Major Summary (consolidation of notes from Leonard, Janice and Steve)

A. Folks wanted to know what the objective of ELVeS is. Why are we building a new model.
- Support NPS and CERP Everglades Restoration
- Dynamic wildlife habitat layers
- Climate change / sea level rise

B. Several participants were concerned with the scale / resolution of the model. Citing recognized inconsistencies between the hydrological data layers (400 meters) and vegetation type distribution patterns (which respond on order of meters).

C. Many questioned our approach to assigning cell dominance based solely on the majority or highest probability rule.
    a. Suggestions included preserving the instantaneous probabilities for each community and selecting the top 2 or 3 highest ranking communities – allowing the system to define the communities. Recognizes that cells will be mixture of communities, rather than homogeneous. Community definitions still rely on the probability of community presence, not on absolute area of the cell.

D. Parameterizations, currently only using means and standard deviations to define the realized niche for each vegetation community. Other parameterizations should be explored. Geometric mean is one possibility. Developing weighting functions for individual communities might be an alternate approach, if there were a method available to justify a weighting scheme. Skewed distributions could be yet another form we explore.

E. Alternative to the mean annual water depths – Jay Sah suggested using a mean 30 day maximum water depth when depth exceeded 5cm.
    a. Suggestions for when and how to quantify the water depth metric:
        i. Don't count water depth over 5cm until depth > than 5cm has been present for at least one week.
        ii. Growing season water depth are important but very difficult to assign as each community will have a different growing season.
        iii. 30 day max mean (average the 30 days that occur around the maximum water depth.
        iv. Number of wet days & number of dry day should both be considered.

F. Jennifer Richards cautioned against using growing season based metrics as this varies by community and it would be difficult to track and normalize this for the suite of communities considered in the model.

G. Dry periods are just as important as the wet periods. Need to consider a dry event index – similar to the depth days index. Possibly consider a dry event index : depth days index ratio to capture the variability between both metrics over a specified referenced time period (annual, multiple years).

H. Legacy issues need to consider two domains:
    a. The influence of drivers from previous years on current vegetation status.
    b. The influence of current vegetation fidelity to a site and future vegetation in the same site.

I.   Assessment of the highly dynamic cells should be examined relative to the changes observed in the drivers in the same cells. Suggests a dual serial autocorrelation analysis of the consistency of the drivers to maintain a correlated pattern and the correlated pattern of the vegetation. Basic question – How much of a change in the driver(s) is required to change the ranking of the vegetation probabilities?

J.   Tree island issues – can be thought of as source and sink for phosphorus – cells neighboring the tree islands will receive phosphorus run off from the islands. Vegetation dynamics in zones near tail of island will likely behave differently accordingly. Spatial position is an important variable in tree islands – nutrient concentrations likely to be increased in tail of island relative to surrounding marsh – thus shrubs instead of just sawgrass even though hydrology metrics will be the same in both tail and surrounding marsh.

K.   Asymmetrical patterns of vegetation trajectories following disturbance. Fire effects on vegetation and water dynamics. Vegetation transitions may not "recover" at same rate once disturbance is reduced or eliminated. Existing veg may be replaced by another type following disturbance but it may not necessarily shift back to the original type following recovery. Basic to resilience and resistance ecology.

      a.   Model may be able to identify where transitions are more likely:

          i.   ID Grid cells where several communities have similar probabilities

          ii.   ID cells with substantial variability – more dynamics. (see I above – similar to the notion of serial correlation) could be used to gain appreciation for regime shift thresholds.

L.   Primary transition forms that should be considered include the following:

      a.   Ponding to flow restriction

      b.   Fire and hydrology

      c.   Over drained and flow

      d.   Phosphorus driven dynamics

      e.   Freshwater flow and saline encroachment

M.   RMS hydrology model will include depths of the sloughs and ridge depths. This could help establish a finer set of controls on the dynamics within the ridge-slough landscape areas.

N.   Development of a landscape heterogeneity metric in the ridge – slough landscape could be helpful in constraining or providing an ancillary data layer that will promote ridge – slough

ELVeS Workshop. Afternoon session (notes from Steve).

Topics identified as critical for discussion prior to breaking for lunch.

   A.   What are the over arching goals/objectives of ELVes?
   B.   Answer
       1.   Wildlife modeling under both water management and climate change conditions require
            dynamic habitat data layers.
       2.   Hydrological scenarios for everglades restoration
       3.   Climate change modeling – support for MIT program as an example
   C.   Majority rule:
       1.   Other numeric relationships besides the normalized distribution and logistic curves
            currently being used.
       2.   Parameterizations – what numbers should be used? Are the numbers currently used
            correct?
   D.   Scale 400 meter resolution
            Communities respond to lower spatial and temporal resolution data than the hydrological
            model data provide.
   E.   Legacy Issues – How much influence does the vegetation layer retain, 1yr, 3yrs, in both
        spatial and temporal domains.
   F.   Drivers already influence the vegetation for specific time periods
       1.   How should the legacy of the drivers be considered?
       2.   How should the legacy of the current vegetation on future vegetation be integrated?
   G.   Tree Islands and Shrubs (Phosphorus – source sink issue)
       1.   Neighborhood influence on Phosphorus contributions to nearby non-tree island cells
   H.   Group Agreement on outcomes
   I.   Model should serve as a hypothesis generator for testing responses.

   _____

After returning from lunch – each of the topics were addressed.

   1.   Parameterization: What numbers should we use in the model for different communities?

        Water Wet conditions (> 5cm) . Leonard asked if we should be aware of anything different
        to consider with respect to hydrology.

        Growing season water depths – for example (march – june) and water depths above 5cm.
        Also consider length of time the 5cm depth criteria is met during the time period.

        Jay Sah (mean of a 30 day maximum water depth)
        Using the complete historic record to examine this. Running 3 year mean over the
        maximum water depth. Jennifer – growing season varies by community – cautions against
        using this as a basis for thinking about the temporal period for this metrics mean .

Jennifer Richards. Length of and number of dry down events. Ratio of the wetting and drying conditions. Dry event index (similar to depth-days) . Variability of the this ratio may be the important point. See Gann and Richards to see a reference to dry event index.

Also the in between conditions. When the water depth is between -5 and +5. The unknown condition could be used in conjunction with the dry down event index and or the depth days.

Instead of using a normal distribution curve, how about using a true distribution? Distributions may shift slightly but have the same general shape or form.

GRTS panels could be used to help identify the relationships for elevation and water surfaces by vegetation type. 8 panels exist and is linked to EDEN. Each of the marsh communities are represented in the 8 panels. Re-sampling every 5 years is planned.

Sensitivity of the model to the <u>MEAN</u> rather than to the <u>Standard Deviations</u>

Legacy issues, each community responds at different rates. Range of the tolerance matters for each of the communities. Communities move in one direction differently than they move backward. Asymmetries exist in the system. See Zweig's work. Get Jay to tell us what he has seen!

Modeling ecotones to judge where the dynamics will occur   Use existing instantaneous probabilities to find the highly dynamic cells vs. the highly stable cells. And then look only at the dynamic cells, to gain understanding of how the communities are responding to the suite of drivers.

Temporal /spatial variance in the instantaneous probabilities could identify the sensitivity relationships. Neighborhood dynamics may be misleading due to the cell resolution. Smooth temporal pattern. Temporal autocorrelation functions to find the break points and correlation to shifts in vegetation dynamics.

<u>Jed offered these four Transitions</u>
Fire - Hydrology
Impoundment to ponding to flow transitions
Overdraining to flowing marsh transition
Fresh to saline transitions.
Phosphorus and hydroperiod transition
(See Vic's new manuscript on tree island and marsh community steady state dynamics)

Neighboring cell phosphorus will be very important once the tree islands are considered.

Legacy concerns: Asymmetrical probability transitions. Need to sit down with Jay and have him help us define this relationship.

Transition probability weights could be integrated for individual disturbance regimes.   Fire maps, satellite imagery, chronosequence of fire and no fire conditions to understand vegetation dynamics.

Hypothesis testing:
To what extend does a change in hydrology result in a change?

Sensitivity Assessments
Given a change in the drivers, what is the persistence of a community within the cell

Post Processing Assessments

Cumulative Probabilities: 3 year , 4 year cumulative probabilities could do each 2, 3, 4, and 5 year cumulative probabilities.

Scale ridge and slough is lost due to the resolution of the hydrology layers. Vegetation maps do have a landscape scale heterogeneity condition that could be quantified. Community matrix could be developed to supervise the dynamics within this landscape feature.

RSM will have slough depths and ridge depths.   Satellite imagery at higher resolution scales, coupled with the depth measures could be combined to get a handle on the morphology

Recursive partitioning methodology rather than distributions.

Examine biplot or multivariate metrics to see how communities are distributed.

If the predictor has a normal distribution one approach may be better than others. Non-parametric approaches would be better if the driver is not normally distributed.

Probability of presence, probability of absence,

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Phosphorous for Marl species – info from Jay

Do we need to weigh the variables? (geometric mean is one approach)

When to count water depths:

Don't count water depths over 5cm until depths over 5cm occur for at least a week

Growing season water depths – but growing season is different for different communities

30 day max mean (average the 30 days that occur around the maximum water depth day)

#wet days to #dry days index – see index in Gann Richards report

TEST sensitivity of the means

TEST against info from the landscape panels

Do we need skewed distributions?

TALK with Jay for more info on asymmetric transition probabilities (including fire effects)

Transition probabilities are not constant – eg, they are greater after disturbance

Model may be able to identify where transitions are more likely:

1. ID Grid Cells where several communities have very similar probabilities
2. ID Grid Cells with substantial temporal variability

Major Transitions:
1. Ponding to flowing
2. Fire hydrology
3. Over drained to flow
4. Fresh to saline
5. Phosphorous driven

Spatial position is an important variable in tree islands – nutrient concentrations likely to be increased in tail of island relative to surrounding marsh – thus shrubs instead of just sawgrass even though hydrology metrics will be the same in both tail and surrounding marsh.

Cumulative Probabilities over 3 – 5 years

TEST sensitivity to annual years vs water years

Heterogeneity within grid cells *** Better resolution than 400m? Can we find different hydro metrics in ridge&slough grid cells versus sawgrass plain versus all slough ??

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RSM gives slough depths and ridge depths ??

Use 3D plots to guide separability of communities using the different metrics

Recursive partitioning?

Hydo extremes & variability may separate disturbed communities (eg, rotenburg(misspelled)/holey lands) from other communities.

ELVes Meeting Thursday, March 18, 2010 - Janice's Notes

9:40am Questions during slide show:

What is unit size of SFWMD?

What is the distribution of data points in P datasets?

In reality there is a lag time between switching between veg types. Right now there is no lag time built into model.

The map on the slide is a summary mean of 3 year window. Mean annual water depth.

We need to be looking at water depth in terms of wet and dry season without predetermination of months….. above .5 cm. That helps us later when we integrate climate change.

Likelihood of a particular vegetation type given conditions of water, soil P, and previous veg type. Probability of a veg type of occurring. All the calculations are done on 40 m grid cell.

User's do not need to work with the source code, they use an input spreadsheet where they can manipulate parameters.

ArcGIS cannot deal with zero (what?)

Mean and SD numbers indicated that the SD is critical. Whenever you make a prediction of a 40m cell, the conditional probability is assigned…

Geometric mean at each of the variables is a possibility. To give weight to parameters in certain areas.

Output map uses EDEN surfaces at 400m resolution.

Multinomial Model: likelihood of a condition given a set of independent parameters. Single predictor as it is, this takes into account of interaction.

There reason cattail was showing up everywhere was because the P was taken out of that model run.

Slide show over 11:15 am

The trophic level interaction of periphyton, Jenny R. encorporating a periphyton component.

1. Jed: What level are you willing to take the computations for the model?
2. Leonard: spatial temporal relationships would be a good fit.
3. Laura B. what do we want to do with the output of this model, and then we can address how complex it needs to be.
4. Leonard: this gives us landscape level.
5. Laura B. trade off of complexity in the marsh model, since you will be expanding the model to address other communities.
6. Leonard: multinomial analyses will play a part.
7. Matthew: highest probability of being in the cell.
8. Leonard: reasonable lag periods need to be worked out.
9. Leonard: slough may be scale issues because we are at 400m (ridge and slough).
10. Daniel: 400m likelihood of one specific type. (we know classes are mixed).
11. Laura: are there natural breaks that can identify probabilities that are close together.

Topics:

Purpose of ELVes, what questions do you want to answer?

Majority rules

a. Relationships that we need to look at to refine the parameterizations. Skewed distribution opposed to normal.
b. Parameterizations (the numbers)

Scale

Vegetation changes and at a finer spatial and temporal scale.

Legacy Issues

What information do you need to deal with that? i.e. dominance of a neighborhood overtime

Current vegetation affects future conditions.

Salinity relationships to freshwater marsh

Sea Level

Objectives:

1. Model wildlife (wading bird)
2. Running restoration alternatives
3. Landscape dynamics
4. MIT, USGS, FWS scenarios under climate change conditions dynamic conditions for climate change scenarios.

Jed: Structuring specific hypothesis this model to serve????. We need regional topography at a 10meter scale for example. What we want to know, if highly localized elevation patterns (HAAD), do we know enough about the topography to change it (we don't). We may want to be flexible if we have a higher resolution in areas where you expect finer resolution changes in landscape instead of 400m across the area of interest.

3/18/2010 1:08 PM

Physiological response of plants to water depth changing, relationship of water depth may be meaningless by itself because percent of time above .5cm per year, week. If you look at annual depth. Is maximum depth correlated with duration? 30 day around of maximum water depth.

Jenny R. thinks it is the dry down that is important, measure that would be instructive, the number of times that happens. Dryer end communities are shaped by how much the switch is, marsh veg is not good at the changes, threshold. Ratio of wetting events to drying. Differentiated by community ratio, parsed out. When things dry down there is some variability.

You may want to use the actual distribution of species across the AOI. Is there something that seems be better than the standard normal.

We have fine scale elevation for 8 panels, EDEN, point scale of veg, the samples are probably sufficient to say what the community type was. Develop this information to test the curves that ELVes is using.

How sensitive is it to the Mean, is suggested.

If Marl prairies dries out what does it shift to, transition probability. Look at the cells that have substantial variability and look at those on a finer scale. Because you probably know what it going to be in the cell that has been stable over time.

At 400m nearest neighbor would be misleading, because it would cause to much smoothing. Whether or not we see a break in community dominance. How does fire, hurricane etc. affect this model.

1. Fire hydrology
2. Impoundment of flow driven
3. Overdrain to flowing marsh transition
4. Fresh water to saline.
5. P driven hydroperiod (tree island)

Asymmetrical transition probability. Jay S.

Categorical description of probability changes from one type to another at a finer scale than 400m. Make use of fire geodatabase.

Jed: can we can constrain the investigation by size and intensity as a useful way of identifying areas of variability (transition from one type to another), release of nutrients.

Soil moisture content is a consideration because we do not have water depth underneath the surface.

Jed: suggests sensitivity testing as a next step.

Andy: From hydro data, after 5 days, sequentially.

Laura; average depth of greater than > 5cm (does this just records spikes), growing season, mean water depth over 5 days.

Jenny R. growing season is particular to communities.

Document assumptions. To provide more confidence in the output concerning change. What changes you expect based on assumption based on known information.

Do you need to give a confidence level on the output. We have estimate of confidence that is spatially explicit that is essential to understanding how you can use it.

Does it matter the date when you are asking for output? Is it a calendar year, water year, can you be flexible enough to change the dates. Since the hydro preprocessor takes into account. This will factor into the sensitivity of the model.

Jenny R. scale: you never gonna get ridge and slough, you could classify the scale using Landsat, superimpose it, derive heterogeneity matrix, to generate a more complex community scenario. Improve your ability to predict succession. Assess the variability.

Supervised classification of community types. At different scales it may not make sense.

If we are going to have RSM it will have ridge and slough depths. Going from sawgrass to ridge and slough (heterogeneity). Intimately related to the next transition. Another category to capture ridge and slough vers. Sawgrass. Field work to validate.

Important over time to show that CERP is showing that we are moving to rehydration.

Detection limit. 50X50, if you look at the 400mX400m. Drives the classification

"degenerative" veg type, affects stability of areas, add this classification.

Use remote sensing, non-parametric approach. Multi-spectral. If you have a lot of overlap.

What the probability mean? Probability of a area containing a class. How are you going to evaluate the outcome. One way would to be to do the sensitivity test. Independent field, but it will be difficult to test. Less of a majority wins, if this cell predicts a mixture and gives the probability.

To answer questions, what are the scientific desirable conditions and the model show we are getting there?

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