CT River Watershed Pilot Project
Core Team Meeting
September 26, 2014

Attendees (in person): Mitch Hartley, Lori Pelech, Bridgett, Deb Roque, Marvin Moriarty, Ken Elowe, Chad Rittenhouse, Andrew MacLachlan, Tanya Lama, Patrick Comins, BJ Richardson, Andrew Milliken, Jeff Horan, Ethan Plunkett, John Warner, Ken Sprankle, Kim Lutz, Kevin McGarigal, Bill Labich, Nancy McGarigal, Georgia Basso, David Stier, Bill Jenkins, Randy Dettmers, Scott Schwenk, Marvin Moriarty, Maritza Mallek, Rachel Cliché, Tim Wildman, Bridget Macdonald.

Attendees (by phone): Bob Houston, Catherine Doyle-Capitman, Jed Wright, Emily Preston, David Paulson

Nancy – Intro

Thanks everyone for being here. I hope everyone had a good summer. We're using the same format for this meeting as usual – subteam updates, Scott is going to show us Databasin, and then we'll move into Kevin's presentation on species core areas.

Randy Dettmers – Terrestrial Team Update (see slides)

We've had a busy month. Thanks to everyone who participated. We had 2 teleconferences during September and tackled some of the remaining questions. We have decisions made on three of the major questions: we'll be moving forward with a design that includes 25% of the landscape in core areas, uses a weighted approach for ecological systems of high concern/value, and captures fewer, larger (as opposed to more, smaller) core areas. We've also more or less finalized the weights for different representative species. We assessed each species based on threats, responsibility, and rarity, and weighted them relative to each other.

Randy reviewed the specific weights for the representative species; this table can be viewed on the Pilot webpage.

Specific details of the discussion can be found in the notes from the terrestrial team meeting.

Andrew MacLachlan – Aquatics Subteam Update

We'll have met 3 times in September after we get done this afternoon. I want to thank everyone on the team again for making so much time for this project, for dropping what they're doing to attend meetings and conference calls, and for spending so much effort thinking about this conservation design.. I'm feeling very optimistic about our progress so far. On the ecosystems side, we've reached conclusions on about 3/5 of the questions. We're using an unweighted, or equally weighted scoring system. We're basing the selection index off of IEI and the Brook Trout modeling work. This is different from the terrestrial folks, so I want them to know how our approach differs. We're using a seed-based approach for defining core areas. We also discussed using a HUC-based approach and defining HUCs as core areas, but have decided to go with the former.

We're working on minimum core areas. We've started talking about aquascapes, as opposed to landscapes. We're specifically trying to focus on the water, not the riparian areas and surrounding landscapes, so we don't rehash old information. At the moment our minimum size is 1km. In many cases they grow to many times that, but in some headwater streams the cores are fairly small. We're also leaning towards putting 20-25% of the aquascape in cores. That's similar to the terrestrial folks. We're also continuing to work on the selection scaling. We think the northern part of the watershed will have the highest scoring cores, but that this doesn't allow us to anchor our core areas in a distributed fashion to increase resiliency over large areas, especially to disturbances. And we want to maintain a realistically connected landscape, and avoid isolating cores.

We really appreciate how responsive and helpful the UMass team has been as far as allowing us to explore different directions for the aquatic design.

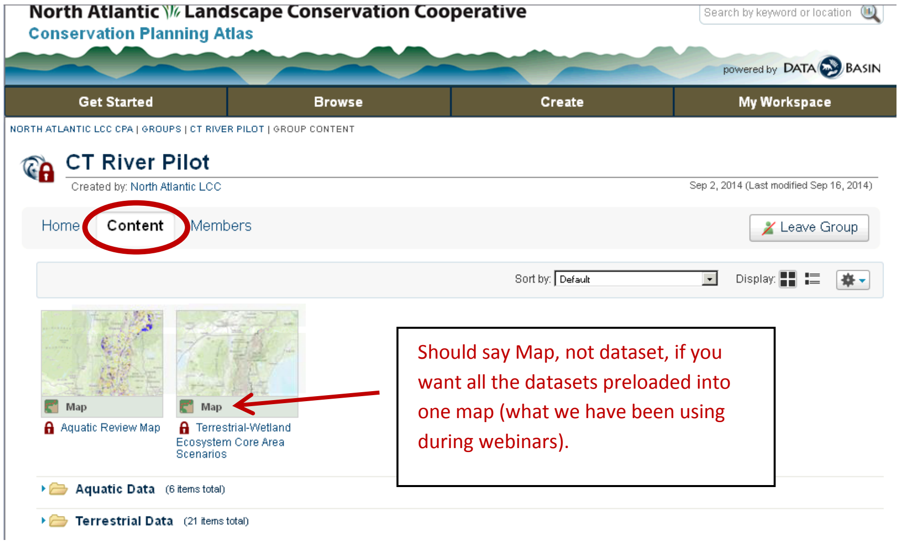
On the species-side, the aquatics team has much less data than the terrestrial team to define core areas, so we're not using species in the same way. We are using Brook trout data as representative of cold water streams, and the other focal species will be an anadromous fish, perhaps American shad. It is mapped, so that helps. I say this with some caution, but I think we're going to take a stab at delineating habitat for anadromous fish. We think we can highlight impounded vs. free-flowing streams, in order to select more valuable habitat for anadromous fish (free-flowing). So we'll end up with some categories of scoring for anadromous fish. It won't be a gradient, but we think it will be better than choosing to skip this.

Scott Schwenk – Overview of Data Basin

In order to make some decisions about the design, we've been considering our basic objectives, and then look at some preliminary results. Kevin's team has put together tabular and spatial data for us. We have put some of that spatial data online on our conservation planning atlas for the North Atlantic LCC. These are in a secure workspace for our group (you must register and obtain a username and password) to review outputs. Please be aware that these are draft maps that are subject to change.

After signing in, choose My Workspace on the menu bar, and then select My Groups. The CT River Pilot group is the one set up for this purpose. If you move from the Home tab to the Content tab, you can see some maps and datasets for your perusal. The terrestrial one is already up and being used and BJ has been working hard this week to get the aquatic one up and running.

For a video walkthrough of this segment, please view the WebEx recording of the meeting.



BJ: There are a lot of base maps available to be loaded. If you're familiar with ESRI base maps, all of those are available.

Marvin: You can also adjust the transparency of different scenarios, which can be very helpful for comparing the different layers.

Bill: Did you add those base maps?

BJ: They are already in Databasin at the bottom left corner of the screen. The different base maps are available across Databasin, regardless of the group.

Bill: I also wanted to say that the drawing tool is really cool. It's very intuitive. And you can draw on a map, highlight areas you're interested in, and then save that map and share it with the others in your group. As a warning to others, I've noticed that there is a timeout period and you have to save your map before it times out.

BJ: Yes, that time period is about 10 or 15 minutes.

Jeff: This map also highlights the fact that secured lands and core areas overlap in some areas, but are very different in others.

Patrick Comins: I'm having trouble finding the map with preloaded datasets.

BJ: Within the CT River Pilot group, be sure you're on the Content page, and then open the map.

Patrick Comins: Is there an option to export to KML?

BJ: This is set up to work with ArcGIS products. If there is a specific dataset that you need, we can help get it into a KML file.

Kevin McGarigal – Species-Based Design (powerpoint presentation; posted on website)

It's good to see you all again. As you know we are still in step 1 of our adaptive landscape design process (showed figure). We've been here for about 6 months, and most of our effort is in this box. Once we get the design components built we'll be moving on to implementing it and designing a monitoring program to make sure it works. So today we start talking about the species-based approach. We've spent our time until this point talking about the ecosystem-based approach

Slide 5: I'm just going to say 2 things about these products. First, the concept of landscape capability – just to remind you that this is an integrated concept that deals with integration of species habitat preference, climate niche, and prevalence on the landscape which may be independent of their habitat needs. We talked about this in more depth in that other presentation. And it is nothing more than an index that highlights places that are relatively more likely to support a given species over the course of their lifetime. Landscape Capability – not a population index, but rather a measure of assumed ability to support a given species

Slide 6: For each species, rescaled from 0-1 across the landscape of interest. I'm also showing the model for Brook Trout, which you can see are at a much coarser scale – "catchment scale." I want you to see that it is a different kind of map product. Here every cell in a catchment has the same value. This has implications for building core areas for species.

Slide 7: We have developed 6 map products that can stand alone for visualizing potential future change. They can also be used as inputs to, for example, prioritizing areas for species conservation.

Jeff: Can you remind me what the timesteps and timeframes are?

Kevin: Our model works on a 10-year timestep. Right now we simulate out to 2080. We're debating whether to include the 2030 outputs. The reason for this is that land use change and climate change impacts tend to still be relatively small by 2030; by 2080, however, more substantial changes can be observed.

Bob Houston: Is there any link to the new Audubon report, Species on the Brink?[1]

Kevin: No, no explicit link.

Slide 9: Step 1, selecting species, assumes that the representative species are acting as surrogates for other priority species.

Slide 10: The suite of species and associated habitat guild. The interpretation is very similar to our Landscape Capability (LC) product.

Slide 11: Rare species are difficult to incorporate because data are often unavailable, and data that exist are often presence/absence data, or presence-only.

[1] http://climate.audubon.org/

Slide 12: Establishing targets on objectives. The terrestrial team has done a fantastic job creating weight, but also documenting and formulating a defensible, scientific process for choosing weights.

Slide 13-14: Establish representative species' targets: we translate the target % from the weighting table outcome to the LC units.

Bill: Randy, can you explain how we went from the weighting to the target percentage?

Randy: We started with the assumption that a neutral weight was 50% of LC.

Scott Schwenk: One quick comment. Prairie Warbler is included here because it was just finished and it is representative of a new habitat type.

Ken: If your population objective was status quo, what does that mean relative to the target? We assumed a linear target between habitat availability, capability, and population. Does that mean we only capture 50% of the population?

Randy: In core areas.

Ken: So because we have a continuous surface, we're not saying that our population objective would be lower, just that the core areas and prioritized areas would not support 100%? [Answer – correct]

Colleen: I'm thinking about black bears. What is 40%?

Kevin: It's 40% of their current total LC. If we take all the Landscape Capability across the entire watershed for black bear and sum it, that's the current total LC. If a cell is perfect habitat for black bear, it would have a 1. If every cell in the watershed were 1, the total LC units for black bear would equal the area in the watershed. Obviously, that's not the case. Some species are more widely distributed, like black bear, so they have lots of LC units. Some are patchy and rare, like blackpoll warbler, so their total LC units is much less. So we're saying given the current condition of the species, if we relate it to LC units, for the core areas, we're going to target a certain proportion of LC units. But then we'll move that up or down depending on our goals for that species. Some species like black bear, which we think will be fine either way. So we downweight that so that we can increase the weight of other species.

Marvin: Are LC units all the same in size?

Kevin: An LC unit of 1 is a cell with the highest index value. That cell is 30m x 30m. It's a relative measure though.

Marvin: So the size is variable?

Mitch: Is it the same as saying 1000 good acres are the same as 2000 half-good acres?

Scott: Yes.

Kevin: So the LC units could be translated directly to acres as an equivalent measure only if the LC value is 1. But, it is just an index. The LC values actually range from 0-1. There may not be any really good habitat in the Connecticut.

Mitch: This might be similar to Colleen's question. I'm having trouble connecting the dots with the constraints. We're constraining 25% of the landscape in core areas.

Randy: No, we're not constraining to core areas to 25% for the species-based approach. We're constraining them based on these LC targets.

Mitch: The 25% in the end will be made up by an optimal combination of these targets?

Kevin: And whether we get to 25% is a question we'll talk about today.

Colleen: Is this like saying a 40% target is like targeting the top 40% of the potential of the landscape to support that species in the core areas?

Kevin: Yes.

Ethan: I might add habitat value, because if you just say habitat you might think of an absolute proportion of the areas.

Kevin: This LC measure is supposed to be relative. It's supposed to help us target. It's not meant to be translated into acres.

Ken: To bring this back to reality, this is not unlike habitat suitability, where we have a continuum of quality of habitat and all we're saying is that a unit equals some contribution to habitat quality. One acre might contribute 1 unit, and another might contribute 0.3. It might help some people to think of the old habitat suitability index that used to be common.

Kevin: Yes, this is basically a souped up version of the habitat suitability index.

Jeff: And we tried to make the weighting as objective as possible.

Slide 15-18: Step 3! Creating the selection index. Key question here is which of the products that are given in LC units, that we want to use. Our targets are specified in LC units. We want to use grids in LC units to prioritize the landscape. 4 products listed on the slide. For now, we're only using the current LC. In the future, when all these grids are completed, we will need to decide which grid or grids to use. Right now, we're including the modeled representative species and 2 rare species: bats and tiger beetles. Then we combine them all to create a selection index composed of a standardized sum of the selection index across all the species. That's the starting index, and then we choose whether or not to add rare species in as a 1 on the index.

Andrew: For the aquatics folks, since we have binary or categorical data for anadromous fish. Would we consider addition of that species as a rare species model process?

Kevin: If we bring those into the selection index, yes, they would effectively be treated like a rare species. The normalization would be – right now, we have 15 species with brook trout. We're summing it up and dividing by 16 if we add shad, so that 1 would go in as 1/16.

Slide 19: We want to achieve all species targets in the minimum total area, without impractical core areas. We want to avoid tiny cores, slivers, etc. I'll review this because this is the key. How do we achieve species targets, but in the minimum combined area? We want to be efficient, but we don't want core areas to be fragmented and pixelated, and we want to get the best habitat. We don't want a lot of mediocre habitat. So this is a tall challenge, right?

Slide 20: Turns out I think we're most of the way there thanks to Ethan's efforts. Illustrating the idea. What you see here is that a lot of the landscape has low LC values, and then there's a long tail. Very few cells are near 1. So to get the best habitat for this species, we have to select mid-level LC, from 0.4 to 1., To minimize the total area, we want to ensure as much of those cells are chosen. And we want all the higher value cells.

Slide 21: We don't plan to use Approach 0. It has been tried many times over the past many years without great success, as it has fatal flaws. The two worst are that the richest areas are not necessarily complete, and secondly that it emphasizes edges because of species overlap, but it doesn't capture interior areas, which are usually good habitat. We're showing this for information purposes.

Slide 22: Approach 1. Achieve species targets individually, and then add them all on top of each other. The main problem with this approach is that it doesn't minimize area to conserve. For each species, we slice the top habitat to minimize area to meet targets on a species-by-species basis.

For practical reasons, we did not slice it to achieve 100% of the target, because we ran out of time. Instead we achieved 25% of the target. We attempted to do 100%, but they failed. So these results are hot of the presses. So we decided to keep each species relatively the same, but reduce each species' target by 25%. For example, black bear became 10% instead of 40%. We did this only to ensure a completed run for this presentation. However, the results can be interpreted similarly as if we'd done the full 100% of target. The main point being, that this approach is not very efficient. The representative species were chosen because they tend to belong to different habitat types, so it's not that surprising that we would have widely distributed small cores. Some species, like black bear and moose, do overlap other species. But overall, the resulting surface is highly fragmented and pixelated because we are slicing a continuous surface, even after you stack up the slices from all the different species.. So this is not a practical solution. And it has no efficiency benefits. I suggest discarding this approach as well, but wanted to present it for comparison.

Slides 23-27: Approach 2 (preferred approach): pseudo-optimization algorithm. In Phase 1 we attempted a solution that used a priori designation of conservation units (using Marxan). The problem is that we found many potential designs due to the stochastic nature of the process, which overlapped by as little as 50%, and seemed impractical. Unlike Marxan, we didn't want an algorithm that would come up with hundreds of different designs (stochastic approach). That's not very practical, I don't think. So we wanted an approach to avoid that, and to avoid the pixilation from the previously described approach.

So, we decided to implement a kernel approach, something analogous to what we did for the ecosystem-based approach. So instead we propose to again build cores with kernels to avoid pixilation. Also, we want a deterministic solution. I present here this approach, which is hot off the presses and still subject to some analysis.

We select a seed. In ecosystem approach, we used a slice to select patches as seeds. In this approach, the seed is a single cell. It is the single richest spot in terms of LC units across species in the watershed. Note, we could do this by the HUC8, but this example is by the watershed scale. The kernel does still spread across a resistant surface. We can adjust how readily the cores spread and how responsive they are to resistant features in the landscape, as well as specify barriers and a minimum size.

Slides 28-32: Once a core is generated, we show here a simple example of how we calculate how well the core area is optimized for each rep. species. Next we calculate the area in cores, and see what percent of the target for each species has been met. That number is subtracted from one to compute deviance, and relative deviance measures are used to compute weights. A higher weight means that species that is less well represented based on the current set of cores. Then the selection index is rescaled according to those weights, and the best cell is again selected. This is iterated through until all species targets are met or a specified percentage of the landscape is included in cores.

In the plot, the species that go up quickly are species whose habitat overlaps with other rep. species. Blackpoll warbler looks like a stair-step function because it doesn't overlap much with the other species. Its weight increases until the algorithm chooses a blackpoll warbler seed. That habitat tends to be aggregated, and the LC absolute unit value is relatively small, so one core causes the proportion of target value to jump up quite a bit.

Some species' targets are exceeded because they share habitat LC value with other species.

Question: What percent of landscape will be needed to meet the targets specified by the terrestrial group? The current table specifies that it took 9% of the landscape to get to an average 25% of targets.

Ethan: It will probably be more than 4 times as much land needed to achieve the targets specified because each cell will have progressively less value.

Kevin: If the total amount of the landscape is too much, then we can proportionately reduce the target, as we did for this example.

Marvin: Why are the meadowlark and prairie warbler patches increasing so slowly?

Kevin: This happens because those habitat patches are less common and tend to be small.

Georgia: Why is the goal to capture the best habitat in the least area? Why not just capture the best habitat?

Kevin: We want to be strategic and efficient, and focus our resources on areas we need most. And realistically, it’s going to be difficult to conserve all the acres we target anyway.

Colleen: I’m wondering about urban growth and climate change. So this is the present landscape, with no predicted change?

Kevin: No. As soon as we have the landscape change results, we’ll incorporate them. We may not ever use the current landscape only. I’m showing these results today to teach everyone about the algorithms. But whether we would use the scenario that doesn’t consider future landscape change? I don’t know – that is up to you guys. It’s ultimately your choice.

Scott: The terrestrial team has been discussing that we would like to include future scenarios in creating the design so that persistent areas of good habitat would be included.

Colleen: So that’s hypothetical – it’s not where we’re headed.

Kevin: It’s not hypothetical. It’s real based on the assessment of the current condition.

Colleen: But that core area is not likely to be a core area when climate change is taken into account.

Kevin: We just don’t know yet because we don’t have our predictions in. It’s possible that that place would still be the best when we bring in future landscape change, but we can’t conclude that yet.

Slide 33: Core areas near Montague, in Massachusetts. Cores are represented by thick black outlines.

Slides 34-36: Showing the initial conditions, those cores are not very important. At step 1, these areas were not highly valued, because they don’t overlap with other species. But at step 400-something, it becomes much more important. The patch on the screen turns out to be created from the single best cell at that time in the whole watershed. This is how the weighting scheme plays out. That patch is conserving prairie warbler habitat capability. If we chose all the cores at the very beginning, that prairie warbler habitat patch would not be selected for a core area.

Slide 37: This slide highlights the fragmented results from the species-based approach, which as I said earlier makes sense when you consider that the species are representing disparate habitats. On the right, the core areas in orange regions are capturing habitat for species that may be the only species in that region (which leads to its low rating).

Slide 38: This slide should be interpreted on a relative scale. We got a disproportionate amount of the best habitat for woodcock. This is probably because good woodcock habitat is shared with some of the other rep. species. Kevin reviewed other representative species as well. These plots do not all show up on the PDF; for a copy of the PowerPoint file please contact Scott Schwenk. Now, these results are going to change. But the good news is that the algorithm did what we intended it to do.

Slide 39: Comparison of species-based and ecosystem-based approaches.

The remaining slides contain key questions for the subteams to decide on. Each question on a slide is really an umbrella of sub-questions that will need to be answered.

Ken: Are the core areas accounting for the spatial requirements of each species? For example, black bear has a large home range.

Kevin: Those spatial needs are directly incorporated into the LC index for each species. That algorithm looks at the suitability of each cell as the center of a home range for a given species. However, when we build the cores we don't include an explicit scaling relationship. We talked about trying to do that, but we haven't taken that step other than thinking about it. This approach, described today, is simpler, and we hope that the product will, through the cores and corridors, meet the spatial and connectivity needs of each species.

Ken: Are the cores that come out of this composite species approach going to meet the connectivity and spatial needs of species that scale to the landscape differently?

Kevin: The honest answer is that I don't know. But I suspect that species that don't need a lot of space, like birds, will have small cores and will be ok. Species with larger habitat requirements, like bears and moose, do get captured earlier on in the process when the cores are considerably bigger. I can think of a lot of ways to address that, but I'm not sure how it will play out. Great question.

Discussion

Andrew: Based on your initial work, it seems like if we set a target of 25% of the landscape, we're likely to hit that target before we meet the species needs. So I think that's going to be an important decision – do we achieve the targets or do we restrict the % of the landscape.

Kevin: Yes, and we don't know the answer of how much of the landscape will be required to meet all of the species targets. It's probably going to be in the neighborhood of 50% of the landscape. We as a group have to decide if that's too much. If 50% of the landscape is in cores, is that going to work as a network that is strategic. On the ecosystem side, if you go much more than 30%, then you're not very strategic. So it may be interesting to illustrate what would be needed to achieve the target, and we may have to sacrifice meeting the target for strategic.

Ken: The other thing is that regardless of the area in cores, we're still going to get a continuous surface. What do we need to protect first, second, and third for conservation? So we'll have whatever information we need to work at any scale.

Kevin: This is more challenging than the ecosystems based approach. Here you can't just take the initial selection index and use that to evaluate lands inside and outside of the cores, because it doesn't deal with the complementarity aspect of the species. So you have to look at all the species grids to understand the value of the cores.

Ken: If the option was that the present and future conditions could have a couple of different tiers, of proportion of the landscape.

Kevin: It's different in the ecosystem based approach because we agreed upon a target core area network, and then we're tiering or showing as a gradient the value of land in and outside the cores. That's different from what you just described. If we were to build cores to get 25% of the landscape, and then build cores to get 50% of the landscape, those will be two different spatial solutions. It's not the same as having tiers or a continuous gradient inside or outside the core area network.

Scott: We could have our target and try to hit our conservation. But you could have your next selection process until the entire landscape is done.

Ethan: There's an important detail here. If you had sliced this at 50% of the target, you wouldn't get any prairie warbler.

Ken: If you kept running it, the species above the target would continue rising a bit.

Kevin: This is an interesting question but it's a little premature. Ethan and I discussed a solution that will change how this is done. We're hoping to include some of the delayed species in the solution a little earlier. Now, we could run it again for 50%, but no, the solution would change.

Ethan: What we could do is force the 25% solution as the starting point for the 50% solution.

Kevin: Yes, these are all things we have to explore.

Mitch: Let's say that hitting 100% of the targets takes 65% of the landscape. I don't' think that's a problem with the species based approach. I don't' think that's a problem because right now those species are out there. Answering the question of how much is enough - it is critical to find out what we need. So we know that we're sustaining the populations now with the landscape where it is now. And maybe we can be strategic and see that black bear will be fine no matter what, but some of these species need management, and then we can focus on the trend for that land use, and focus conservation efforts on that kind of habitat. And then we don't have to deal with them as a group because some will be okay on their own, but others won't. So then we can switch to the species that need to be focused on first. And we can put other species last.

Kevin: I can see a lot of ways to explore that, none of which we've explored yet. This is our second or third weighting scheme. And a different one might accomplish what you're talking about. It's also possible that this method produces 60% of the landscape in cores, but then within that you focus on the cores that correspond with species that have management needs. Maybe only a few of those cores need to be managed.

Chad: I think this is where the weights assigned to these species become really apparent. If it's not acceptable that Eastern meadowlark and Prairie warbler have the short end of the stick, then we could change the weights in the species matrix.

Kevin: But that assumes that coming in late means you're being harmed. This only ends when it ends. And the whole core area network needs to be included.

Chad: Then I'll change my statement to say that the core areas should not be done sequentially.

Kevin: Yes, you can plot the core areas by sequence number, and if you conserved them in that order, you would run into that problem. I think using connectivity to prioritize cores is a better idea.

Andrew Mac: I have an observation. Sometimes we act as though we think there's excess capacity on our landscape for wildlife. We have to remember that core areas are not enough for what we're headed for. Sometime I think we forget that our current populations are already using everything, so the idea that we're going to get efficiencies out of the landscape in less land than we're already using is perhaps an error. We have no way of assuming that we have too much land. So I think running these models will be a useful way to demonstrate what we would need to meet existing targets. It's a good reminder that core areas are not the solution; they are a starting point, and we need the matrix around them to sustain wildlife.

Jeff: If we scale this by HUC8, would it change things like Prairie warbler? So now we've seen these pieces and can almost visualize what this will all look like. When I see these pieces, I'm' worried about the fact that the north-south connections, especially along the river, are not showing up, and I don't think they will show up. I think we need them, for things like migrations. Will it help to add riparian? Floodplain forests? We're seeing the implications of the decisions we make, and I'm comfortable with almost everything except the north-south connectivity.

Kevin: Remember that the core area network without the rare communities is what you saw before. Now, those aren't continuous, so just adding them in doesn't mean we're going to get great connectivity along the river. But Brad is running those scenarios now to see what the effect is of using them. The other idea is mapping floodplain fields and forests -w e don't have a great dataset, but we have a TNC active river area grid. We could intersect that with undeveloped lands to create a corridor/swatch along the river, and you could then guarantee core area in that region. But if it's more about connectivity, we still have a problem because the gaps between those rare communities are really far apart (>20km).