury, NH has a traditional frequency under (FACU) the margin of error for a 95% CI and a weighted frequency above (FAC) the margin of error
- *M. canadense* in Rochester, VT has a traditional frequency under (FACU) the margin of error for a 95% CI and a weighted frequency above (FAC) the margin of error

Discussion:

- Why is the traditional frequency under represented?
    - Because we only sampled x number in wetlands and x number in uplands so there wasn't an equal distribution between the two. If it was an equal sample size we would not need the weighted formula.
    - If you have a species that is on the cusp (like Salisbury weighted) what do you do? What rating does it get?
        - The sample design should really address this so the error bar is less.
            - Suggestion to have a rule to say it's one or the other
                - One idea would be to look at in the Bayesian model

Slide 3-Graph depicting traditional, weighted frequencies and Pr for *M. canadense* in Salisbury, NH and Rochester, VT

- *M. canadense* in Salisbury, NH has a Pr =0.88 (FACU)
- *M. canadense* in Rochester, VT has a Pr=1.00 (FAC)

Slide 4 –How confident are we?

Challenge 2012	**Challenge 2012**
T. canadensis F_{wet}=42.6% in Salisbury, NH HUC • 95% CI – m =8.1 • 80% – m=5.3	*T. canadensis* F_{wet}=21.6% in Salisbury, NH HUC • 95% CI – m =6.1 • 80% – m =4.0
Challenge 2011	**Challenge 2012**
M. canadense F_{wet}=33.7% in Salisbury, NH HUC • 95% CI – m =3.3 • 80% – m =2.2	*M. canadense* F_{wet}=38.7% in Salisbury, NH HUC • 95% CI – m =1.3 • 80% – m =0.9

Slide 5: <u>When should the Bayesian models be used?</u>

- When wetland frequency (including margin of error) is borderline between two rating categories?
- Number of transects is smaller than desired?
- Under-represented landscape position is extremely small (i.e. <5)?
- Larger spatial scales?

<u>Summary:</u>

- Denali data was standardized including transect length, plot data was converted to presence/absence.
- Behavior category is an artifact of the definitions of the indicator status.
    - Graphs are not frequency but behavioral patterns
- We did find using the traditional frequency formula, many species were in the wrong indicator status

<u>New Name for the Basic Rule</u>

- Options for renaming the Basic Rule:
    - Hydrophytic Calculation- do not like
    - Cover test
    - Canopy cover
    - Hydrophytic Vegetation Standard-do not like
    - >50% Rule-do not like
    - >50% Cover-do not like
    - Hydrophytic Indicator – do not like
    - Hydrophytic Index
    - Hydrophyte Index
    - Hydrophtytic minimum-do not like
    - Positive hydrophytic minimum- do not like
    - Hydrophytic threshold-do not like
    - Hydrophytic vegetation index
    - Wetland vegetation index
    - Hydrophyte cover
    - Hydrophytic cover index
    - Cover index
    - Vegetative index

- Vegetative cover index
- Vote to have HYDROPHYTIC COVER INDEX replace the Basic Rule
  - Unanimously agree

Update on data base evaluation

Database and Algorithms to support the NWPL- *Presented by: Matthew Buff*

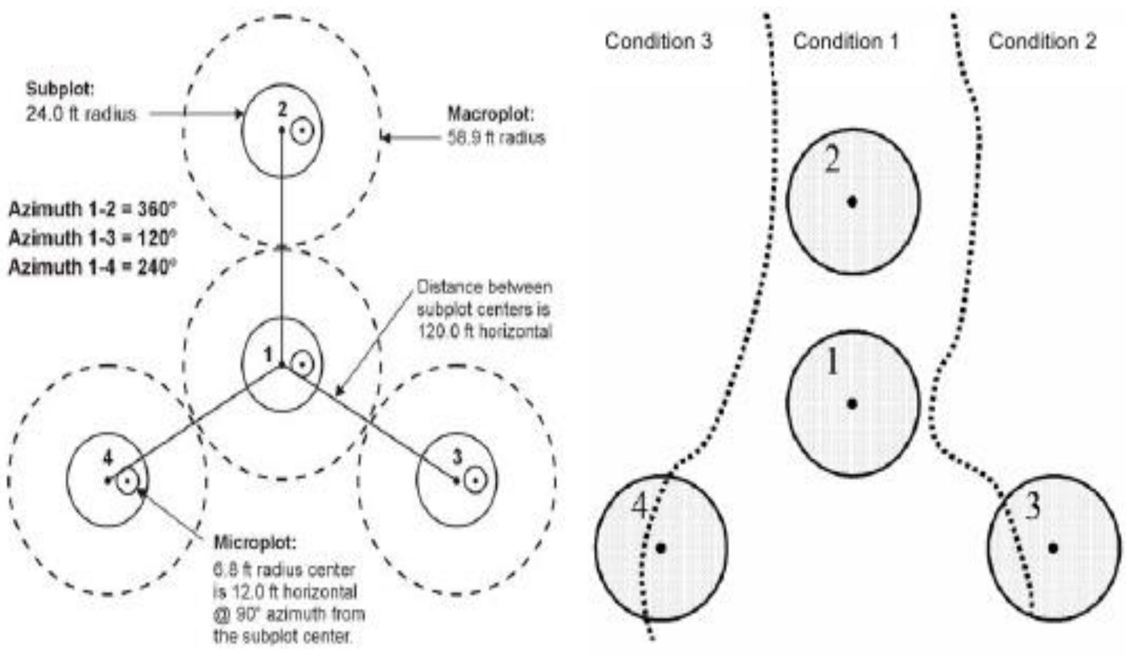
Slide 1: Study objectives

- Create a database of plant species occurrences in both wetlands and uplands at a regional and national scale
- Use that database to calculate wetland indicator status for each species

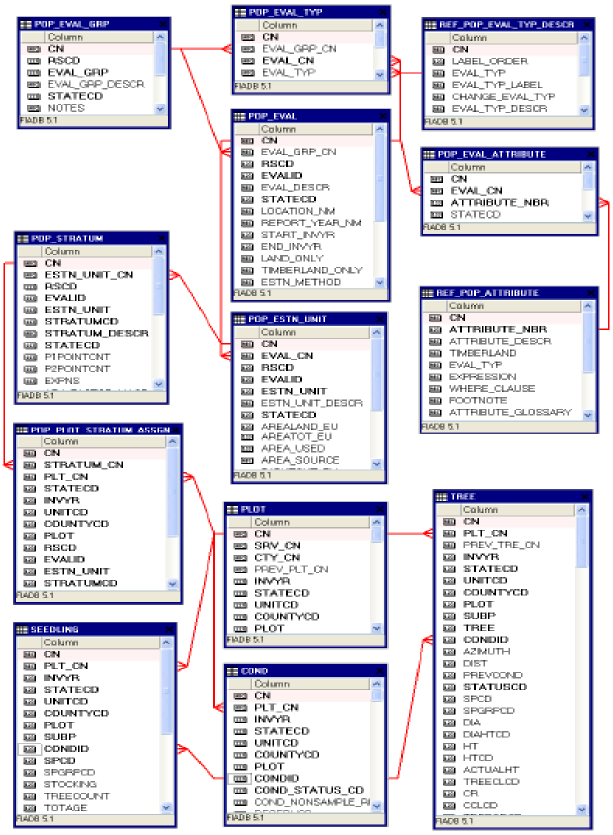
Slide 2: USFS FIA Database

- Good test case to develop methods to be applied to other data sources
- Very large (~16 million tree records, ~1.3 million plot records, ~400 tree spp., national coverage)
- Complex structure-plot design and database tables (e.g., mixed variable/fixed area plot design)

Slide 3: FIA plot layout



Slide 4: FIA database structure



Slide 5: Processing Steps

- All work done in PostgreSQL server
- Convert plot locations to region
- Link trees, plots, and conditions
- Count sp. Occurrence on wetland/upland plots by region
- Count all wetland/upland plots by region
- Apply landscape adjustment
- Calculate adjusted frequency in wetlands
- Translate frequency to wetland indicator status

Slide 6: Correcting the prevalence of wetlands on the landscape

	wetland	upland	
present	n_{pw}	n_{pu}	$n_{p\bullet}$
absent	n_{aw}	n_{au}	$n_{a\bullet}$
	$n_{\bullet w}$	$n_{\bullet u}$	N

$$\frac{n_{pw}}{n_{p\bullet}} = \frac{n_{pw}}{n_{pw} + n_{pu}}$$

$$\frac{1}{1 + \frac{n_{pu} \cdot n_{\bullet w}}{n_{pw} \cdot n_{\bullet u}}}$$

Slide 7: Preliminary results

Taxon	Region	N_{pw}	N_{pu}	N_{w}	N_{u}	Wetland Frequency	Wetland Indicator
Acer saccharinum	AGCP	22	423	15,851	93.086	23.40%	FACU
	EMP	18	635	688	98,062	80.16%	FACW
	GP	10	43	178	9,316	92.40%	FACW
	MW	280	2,081	523	20,330	83.95%	FACW
	NCNE	266	1,425	12,377	102,932	60.82%	FAC
Acer saccharum	AGCP	9	651	15,851	93,086	7.51%	FACU
	EMP	78	20,0005	688	98,062	35.72%	FAC
	GP	0	7	178	9,316	0.00%	UPL
	MW	41	5,394	523	20,330	22.80%	FACU
	NCNE	516	37,835	12,377	102,932	10.19%	FACU

Slide 8: To do:

- Power analysis to decide which species have enough samples in a given region to support a good estimate of status indicator
- Confidence intervals to determine level of support
- Correct estimate of landscape wetland: upland ratio to account for different plot areas, remove dead trees , etc

Slide 9: Future efforts

- Apply these methods to other datasets
- NPS vegetation inventory program
- MN releve plots
- Veg Bank
- Others? FWS has data over 20yrs in the NE but there is no upland data to go along with this

Discussion

- Note-for the results, Matt needs to make a correction due to all the multiple plot sizes that were used in the databases
- Other possible databases to look at:
  - National Park Service
  - National Forest
- Suggestions
  - The number of occurrences in both wetlands and uplands for both species are relatively small compared to the actual number of wetland and upland plots. Might be better to get a species that is more frequently occurring
  - Keep this study regional
  - Keep the species nomenclature as it is the database for right now; no need to worry about updating the names
- Concerns

    - How do you know a plot is a wetland?
        - No real clues except for the obvious ex: swamp, bog, etc
        - Suggestion to plot the sites out on a soil survey map to see what other conditions may be at the site
            - Coordinates are fuzzed about a half mile so would be hard to get the exact data
        - There are also descriptors for each site that may provide further information to make a more informative decision
    - It doesn't seem like you have the support to make the split between the wetland and upland call
        - A possible solution is to have Corps employees go out and ground truth the sites. They could collect the 3 factor wetland data
    - Splitting data based on mesic and xeric conditions
        - To get around mesic/xeric, could check to see what classification OBL and FACW species are falling into and determine whether that's accurate or not
            - Try this at a regional scale to save time
            - Match up the questionable classifications (mesic/xeric) with GIS layers (NWI, Hydric soils) to double check classifications
            - Use Boolean logic-if this, then that, etc
        - What about photos?
            - If plots came with photos, they may be helpful to look at to determine what classification a site should fall under

<u>Discussion to broaden challenge to a regional emphasis (instead of watershed)</u>

- Regional or sub-regional approach?
    - Species should be driving the approach and not the region
    - Ex: if red maple was challenged, would it be just one region or the entire range?
        - Most likely just the region it's being challenged in
    - Regional effort first and then take it down to a sub-region if necessary
        - Currently there are only regional indicators
        - Ex: AW could be problematic in a regional approach because there are multiple ecosystems, very diverse vegetation
- Ideas for the New Regional Challenge Procedures
    - Creating a Regional Species Map
        - Where does the species occur in your region?
            - This information will be informative to us when we go to evaluate proposals
            - Gather other information including climate, geology, other plant communities, soils, etc. to determine the range and habitat
        - How do we get a species map?
            - Herbaria
                - Also could use to get locations for specific search locations
            - There is a lot of local and state data available ex: NY historical data records that are county by county
    - Plot locations/Search area
        - If a random point falls within a landscape type then any species occurrence in that unit would work

        - Have wetland and upland plots as close as possible but they have to be separated at some distance so we are not doing boundary work. This way you are also not doing 100 wetland and 100 upland points in different locations.
        - How far do you go from the search area to look for a species?
            - Ideal to have wetland and upland points reasonably close so you can search for both in the same location
        - Should have a minimum number of points per area and they need to be a certain distance from one another
    - Cost surface model
        - Adjusts how much effort you want to put in to getting to each plot
        - Overlay project with roads, trails, etc. Also need to think about how steep slopes are and whether or not there are rivers to cross
    - Need a statistician on board the whole way to help with the decisions-spatial statistician
        - Advice on whether to look for wetland and then grab upland, vice versa, or have both scenarios
    - Abundance vs. frequency-is it the species level or individual level? (data collection)
        - Simplest account of frequency is presence/absence
            - This would parallel with the database portion of this study
            - Should we still take note how many individuals there are?
                - How would the # of individuals help with getting our indicator status? This would mean that you would count absence in our calculations. The paired concept would strengthen this absence count.
    - Suggestions below were submitted after the meeting on 30 November 2012 and were not discussed at the meeting
        - If we were to take note of how many individuals there are perhaps abundance classes would be useful and could be categorized as follows:

            1) abundant = 9 or more individuals within 30'-radius
            2) common = 4-8 individuals within 30'-radius
            3) few = two or three individuals within 30'-radius
            4) solitary = one individual within the 30'-radius

<u>New Regional Challenge Study Methodology</u>

1. Create a Regional Species Map
    - Creating a search area (previously called a sample point)
        - a. Where does it occur in the region and what's density variability
        - b. Contact regional field staff
        - c. Herbarium specimen data
        - d. Existing data from: heritage program, universities, floras
2. Map wetlands vs. upland w/ GIS & soil maps
    - a. Generate random wetland plot locations
    - b. Generate upland plots "near" wetland plots
    - c. Get statistical advice on generating wetland or upland first or alternating which is first
3. Cost surface model = $/plot
4. Search Time= ½ hour
    - Absent-go to next random site
    - Present-verify wetland soils & hydrology
5. Sampling size of 100, then generate 1,000 random possible sample points

6. Distance between plots within a contiguous wetland necessary to maintain statistical validity
7. Analysis –solicit statistician
8. Solicit funding
9. Select a species from potential challenge list (ex: *Ilex opaca*)

<u>2013 Meeting</u>

- Possible locations for the next annual meeting:
    - Charleston SC-Option A
    - Norfolk, VA-Option B
- Options for dates:
    - April-works for most, Hans can't make the 15-22, so first week in April is the best possibility
    - May
    - September
- Topics for the 2013 meeting:
    - Morphological adaptations
    - Testing the new indicator challenge methodology in the field
    - Reviewing challenge species