CT River Watershed Pilot Project

Core Team Meeting

December 19, 2014

Attendees in person: Randy Dettmers, Ken Elowe, Renee Farnsworth, Mitch Hartley, Jeff Horan, Bill Labich, Kim Lutz, Bridget Macdonald, Nancy McGarigal, Andrew Milliken, Marvin Moriarty, Dave Perkins, Ethan Plunkett, BJ Richardson, Scott Schwenk, John Warner, Catherine Doyle-Capitman, Andy Fisk, Tanya Lama, Kevin McGarigal, Chad Rittenhouse, Ana Rosner, Colleen Sculley, Ken Sprankle, David Stier, Tim Wildman

Attendees by phone: Patrick Comins, Bob Houston, Eric Sorenson, Bill Jenkins, Rachel Cliché, Georgia Basso

Randy Dettmers – Terrestrial Team Update

We have focused on a couple of the biggest issues where we remain somewhat undecided, including what would be the combination of the ecosystem and species approaches in terms of the final design and core areas. What Kevin proposed was growing out the ecosystem core areas and adding species core areas to get to 25 percent of the landscape. We talked about an alternative to address concerns about the number of core areas in the combined approach before: Growing ecosystem cores to 20 percent, and adding species to make the final 5 percent. This was to address concerns about the number of core areas we had in the combined approach before.

We also talked about the matrix, the cookie buffers, and I think Kevin is going to present some refined thinking on that based on our input last time.

We have also been thinking about comments about why the results were so different between ecosystems and species. Why isn't there more overlap? We looked into that, and I think our basic understanding is that they are different processes, using different approaches to develop core areas, and so the results are going to be different.

Scott actually did an analysis that looked at the average Index of Ecological Integrity score for species' habitats, and they all captured high IEI, but when we think about process of optimization, trying to capture good habitat for as many species as we can in a small area, inevitably, we are capturing some areas of lower value as well. So it is a matter of being strategic. We think the species and ecosystems approaches compliment each other – they are doing different things, and we want to use them in combination to capture the full compliment of ecological integrity.

Andy Fisk: Moving forward, how adaptive are we able to make these tools. So if three years from now, we decided we want 30 percent ecosystem, 2 percent species based on what we are learning, for example - how fluid is this? Can we turn dials easily enough, or is that a fairly big project?

Nancy McGarigal: Well we have been talking about this, and consider what we are doing here as version 1.0. Depending on what kind of tweaking you are talking about, it could be substantial, a whole other supplemental project.

Patrick Comins: I would imagine that ground-truthing could influence things to refine the models etcetera.

Dave Perkins - Aquatic Team Update

We have been reflecting on similar questions about comparing ecosystem and species approaches. Looking at some of the new data outputs that Kevin has provided has been helpful, and the next step will be to look more closely at the modeling results and at some of the decisions made along the way, sometimes made based on our best judgments, sometimes made just based on trial and error as with the core areas and the weighting we applied, and see if those still make sense or we need to adjust. Another piece that is new in a sense is the lakes and ponds classification that's finished by TNC. We've known it has been coming, but how do we use it? Do we want to push for using that now, or in a second phase?

We had been operating under the assumption of lakes and ponds as two different categories. Now with this new system there are four different variables going into classification. Can we incorporate the data now? Does it make sense to use the full system? Those are some of the things we've been thinking about, and we want hear back from others about.

Presentation by Kevin McGarigal, Designing Sustainable Landscapes

Topics for today

1. How aquatic connectivity is being addressed
2. Incorporation of future landscape conditions into the design
3. More substantial scenario comparison
4. Derivation of connectors
5. Concept of core-area buffers
6. Conservation tiers/priorities for watershed
7. Fitting restoration opportunities into the design
8. Terrestrial and aquatic area overlap
9. Model validation options

1. Aquatic Connectivity

We have dealt with Aquatic Connectivity in a couple of ways:

First, in the calculation of Ecological Integrity, one of the many metrics is aquatic connectedness, which deals with local connectivity at the scale of a few to several kilometers. Basically, this metric accounts for ecological dissimilarities between locations, operating with aquatic environment, comparing a cell in this environment to any other given cell. How different is each from those around? The more different it is, the more resistant it is to movement from the focal cell. If you are surrounded by similar cells/environment, there is less resistance to connectivity. As opposed to where there is high resistance to movement, meaning you can move less far. That is the core idea.

Also, dams and culverts can be sources of impediment to movement. So we have a pass-ability-for-aquatic-organisms score.

The question is: Locally, how far can I move based on proximity to ecologically similar environments, and impediments? That metric goes into the overall Index of Ecological Integrity (IEI). The way we have parameterized.

Given the weights we have assigned for aquatic systems, Aquatic Connectivity (AC) contributes 15 to 20 percent of IEI.

Question: Dave Perkins: Is that percentage parsed out between those two aspects of AC? I think it's confusing because there are two separate parameters.

Answer: No. When you hit a barrier, resistance goes up by some amount proportional to the height of the dam, the pass-ability of the culvert, etc. The resistance conferred by culvert and dams generally dwarfs that conferred by different ecological settings.

It's all integrated into one metric, so we cannot easily parse it out.

Dave Perkins: Ok, there are some thoughts about the value in people being able to distinguish between ecological connectedness and barrier connectedness. Given that the ecological data on similarity is based on stronger, better data, right now what we have is a "connectedness" score.

Kevin McGarigal: Clearly the estimates on pass-ability for un-sampled culverts are high. The dams database is much better. For the most part, we have a reasonably good idea of where dams are, so there is less uncertainty with dams than with culverts. It would be possible to create a new metric just for dams and culverts, treating the ecological environmental as homogenous otherwise.

Dave Perkins: Part of the concern comes from looking at results that show high connectivity where we know there are dams and culverts. If we know it is just showing ecological connectedness, and we might know about the dam/barrier challenges already. We might come back to how we weighted this, maybe think about what we should do different.

Kevin McGarigal: There is no conceptual challenge to doing so.

John Warner: In the way that this was calculated, as far as a stream that is considered connected, and the distance between two dams: What matters in the model in terms of resistance? What increases score?

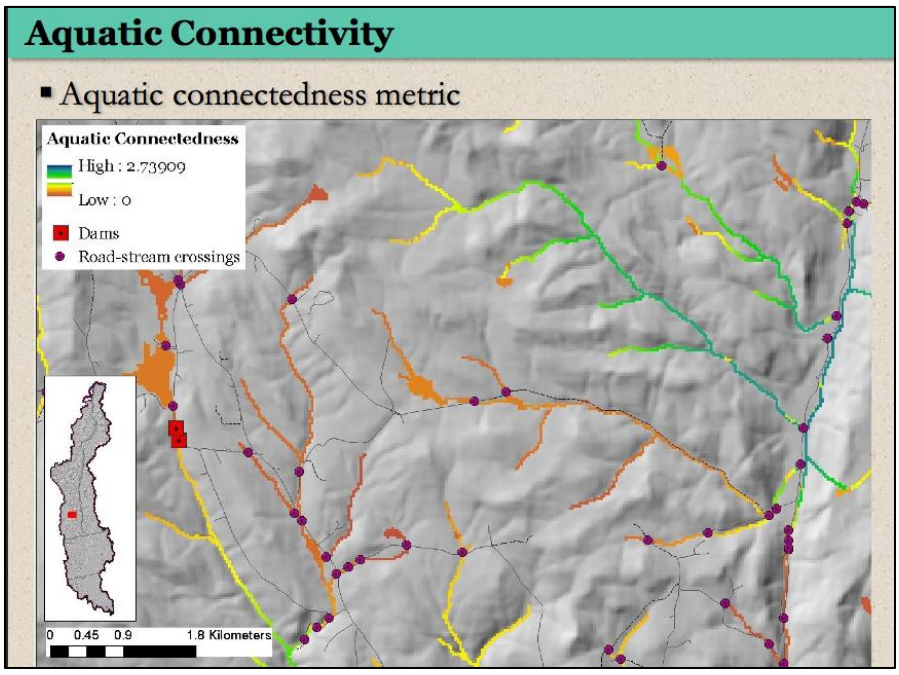
Kevin McGarigal: The closer you are, the mores resistance you will have. With this particular kernel, there is a bandwidth of 1.5 km. Dams up to 7 km from a cell have an influence, but most resistance comes from within the first kilometer or two. That's why this is local connectivity. We are not dealing with larger scales. That's important, it's just not currently in the mix.

John Warner: I'm just wondering because, for example, Deerfield is scoring high. So how does that resistance play in? So my follow-up question would be: Is that 5 to 7 irrespective of stream classification (small or large)?

Kevin McGarigal: Yes, but there will be resistance coming from the changing ecological settings between those different classifications.

Andrew Milliken: Just a really, quick point: The pass-ability data layers scores are available to use for planning separate to this, and there is complimentary project to replace modeled values with surveyed data, and to use the scoring system to determine where connectivity should happen. That will feed in better data as it progresses.

Kevin McGarigal: We are making use of all field-based measurements of culverts that were available, and working with Scott Jackson (UMass) to periodically update with the best data. I also want to mention restoration opportunities where AC is dealt with explicitly.



Aquatic connectedness metric: The higher values indicate "more connected" in darker blues or green. In this tributary, 2nd reach has high C cause no dams, no road-stream crossings.

The area above a dam has reduced AC. Then below it tapers off until you get a considerable distance away.

Dave Perkins: That's interesting. So theoretically in a lower stream, with lower score, if road crossings had a 100-percent pass-ability score, that would improve AC?

Kevin McGarigal: Yes. I don't have these plotted based on pass-ability score, but then you could see that if this were a bridge, not a culvert, it would have maximum pass-ability because a bridge is not an impediment.

Dave Perkins: That highlights the importance of the pass-ability scores.

Kevin McGarigal: Right, so to Andrew's point: We need field measurements to get the best information. Modeled scores are noisy, so we are making predictions on noisy scores. But recognize that it will never be complete, even with the Aquatic Connectivity project. There are 27,000 stream-crossings modeled. How many of those will be assessed in the next year? There will always be gaps.

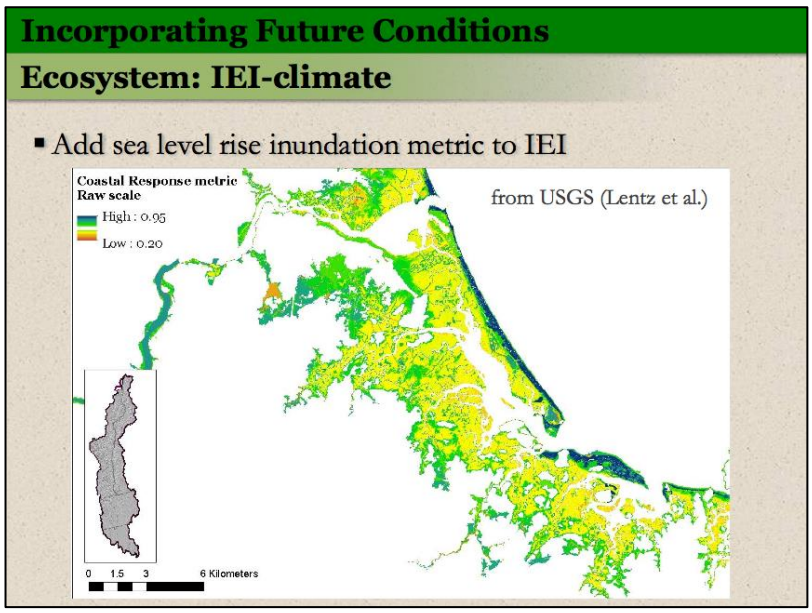
Jeff Horan: Does this run one-way: Higher water to lower water?

Kevin McGarigal: This runs both directions. The watershed metric, which is how much is up-stream from you only look up-flow, but this goes both ways.

[31:00]

2. Incorporation of future landscape condition incorporation

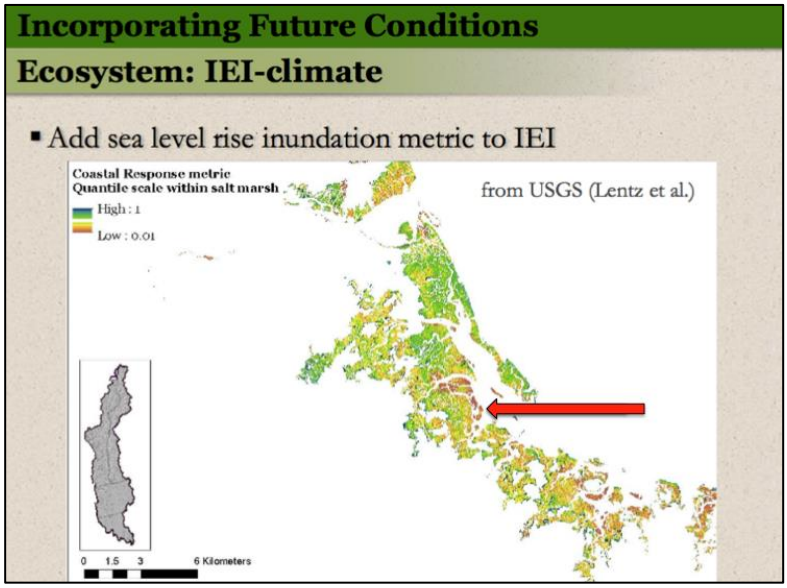
Future Ecosystems



This work is in progress, so we're not presenting the final products today. Essentially, at the ecosystem level, we decided it made sense to bring in climate-related impacts on ecological integrity and species capability, while leaving development as an overlay because it's harder to predict development patterns in terms of incorporating them in the design.

On the Ecosystem side - IEI is one component of a few key components that goes into the selection index. Specifically, on the Terrestrial side we have IEI, terrestrial resiliency, rare and natural communities. On the Aquatic side we have our IEI and in headwater creeks it's stream temperature sensitivity.

Essentially, we are producing an "IEI future climate". We compute IEI in the same way, but instead of using current climate conditions, we use future climate conditions. Thus we are looking at places with high integrity today, but that you would expect to retain high integrity in the future, not taking urban growth into account. So to do this a few things have to happen. We take a sea level rise metric, add a climate stressor metric (similar to the species climate niche modeling) (this part is still in progress), and then recomputed resiliency metrics with the future climate settings. Specifically, there are four variables that are affected by climate: growing degree days, minimum summer temperature, a heat index, a wetness index (affected by precip), and then a flow volume for streams. As those setting values change, those metrics will change. So we recompute the resiliency metrics, and then recompute IEI. Think of it as "IEI climate". We don't have



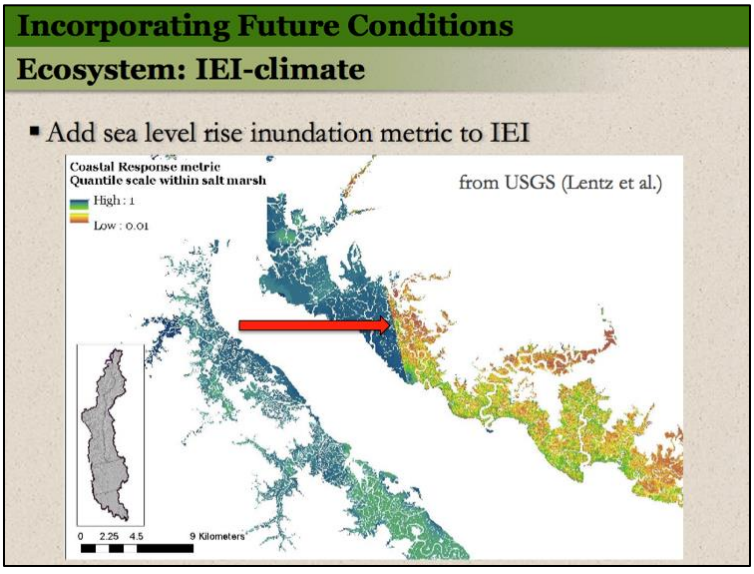
it yet because we're still working on the climate stressor metric, but it will be a map just like this, just slightly different, shifted a little. We are not expecting major changes. Clearly the main impacts are along the coast. We are not expecting the metric to cause wholesale shifts. It's going to cause subtle shifts, but not major shifts. The resiliency metrics are similar. Those are only five or so of the 20 or so settings variables that influence the resiliency metric. Even with changes, connectedness will not be totally different. It will be subtle shifts, which will be local. So that's what we're doing on the ecosystem side.

Just to show you what the sea level rise/inundation metric looks like, this is work by Erica Lentz and Rob Thieler at Woods Hole. They predict likelihood of dynamic response in coastal systems, a function of likelihood of inundation, and the capacity of a system to adapt and respond to rising sea levels. A system that is able to keep pace with sea level would be considered dynamic, as would a system that may not persist but will be replaced by another system. A system that cannot change because it's paved over is not dynamic. That will be an inundation response. So the metric is an index of likelihood of a dynamic vs. inundation response. The bottom line is that for a given system (e.g. a beach or a salt marsh), greater index values indicate higher likelihood of a dynamic response value, which can be interpreted as a higher likelihood that a system will be resilient to sea-level rise.

In this example in the Parker River, the colors represent a gradient, and brown indicates where it is most likely to be inundated and become open water. The map shown is the model results from Lentz et al. (not the IEI). So this is the raw data, and it turns out that it's difficult to look at it, because the response depends on the type that you're in. So really you have to look at each system to see the areas that differ within the same system. We took the metric and scaled it by system. The next slide is the quantile rescaled coastal response metric, just for salt marsh.

Patrick Comins: Does this take into account the conversion of high marsh to low marsh?

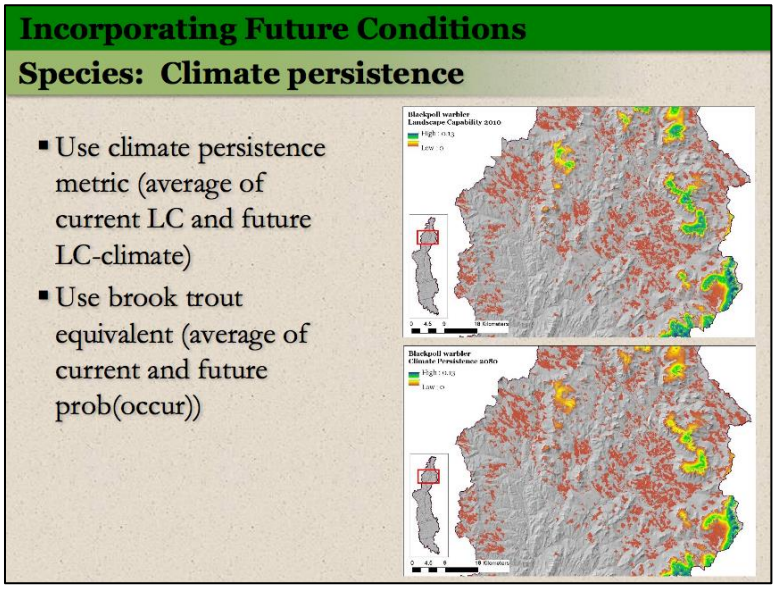
Kevin McGarigal: This does not take that into account. Clearly that's important, and efforts are underway through Hurricane Sandy projects to map high and low marsh, and deal more explicitly with it.



Patrick Comins: I think in some ways this could give a false impression of security for high marsh, because it shows high marsh as high dynamic capability.

Kevin McGarigal: Yes, this is a placeholder until something better exists. We do have an interim high-low layer from the University of Maine, but it does not meet our standards. We are using it in the salt marsh sparrow model until it improves. Hopefully in a year or two we will be there.

This image shows sensitivity to subtle variations in the DEM, because that obviously determines inundation. Problem is that it is mostly LIDAR based, so it's good in most places, but there are gaps where it isn't, and those produce arbitrary changes in elevation which their model has no way of dealing with.



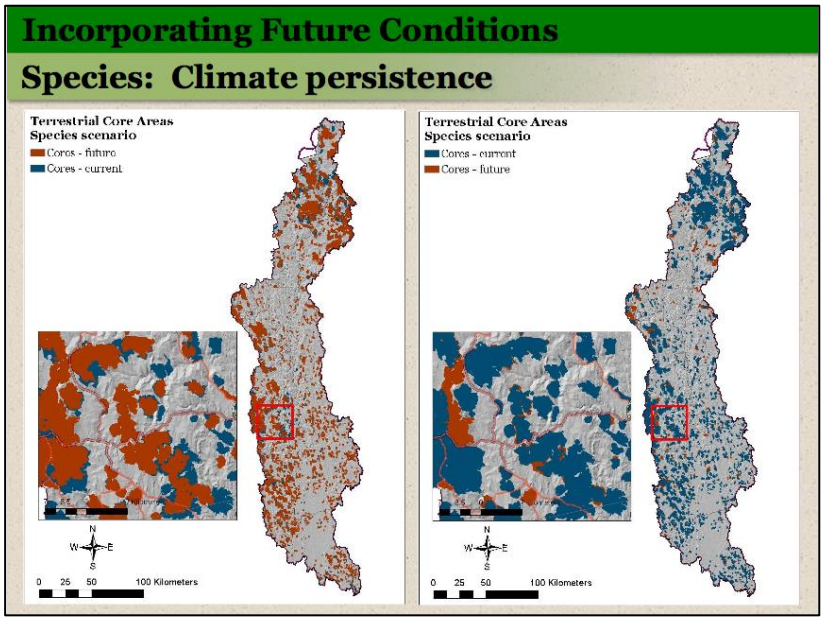
This line is not real, and it is unavoidable. We recommend going forward, and hopefully gaps will be improved.

While important regionally, this is not important in the Pilot because we are just dealing with a tiny section of coastline at the mouth of the Connecticut River, though it does represent bad DEM data, where it's not LIDAR based. We are toying with ways of smoothing to minimize noise, and we are still playing with it. This is still slightly a work-in-progress here. But for the most part it won't matter for the Pilot because it's all floodplain rare natural community in the Connecticut, so it will get into cores regardless of what we do.

Future Species

On the species side, in terms of future conditions, we are bringing in climate, and leaving development aside.

We take the modeled landscape capability, and then change the climate and get a future landscape capability. We then average the two (current LC and future LC). For no particular reason, we've given them an equal weight. These are places modeled to be good habitat today, and to some extent, likely to have suitable climate in future. But because it's an average, we're not going to see a wholesale shift.



So as an example, we look at Blackpoll warbler, you see subtle shifts in how well it rates out. Even a patch that will still be a patch is not as good. Some will drop out entirely and not make it into a core area. In other cases, it's just a slight change, a little shrunken, where it migrated to higher elevations. So we don't expect a major change. It *might* affect the size and configuration of a core that ends up being there. And so for some species, the climate persistence actually is almost imperceptibly different

from the current LC, because the effect of the climate niche modeling on that species is very minor. So it's only for some species that you'll see the kind of effect that we're looking at now with blackpoll warbler. With brook trout, we're doing the equivalent unless we hear otherwise, so we are dealing with the average of current and future probability.

So we looked at how this could play out if we did a species-only core area network. [On slide on previous page], the blue is if we use climate persistence. Anyplace in blue is uniquely in the current only solution, and did not come out in current approach. On the right-hand side, we have the opposite: Anyplace in brown only came out under the future approach.

But you can see, my assessment overall, and it's not surprising, because almost everyone one of our scenario comparisons is like this, is that the results are about the same. Just assessing it visually, there is a 5 to 10 percent change at most. We're not talking about major changes; it doesn't wholesale shift where cores are you get slight changes in the extent of individual core areas; a few cores drop out and a few get added. It is fairly subtle, but perhaps non trivial difference – perhaps on the order of 5-10%. This is what we will see for species-only approach. When we do the ecosystem approach, I suspect we'll see something pretty similar, but I suspect that the shift will be even less, because more of the inputs are not affected by climate. The combined approach, it will be somewhere in between that. On aquatic side, same conclusion: Basic distribution of the cores is the same.

Questions:

[53:00:00]

Eric Sorenson: How do you picture this being used in the Pilot? Is the idea to have one set of core areas based on incorporating climate, and one that is not climate? Or is this so we can compare the two?

Kevin McGarigal: I think that's an issue for this group. We probably went into this expecting that we would use this future approach in the final design. It's not ignorant of current conditions, just modified slightly by future climate predictions. So it's a point for discussion, and an example along with other questions, of how much we are striving for a single design versus multiple versions, in terms of what we put out to the world, not what we use for our internal comparisons.

BJ Richardson: I might need you to go back to the introductory slide in this section: What is the logic of adding another couple of resiliency metrics when TNC's Terrestrial Resilience is already part of final selection index?

Kevin McGarigal: TNC uses landform as a surrogate for climate. It's a strategy for dealing with climate indirectly. This approach deals with climate directly, which brings in uncertainty, but mirrors what we are doing on the species side - looking at distributions of species and ecosystems in relation to climate variables. So asking, if we change the variables, how does that shift distributions? Terrestrial Resilience is really about what is around you: Are there a lot of diverse landforms around me that I can find suitable climate within? Ours is about climate suitability in relation to location: Is a particular site likely to be under climate stress in the future? So it gets at climate-based resilience in two different ways.

BJ Richardson: So combining them essentially refines the concept of resilience further.

Kevin McGarigal: Right. It won't drive everything, it is just one more component, and we have to figure out how we want to weight it.

Scott Schwenk: Back to Eric's point: We have the option to go back to climate, and I think we should shoot for one set of core areas, not "one for now" and "one for later". As part of that, we have to decide if we want to incorporate climate or not. The result we are seeing is reasonable in that we didn't want climate to have a gigantic influence, but if as a group we decide we are uncomfortable with the uncertainty, we can do so.

[1:00:00]

There were species you have shown before, that have had even within the watershed fairly large changes, I think Blackburnian warbler was one, and I was wondering if you are seeing major shifts. The next question: When looking across the region would you expect more substantial changes? Or does HUC-6 scaling erase those changes?

Kevin McGarigal: Yes, blackburnian compared to black poll, showing significant shifts in the Connecticut River watershed, in comparison with others where shifts occur across the region. But given shifts, and given the scaling, the net effect is subtle shifts. So some shifts are from those species, and we would have to drill down to look at how each species' result affected the overall shift, which we would be interested in doing in the end. But given the HUC-6 scaling, would we expect to see any major shifts that are climate driven on species distribution? I think it depends on species climate-niche model. Given that these are based on logistic regression, which is based on s-shaped curve (sigmoidal), the steepness of that curve will vary with species, based on response to climate change. Those species that are very sensitive and have strong threshold responses to climate will have steeper curves. So a very small change can dramatically change the probability of occurrence. There's a good chance that one or more species will be near that inflection at HUC 6, but most will not. It will be interesting to look at the entire region.

Dave Perkins: Back to brook trout, I was surprised with a cold-water species, to see additions in the future scenario. I would expect the habitat would shrink, not change, not grow.

Kevin McGarigal: Let me clarify. We are picking up new areas because we are dropping others out. There is a subtle shift to places that can compensate for the loss of other places, but might not have been as good in current conditions because other places were better. Given that things are going down, relatively, where are the best spots to fill the 25 percent?

Ethan Plunkett: So you might shift to parcels in a more Northern watershed that might not have been considered as good if you have a southern watershed that looks better in the current climate.

Kevin McGarigal: You don't see this shift north because the brook trout model has the core areas well distributed. It goes back to Ben Letcher's model, which predicts occurrence just as frequent in the north and the south.

Nancy McGarigal: Can we get a decision on whether to include climate? It sounds like Eric is a little skeptical, but as Kevin said, that's where we were headed. Is there a concern about pursuing climate the way that Kevin has

proposed? Is that a surprise to folks? Mitch is nodding his head. Mitch, is this a surprise to you? We just want to give this five minutes to see if we have consensus.

Mitch Hartley: It was both. I do agree, and I am surprised there is not more of a shift.

Kevin McGarigal: That's because we are not allowing climate to dominate. Landscape Capability has other elements: it's a function of habitat capability prevalence and climate niche. We don't want climate to drive the whole thing.

Mitch Hartley: I think I missed that detail, and I agree with that. I'm happy with that.

Nancy McGarigal: Anyone else? Anyone on the phone? Eric?

Eric Sorenson: I don't have any more thoughts. I'm just concerned that we can model what will happen with ecosystems. We have enough trouble with the current model. We need to pull back from predictions unless we are sure. I am skeptical about saying we know enough to say, "This is how they are going to change."

Kevin McGarigal: Just remember, we are not really predicting changes in any explicit way - just where there is likely to be more stress if the climate were to warm. We are not saying how it will shift in terms of composition, structure, etcetera.

Eric: Sorenson I understand, but those kinds of shifts in ecosystems are part of what makes the landscape resilient, and why the TNC approach captures that. It's like we are trying to deal with same issue in two different ways. It's not clear how they work together. Places where stresses may occur are likely to be ameliorated if it is a resilient site.

Patrick Comins: That's a good point, and perhaps this parameter could be a separate side option, available to be taken into account.

Scott Schwenk: One important point: We are using both IEI and TNC's Terrestrial Resilience, and when combined, something with a high score is considered resilient according to two ways of looking at it, both agreeing that it is likely to persist and have resilience in the future. I think it's fine if we have different approaches, and if we are seeing dramatic shifts, I might be concerned. But it looks like it will be subtle changes in the IEI that goes into selecting our core areas. It seems reasonable.

Steve Fuller: There've been a few comments about relationship between TNC and this climate measure, and my thinking is if you step back and look at ecological concept of resilience, it seems like two sides of the coin are the magnitude of stress, and the ability of a system to recover. Maybe TNC captures ability to recover, and this captures the magnitude of stress.

Kevin McGarigal: Interesting analogy. In the sea -level response metric, inundation is a stressor, and dynamic response is the ability of system to respond, so in some ways it is kind of analogous to that.

[1:15:00]

3. Scenario Comparison: Current options

Due to discussions, I wanted to pause and review some issues we are struggling with. It has to do with multiple and competing goals in creating core areas. Those include at least these three.

- Desire for fewer larger core areas, in relative not absolute terms
- Desire to most efficiently capture the LC units across all species, in the least possible area
- Desire to capture most of the best places for each ecosystem and species

There are inherent conflicts between these goals. First, it necessitates that we grow cores areas through places of lower LC value. By growing cores larger, we sacrifice better LC habitat.

In terms of efficient capture, if you overlap units, you get the most efficient capture, but you lose some of the highest value. Trying to get the most "bang for your buck" can work against finding the best of the best for each species

Lastly, if we capture the very best for species and ecosystems, it will be inefficient and lead to more, smaller cores. These are fundamentally competing goals. We cannot have it all. If we want to be efficient, we may not get any of the best habitats because we are focusing on where habitats overlap, not where they are best. This is the root of all of our issues about getting a final scenario.

Bill Labich: I'm wondering is it possible to weight these goals in a way that we can rank them? If we are focused on capturing most of best places for each species, could you do that given predicted changes to climate?

Kevin McGarigal: Funny you should ask: That's the next slide. In our minds, we are already weighting these. But I'm not sure how we would do so formally.

Bill Labich: I think we have to include climate change. If we don't, our stakeholders will wonder why we left it out. They will say, "What are you thinking?" If we took away the restraints, would we just focus on capturing the best places today? In my mind, the few larger cores are most important, assuming climate shifts won't be that different if we are protecting fewer larger cores that have different underlying geophysical settings.

Kevin McGarigal: The only thing is: With fewer larger cores, you will sacrifice other goals.

Bill Labich: But can we even meet those goals in the face of climate change?

Kevin McGarigal: We are trading off these goals, and whether we include climate, we still have the same tradeoff. I see that as independent of how we build cores. The issue exists with or without climate.

Andy Fisk: This goes back to my question about the number of dials we can have on the final product: Why do we have to make decisions about picking goals? As users, we are making decisions about how partners will use this information. Whether it's based on money or on opportunity, either the most efficient cores or those that capture the best habitat will help them. And this is ignorant of what we need to have for final product…but why wouldn't we be able to have efficiency and the best of the best?

Kevin McGarigal: The generation of these products is done on a high-performance computing cluster. It cannot be done in real time on a stand-alone computer. The final product will be a stand-alone set of products, and the tools exist to change it, but the process is computationally intense. So in the next phase of this project, we want

see what can stand alone with some dials for real-time adjustments. But a lot of this stuff, like connectivity modeling, will never happen in real time. There may be aspects of building the cores that can be done in real time. The reality is that there will be a version 1.0 set of products, and in a year or so, if we have more data, and there is interest, we can reconvene and decide to generate new products.

Andy Fisk: Maybe I should have phrased differently. Why not two products: One that captures efficiency, and one that captures the best of the best?

Kevin McGarigal: It goes back to what we want to have for a deliverable, the final product. Do we want multiple scenarios with multiple products?

Jeff Horan: I think we need one agreed upon optimized product, but we can have lots of opportunities to show how this package can be used in different ways. You could say we are interested in species models, and pull out specific species to see how they are ranked. Also, the IEI is a continuous surface, aquatic package, etc. But we won't be able to run these all together. We might be able to localize it in the future. But first: How do we present this to audiences?

[1:30:00]

Kevin McGarigal: Whatever we produce will include all layers that are independent of the final design - building cores, etcetera. That is the computationally intensive stuff. For the products connected with core-buffer connects: Is that one set, or several versions emphasizing different goals? That would be more work, but it's doable.

Ethan Plunkett: The problem with different versions: This is a plan trying to achieve goals through complementarity. If different people are working off of different plans, one might be saving great buffer that is part of nobody's core are. With different people working from different playbooks, this loses the value of the entire planning process.

Patrick Comins: Though I think a lot of end users would be particularly savvy, and be able to take into account that different scenarios would be better for different planning purposes – acquisitions versus restoration.

Eric Sorenson: Back to Bill's point about needing to include climate change: At its base, this whole project is the best approach that we can come up with to deal with climate change and protect biodiversity. TNC identifies likely resilient sites, so whether or not we uses IEI with climate, the project is already tuned to climate. I also wanted to make a comment about cores: As Kevin said, we all want larger fewer core areas, but if we are compromising the targets that we are using the best science to arrive at, that's a real problem with me. And also if we are compromising what a core is - an area with an in tact interior - that reduces the salability of the final product.

Mitch Hartley: I thought we were going to produce two products: The species-based and the IEI-based. I don't see the value of an amalgam of those two amalgams because they represent two approaches that both provide tools that, depending on partners' priorities, will be used to help partners with implementation at various scales. I don't think anyone will use this as a blueprint. Even in FWS, given where our Refuges are, I don't think our programs align with implementing this as a plan.

Steve Fuller: Back to the question about resolving tradeoffs: If we are talking about the loss of species by aggregating, it seems to be a species-by species and system-by-system question, because they have different tolerances for being aggregated into cores. I don't know if you can do that in the algorithm.

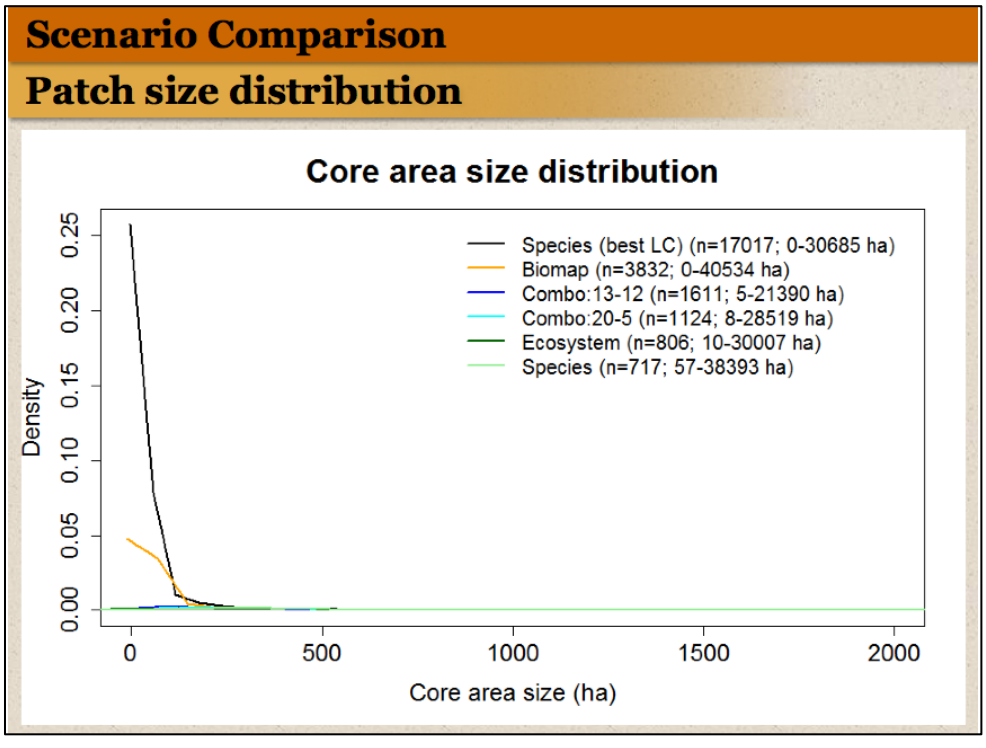
Kevin McGarigal: I'd have to think about that more, but might I suggest I move on to try to shed light on whether we have a single strategy or multiple strategies.

[1:38:00]

One of the things we did was try to exemplify the tradeoffs, to get at: Why aren't we getting the best? Let's adopt an approach that sacrifices fewer larger, and gets the best of each species' habitat, and do it in a way that's still constrained. So we stacked the top X percent of LC for each species without considering overlap among species, but incorporating species weights, and then increment a little more for each species. So where is the top X percent for each species up to the 25 percent goal? We are trying to find the very best, and this is the result.

What's interesting is that you do get a handful of very large cores, basically targeting species like bear and moose. But there are literally 16,000 cores, about 5,000 of them are one or two or three cells, because for each species it's a gradient surface of LC, and you are slicing off bits and pieces of the best habitat. It doesn't achieve the goal of being efficient, because there is no gain. You are not achieving efficiency or growing cores. That's just to show what's possible.

The other idea is to take 20 percent based on ecosystem, and compliment that with 5 percent making up for species that are left out. Thus building species cores that accumulate the very best places that are most efficient in meeting all species targets. It is a combination scenario that is in between the ecosystem approach and the old combination approach – the 13/12-combination approach that produced more, smaller cores.



The new combination approach has 11,000 cores - still a lot of small ones, but not as small.

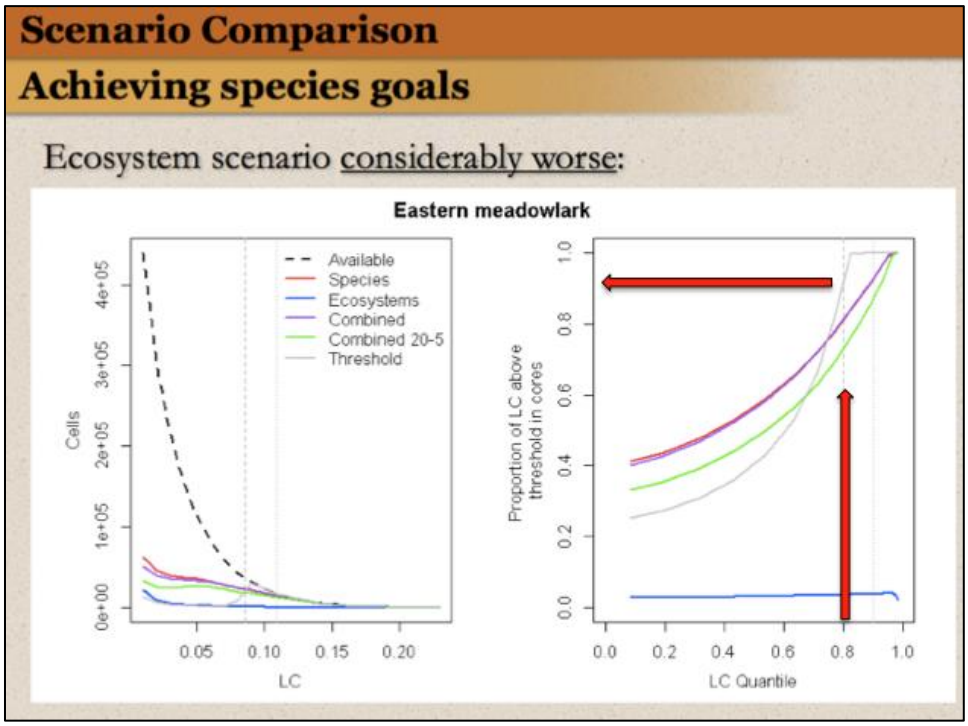
The ecosystem approach only has proportionately more, larger cores. The light-blue approach approximates what the ecosystems and species approaches do, and the original combination approach gives equal weight to each.

In terms of patch-size distribution: Compared with BioMap, anything in our approach has fewer and larger cores.

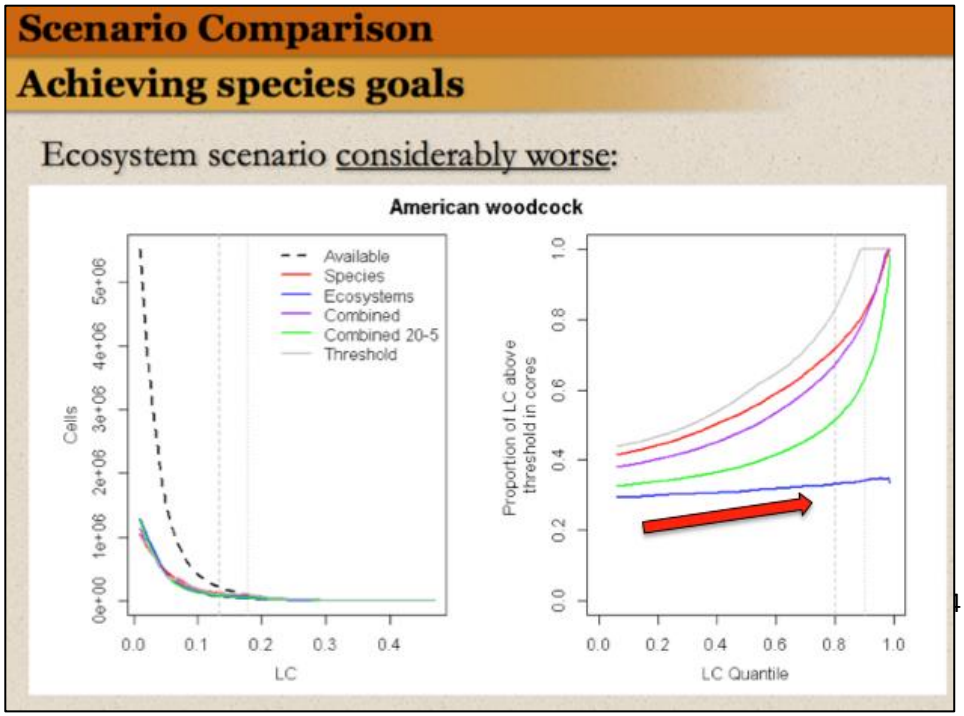
Phone: Can that be because small isolated ecosystems can be very important?

Kevin McGarigal: Yes, just pointing out that even small areas can have important value. It's just a benchmark.

Eastern Meadowlark plots:



The plot on the left shows LC on the x-axis. It shows the distribution of what we are getting in each scenario. Every species has a different distribution of LC. The plot on the right gets at the heart of it: The x-axis is now a proportion of a species' LC above a particular threshold. For example, at 8 if you go up to the gray line, then over to the y-axis. For Eastern Meadowlark, the top 20 percent (.8) of habitat in LC units is capturing 90 percent in core areas for the threshold scenario. If you compare different scenarios, with Meadowlark, the ecosystem approach doesn't capture any habitat. The new combination approach does almost as well as the species approach, and a million times better than the ecosystem approach.



American woodcock plots:

The ecosystem approach does not deal with American Woodcock very well.

Jeff Horan: I just want to add that you are picking out the

species that have the worst overlays.

Kevin McGarigal: I'm doing them both.

In cases when the combined approach is not better, the ecosystem approach is probably not doing a fantastic job, and when we do the combined, the additional core areas are apparently not targeting black poll warbler because most of their needs are targeted through the ecosystem approach.

Where these end at 40 percent, we are saying, within 20 percent of landscape, we are getting 40 percent of a species LC. In every case, we're doing considerably better. All are working, but some are slightly better in terms of capturing the best for all. So this new combination approach does a pretty good job of getting a reasonable amount for each – though not quite as well as species approach of course.

[2:00:00]

The sacrifices play out differently with different species. For example, Wood duck LC units get accumulated with other species, so efficiency trumps getting the very best even in the species approach. In all cases, the species approach does the best across the board in general, with exceptions like wood duck, but the combination approach is in between.

Scenario comparison summary:

The ecosystem and species approaches both came out substantially worse for three species each as a result of competing goals.

Ecosystem cores get much better IEI than species cores, but the combination approaches fall in between.

Scenario Comparison

Achieving species goals

Scott's summary:

Cores	Best – substantially	Best – Marginally	Worst – Marginally	Worst - Substantially
Species	2 Blackpoll Warbler Ruffed Grouse	8	0	3 Marsh Wren No. Waterthrush Wood Duck
Combo (13-23)	0	2	3	0
Combo (20-5)	0	0	2	0
Ecosystem	0	2	3	3 American Woodcock E. Meadowlark Wood Turtle

One other thought: Right now, whether we use the species or combination approach, we basically have a linear scaling of LC. LC of .6 = .6 units. Well there is a way, if not satisfied about getting the best habitat, we can rescale LC. By squaring, or by using the logistic function. Look at sigmoidal curve, get nothing from adding a cell where it was below .4. It will very much target cells that have high LC. Depends if you want gradual emphasis on LC, or if you want to threshold it. But whatever we do here will come at cost of having more smaller cores. You will make surface of LC become binary. Approach would approach you to picking the very best, and having more small cores. There is no ecological justification for choosing one over the other. It's a subjective decision about how we want to weight those goals.

Nancy McGarigal: Maybe we should vote on the climate question after break, and get some closure.

[2:12:00]

Break - 12:15 to 12:45 pm

[02:13:30]

Discussion on pending decisions

Scott Schwenk: Maybe we should do some kind of role call vote on whether to incorporate future climate through the way that Kevin has proposed.

Eric Sorenson: The alternative is to not have climate at all?

Scott Schwenk: Well we do have climate in terms of TNC's Terrestrial Resilience. But the question is: Do we want to have a modification. On the species side, do we want to include climate persistence. Are there ay other comments?

In the room, there seems to be overwhelming support for supporting future ecosystem approach.

Eric Sorenson: I would vote for not using it for ecosystems, but I don't know enough about the implications of not using it for species.

Patrick Comins: And I'm feeling on the fence without knowing the nitty-gritty details

Scott Schwenk: At this point, there seems to be strong support for that, so the next question relates to the overall concept of having a combined approach, 20 percent and 5 percent. Or rather than a single-design product, having separate species and ecosystem approaches. Are there any comments?

Kim Lutz: When you say "combined approach", I am still envisioning series of final maps telling several stories. So the combined approach would be one map, and species alone could be another. I'm still thinking the product is a series of maps that tell a series of stories that we want to communicate to the audiences we care about.

Scott Schwenk: I think all along we thought we'd be providing

Bill Labich: This is responding to comment earlier related to use of the products, and as someone who is currently involved with efforts conveying information to stakeholders – science delivery on a number of scales, from people with solid background in science and familiarity with GIS, to the opposite end of the spectrum – I think having one final product, and having a good story to go with it, is better than having multiple. There is effort that will need to go into delivering that product to different audiences. But how the products will be used? That troubles me a bit. Or whether stakeholders would appreciate one plan? I would say yes, and that we could work overtime to implement that plan, with different people contributing different elements. One plan is the point of why we are doing all of this. What is the network of linked buffered cores that will do what we want it to do? That is the desired outcome.

Patrick Comins: I think what we want it to do is the tough part. Local priorities might be different from federal priorities. Some people might be interested in how many species will benefit from your actions. I think we need a wide variety of products. We can have a recommended optimization, but in reality, we need different scenarios. And when we see the preferred result, we're going to have a lot of questions about specific spots - wondering why things came out certain ways, if we know rare things may be in certain places, or whatever.

Marvin Moriarty: I agree with Patrick. Conservation in the Northeast occurs at many scales. I know the LCC is made up of a lot of these groups. One of the things the LCC wanted to do is go with species because states have SWAPS and feds have representative species. There is going to be great value to lots of small conservation organizations in the Northeast, and having them interpret a single product is best.

Andrew Milliken: I think Bill is right, and Marvin and Patrick. And Scott too. To some degree, there is real value in identifying this connected network and telling a story about that. But part of that story can then be that there are layers that went into this that may be more valuable to your objective, and here is what they are, and how they can work. I think it's how we emphasize and tell the story that matters.

Eric Sorenson: Of the combination approaches, 20 – 5 is better. Vermont has concerns about the species approach, and I recognize that it is valuable to the FWS and the North Atlantic LCC, and especially for connectivity, it is better to have one product. But what worries me is the species that are associated with grasslands or early successional habitat. I don't think those kinds of species need the same kind of networked conservation design as black bear. I think throwing those kinds of species into a conservation design based on connectivity creates problems. I would favor having a species and an ecosystems output, and a combination. And I don't like that solution, but I don't know what else to do.

[2:30:00]

BJ Richardson: In technology we use "Use Cases", to get at: What is the end use for this product going to be? Who are the tiers of users - beginner, intermediate, and expert? There will be people who just want the final output, there will be others who want more information and different layers, and there will be those who want as much information as possible, and the ability to do their own thing with it. All the products will be available, but we want to be strategic about how we roll it out and distribute it and deliver it.

Bill Labich: I think I agree. Ultimately though you will have a map that shows the plan - the thing that we have consensus on. If there was a network, and a plan to realize it, this would be what we want to seek to conserve. And these other layers will be available for people to use as they wish.

Kevin McGarigal: To clarify, I think what BJ is suggesting is that you would have the network for the end user. But is the network THE network, or are there also these alternative networks. Is it one network or is it three below, which is the data that people can drill into? All of the data layers will be part of the final package. The issue is the core-buffer connect. Is it one, or is it three or more alternatives? Is there one consensus overarching network?

Jeff Horan: I like the idea of one optimized ecosystem-species network together. I don't think any organizations look at one or another. But at one time I thought we had talked about running the connectivity analysis on the

species side, and on just the ecosystem side. Where are we on that now? Are we going to go back and create connectivity on those other components?

Scott Schwenk: I propose that we have an ultimate design that is a combined ecosystem/species approach with network connections built into it. And that we not have separate species and ecosystem cores with their own networks. So one combined ecosystem-species network.

Marvin Moriarty: Is it possible to supplement with species without the network and ecosystems without the network?

Scott Schwenk: Yes, I think we all agree that would be important to include.

Patrick Comins: I think people use these as opportunities for inaction. So if it can be used to justify ecological importance even when it's not part of a network, that would be a plus. I think it's fine as long as we have alternative products when issues arise.

Scott Schwenk: Okay, so who supports the combined ultimate product? It looks like most folks in the room. Patrick is a "Yes". Eric, what about you?

Eric Sorenson: I support a 20-5 combination versus a 12-13 combination.

Scott Schwenk: Are there any other phone votes?

Rachel Cliché: I would support.

Andy Fisk: I abstain because I don't have enough technical knowledge. But we need to be careful, because there are a lot people using this, and we don't want to foreclose how partners can use this. We need to be sensitive to how people will use and approach this plan. When you have THE plan that comes from THE experts, there are concerns about people not feeling included. We must be strategic about the presentation.

Scott Schwenk: Agreed: We need to think about storytelling. So we have two combination options, and those are not binary divisions. Species tends to pick up more of best habitat, but both do a good job of getting the good stuff. Are there any comments on either option?

Marvin Moriarty: I may be wrong, but it looked to me that 20-5 is a much more compelling way to go. I thought it was a very strong difference between the two. Seems like a much better way to go.

Scott Schwenk: Right.

Dave Perkins: I'm still wondering about the combination of aquatic and terrestrial.

Kevin McGarigal: On the aquatic side, we did not do the 20-5 combination yet. We did not hear input yet that you wanted to move in that direction. We have to decide if we want to do so to be consistent with the terrestrial side.

Dave Perkins: I am trying to rationalize why we would do something other than an equal split on the aquatic side, why we would move towards a 20-5 approach.

Kevin McGarigal: The ecosystem approach does a much better job of capturing IEI across all systems than the species approach. A bunch of in-between systems do not get captured very well. The anadromous stuff is in regardless; it's really about how much you want to emphasize brook trout headwater creek habitat, versus smaller and medium streams that don't get captured.

Scott Schwenk: Let's make sure we separate terrestrial and aquatic. Are there any more comments on the terrestrial side? Does anyone favor the 12-13 combination?

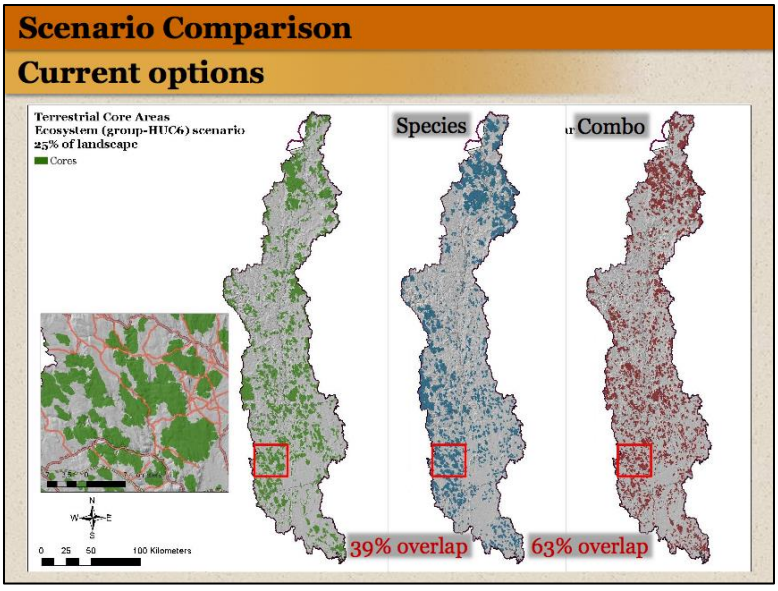
Randy Dettmers: This is not a comment against that, but it just seems that the end result is that almost all species end up with 30 percent, with some exceptions. Essentially, we are equally weighting all species against what we had been trying to do - heavily weighting certain ones to make sure they get picked up.

Kevin McGarigal: They are in fact weighted, but these final values don't reflect the initial weights because of all of the other things that are happening.

Scott Schwenk: Are there folks willing to come out in support of the 20-5 for terrestrial? It seems like pretty much a large majority. Are there any other comments or needs on the aquatic side?

John Warner: We haven't seen the 20-5 breakout, but one thing I noticed is with the combination, is that headwater stream areas throughout Massachusetts especially are almost all included, and it seemed odd that those east and west of the river were rated so high. It could be a reflection of adding ecosystem and brook trout on top of each other, so we are oversampling. I would like to see what the 20-5 split looks like to compare. Massachusetts from the Quabbin west is almost entirely red, and I think maybe a different balance would bring other sized rivers into the picture.

Bill Labich: I'm not on the Aquatics team, and I am always concerned about the focus on species when it's dependent on brook trout and anadromous species, but to what Kevin mentioned: There is more to streams than brook trout, so for the 25 for the aquatics, why not have habitat outside these groups? It goes to the question of use: Who will be using these maps? Is this a map that shows a network of aquatic habitats that will likely be beneficial to all the other stakeholders outside of states and federal agencies? Why wouldn't you go with the 20-5 to make sure you are covering other species?



Kevin McGarigal: The ecosystem approach distributes things more uniformly than the species approach. Both are at the HUC-6 scale. The comparison of all three shows that the ecosystem approach and combination pick up all mapped aquatic systems, not just the headwater creeks and main

stems for anadromous species.

Dave Perkins: It's not so much: Why wouldn't we? It's just the proportion to which we want to factor it in.

Scott Schwenk: So I think in general, the Aquatic Team is interested in the combined approached, but they need to see the 20-5 approach to decide.

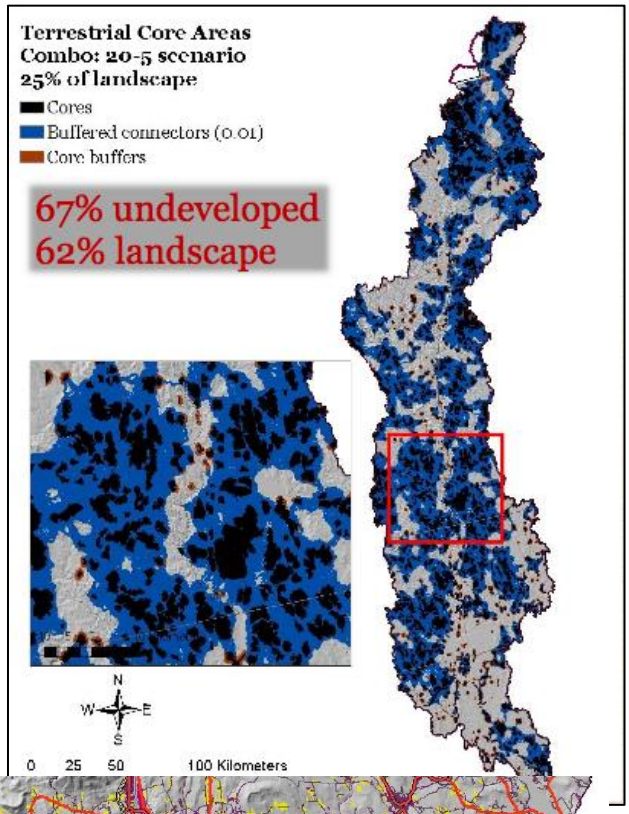
John Warner: I think the combination approach is imperative. The key for us all along is to use data to get at other species. We are interested in looking at other weighting where ecosystem is higher, but we just haven't seen the output. But I expect that's they way I would be heading.

[02:57:00]

4. Connectors, <u>and</u> 5. Core-Area Buffer Concept

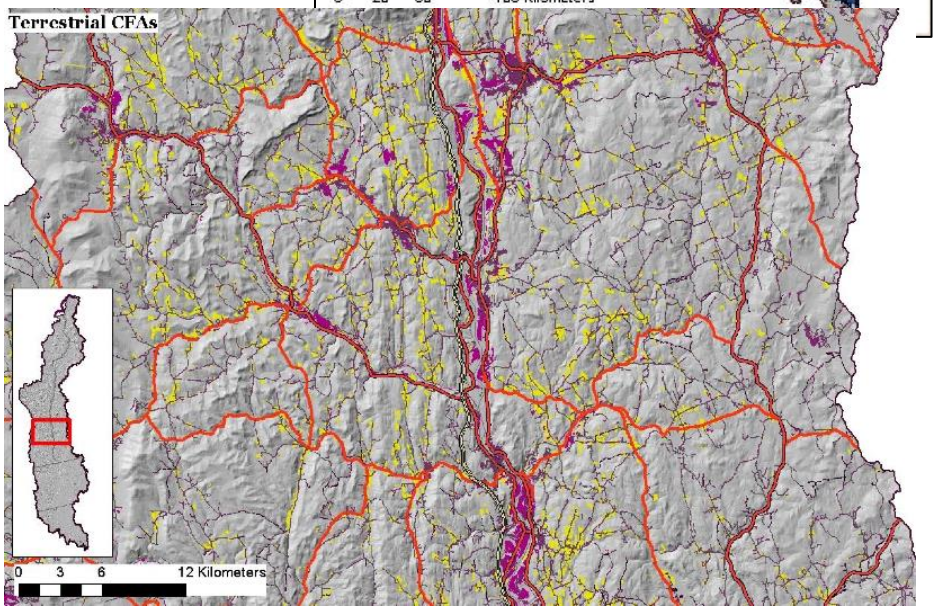
Derivation of Connectors: Conductance

1. Start with core areas
2. Build random low-cost paths
3. Threshold max path conductance, influenced by size of cores, distance between them, and resistance to passage. Core area is in black. The blue pads the cores above some minimal level of conductance.
4. Buffer paths by 250 meters, and because paths run on top of each other, we are mostly buffering the outermost path. We did not want to be left with a single cell path, because it won't do the job. We picked 500 meters, because 30 meters is silly. But that's somewhat arbitrary. We also put a 500-meter buffer around the cores.



So this scenario ends up being 62 percent of the landscape – core, buffers, and connectors. And that's 67 percent of the undeveloped landscape. I should note that there is development within the core. Buffers will not spread through high development, but connectors will.

When you have a high threshold, you end up with cookie concept. There is no easy way to decide where to threshold. How much



area do we want to include in the formal conductors? The more that's in the connectors, the less there is in the buffers. For the most part, connectors end up buffering the core. If connectors are large, they encompass the cores. As we shrink connectors, the proportion within the buffers goes up. The less in connector, the more in the buffers. Remember that this is a fragmented landscape, so we end up with smaller cores.

Yellow = agricultural land

Purple = urban development

Black, orange, red = roads

Green = thresholded paths

Eric Sorenson: The thresholding forces outlying cores. Is there a way to maintain connections to outlying cores when thresholding, so they don't drop away?

Kevin McGarigal: Starting where they are mostly all connected, what you are saying is, as we shrink the overall amount, can we maintain corridors to outlying cores? Yes, it's doable.

Patrick Comins: The central areas look like cookies instead of core and corridor. In terms of design, is there a way to refine those scenarios so it is a corridor-core design?

Kevin McGarigal: So you don't want development showing up in corridors? I think it's safe to say many organisms will use areas of low development, stuff does flow through it. Stuff flows through our back yard all the time. So I don't want to exclude random low-cost paths. The reality is, if it's developed, we cannot do anything.

Patrick Comins: want to identify high priority connections - linkages between cores.

Kevin McGarigal: I don't think excluding development achieves that. You can prioritize linkages, a set of paths, and that might be a better way to do what you want to do.

Patrick Comins: Cost-path design always shows better and worse areas, and you can focus more on the better areas so you can prioritize.

Kevin McGarigal: We don't advocate the use of a least-cost-path approach. It has all sorts of ramifications. But we do show relative values, and we will get to that. There is gradient of conductance and vulnerability to development, and we are going to show that. Where is there greatest vulnerability? I will show you that.

Patrick Comins: Okay. I am still thinking about how we sell this to users.

Kevin McGarigal: The point is: If we want to delineate areas that represent conservation focus areas that are well connected corridors of core. This is a cookie: A conservation focus area with embedded network of cores.

John Warner: Just to step back: To me it makes sense to utilize connectors and buffers around them, and in this landscape it may not be so big a deal. But for example, Rock Creek Park in D.C. is an incredible corridor despite its urban surrounding. I think in the first one you started with, just way too much of the landscape is covered. In terms of buffering the cores, I don't see any ecological reason. They are already defined, and I would eliminate the core buffers to bring in more to the connectors. If that percentage was added back to the connector buffers, that makes more sense to me from an ecological standpoint.

Patrick Comins: If they really are buffers, then that buffer may be serving a significant ecological purpose. If you take away buffer, the edge of the core becomes buffer.

Kevin McGarigal: Buffer is area of immediate influence on the value of the core - whether based on ecological integrity or species capability. If as defined, the core is an area of high value, it requires protection to keep development from encroaching upon that value. Buffer is area in which actions will have an impact on the value of the core. If you conserve core, and do nothing to buffer, you could lose the value of core. We advocate that buffers are areas of influence for ecological value, so they don't have to have value in and of themselves - they can be small roads, tracks, and areas of low development.

Patrick Comins: You can have core that is bisected by power lines and roads, but for forest birds it still ends up being functionally an important ecosystem, and this approach punishes areas close to the expressway.

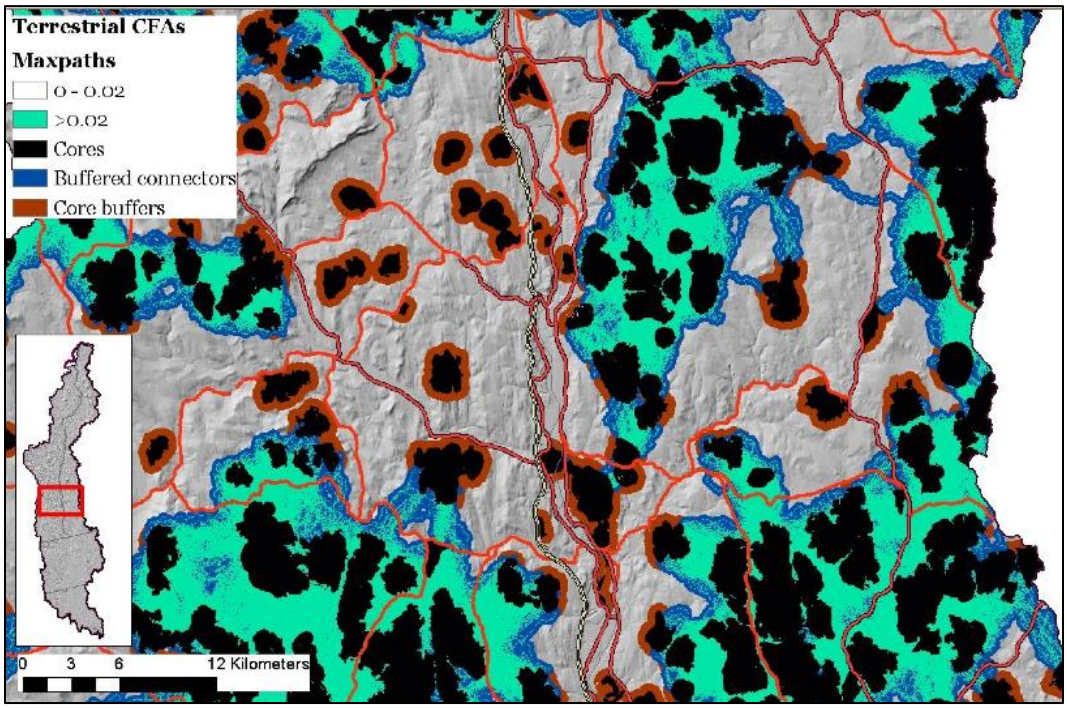
Kevin McGarigal: The buffer would extend to the expressway, but not across it.

Andy Fisk: I think the connectivity is a lot of the interesting part of this, and what a lot of people pay attention to. If we are making arbitrary decisions, we should red flag them. Think of the expert who was pinged on Obama Care, his offhand remark. We need to be careful about what are we are using to make a decision, and just be cautious of our wording.

Dave Perkins: It comes down to a size related issue: I see John's point that a big core is more protected by its size, but a small area is more vulnerable to that edge disturbance. So could we set a size limit where small cores get a buffer, and big ones do not?

Kevin McGarigal: That emerges from this process because bigger cores tend to be more well connected. It's the small cores that end up being isolated and not well connected, and will end up with buffers only. You don't see big cores that end up relying on just a buffer because they have conductance right around them.

[3:30:00]



Bill Labich: When I look at current slide (Conductance), I think of planning, and what a town or land trust might do based on this map. I just want to recognize that we are talking about buffers, cores, connectors, etcetera, but in my mind it comes to executing some set of values. At some point we need to interpret the green. What do biologists say that says this area needs to be preserved over time? What level of development in green areas is permissible? To me, the conductance has to somehow be tied to the execution of the plan. For me to judge whether I would want it to be at zero. I would want that because I know the execution will be imperfect whatever tool is used.

Kevin McGarigal: One more thing: This buffer concept is analogous to the approach we talked about in the past for aquatic buffers – of a constrained watershed around aquatic cores. These are places where we are concerned about what happens and where. Terrestrial ones are fashioned in the same way. This all ties into the next topic: Conservation priorities or tiers. This basically looks at core-buffer connect on these other products as a way to show value, vulnerability and restoration priorities.

Scott Schwenk: If there is no ecological basis, what is the practical basis? What will we be asking people do with this information and what is likely to be effective?

Kevin McGarigal: This decision is analogous to the decision to constrain core areas to 25 percent. It's not empirically based, but it is based on rational opinion.

Rachel Cliché: I think buffers are important and I have a few papers that provide guidelines on buffer size for forest, wetlands, roads, etcetera.

Kevin McGarigal: Let me also say, if you are thinking about variable width buffers for different systems, it's difficult with cores that include different systems. It's a little inconsistent with the idea, but still useful to consider.

Randy Dettmers: If we are thinking about core areas as 25 percent of landscape as a starting point for focusing conservation efforts, then in terms of the depiction of corridors between those places that are not necessarily

discrete systems, do we still need to think about are these connections in particular some sort of an equal priority, or are they more like the buffers - simply an area of importance to consider.

Ken Elowe: I look at the multi-purpose product we are creating as a strategy for where to go first. But also, how do we articulate to those on the ground a pattern that we think is ultimately functional? I like the continuum of values we discussed, but we need to show locals something they understand. Continuous surfaces work for us, but this kind of image might show them where to steer development away from so they can protect areas. But how do we articulate this?

[3:40:00]

Marvin Moriarty: As I watch local land trusts in their decision making process, a lot are focused on connectivity as a conservation outcome. So I think that's very important, as is being able to describe and show it. A level of priority would help as well at some point.

Kevin McGarigal: It would be nice to decide if we want to use connectors and buffers as part of design.

Ken Elowe: Yes, I like the one that shows the larger area. Less concerned about percentage of landscape, than the pattern. In thinking about strategic start, and how to make that functional into the future, this articulates that direction, so it should be part of the design. Shows a pattern that is more functional ecologically.

Kevin McGarigal: We did this sequence because people showed concern about how much area is being depicted. So there was conflict.

Ken Elowe: It comes down to how we bridge the nuance between ecological functionality and those who need to absorb pattern. If we are concerned that it will cause recoil to show so much percentage, that's valid. But when we lose the pattern, when we start to lose connections, we lose the basis for conversations.

Nancy McGarigal: Is there general agreement in the room that we want to see cores, then connect them, and then buffer the cores. We need to distinguish between cores, connectors, and buffers, and each should be described differently in the ultimate design.

John Warner: My problem was with the degree of the buffer and how we came up with those numbers, but if we are doing wetland permitting, we buffer a certain amount legally. I'd like to leave the size of the buffer for further discussion. I think it's important that if we justify size. The concept is great, just hold off on determining size.

Rachel Cliché: The paper says 50 to 250 meters for a forest, and it goes down from there.

Kevin McGarigal: The problem is: It's not always straightforward. Choosing buffer size comes down to ecosystem process, and given that we have ecosystems supporting species from invertebrates to large mammals and birds, the ecosystem neighborhood size will vary quite a bit. I would defy anybody to empirically defend a single scale when trying to meet objectives for multiple species and ecosystems. Which is why I came back to this as arbitrary, and 500-meters is way beyond regulatory requirements, and what has been published on edge effects, but not larger than some of the largest edge effects for very sensitive species. Anything less? Why do it. A 50-

meter ring doesn't do anything. It needs to be large enough to be a meaningful designated tier, but ecologically, the larger the better. We are just being practical by making it as large as we can justify on practical grounds.

[3:51:30]

6. Conservation Tiers/Priorities

Ways to prioritize conservation:

Species value – Takes max LC across any species at any cell, and highlights a cell that is good for any species, not just one species. It's another way to show gradient value for species both in and outside of conservation areas. Within connectors, you can show conductance.

Vulnerability – Built on conductance, irreplaceability, and probability of development. I have thresholded to show highest vulnerability. Places of high conductivity that have a high probability of development, which accounts for places that are secured and have no threat of development. It shows potential connectors between cores that are at risk.

Aquatic stuff is harder to show because it's linear. In the combination approach, remember, we are getting places where IEI says the value is high, and where brook trout habitat is good.

Ken Elowe: Are there any decisions that need to be made?

Kevin McGarigal: If you want to have final design products showing the core buffer connect, one decision we need to make is how to slice the core-buffer connect. On the aquatic side, we need to know if it's going to be the 20-5 combination.

Nancy McGarigal: We also decided to include climate and to go with a combination approach. We decided on a level of connectivity, and a 20-5 split on the aquatic side.

Kevin McGarigal: If a group wants to think about how to portray this on a map, that would be great, otherwise I will show what it looks like, and groups can go from there.

Scott Schwenk: There are a couple more terrestrial-oriented decisions. We could discuss that with a sub-team call, but Dave and John, do you want to be part of that discussion? Do we have the go ahead to work through decisions on:

1. Which of four options we want for connection thresholds, and how to present tiers outside of core-buffer connect.

Ken Elowe: So do these decisions need a timeframe?

Patrick Comins: Are these maps going to be available on Data Basin ahead of the next meeting? What if we do find mistakes in there - like in later iterations I looked at some sites did not show up. Is there a way to rectify some of those issues?

Kevin McGarigal: I think what you are talking about is validating the set of products. Assuming it's driven by expert assessment, and places where they fail, are there opportunities to improve the final products? That is doable, but it's not my decision. We definitely want to talk about validation products, but not today.

Nancy McGarigal: Patrick is wondering about viewing the final core-connector-buffer you present in January.

Scott Schwenk: If we can get those four different scenarios, and the maximum species LC.

Marvin Moriarty: I'm just curious in the terrestrial discussion, is it possible to show the level of resistance between core areas to prioritize where they should be larger or smaller? I can see that blue means more ability to go.

Kevin McGarigal: When we have a final scenario, we will rerun the conductance analysis with several thousand more conductance paths to fill this in and smooth it over to create a gradient of conductance that we can then show. The problem is we have cores, connectors, and buffers, and then there is terrestrial selection, species, conductance, vulnerability, at least four things showing gradient value, and that just doesn't fit on one map. Then put aquatic stuff on top of it. So we cannot put this all on one map.

Ken Elowe: That's appropriate that it doesn't need to be on one map. There is a way that put information up that gives you base pattern that you can dissect with the layers. So you can quickly articulate areas that need to be considered versus those that do not, and then explain using layers beneath.

Kevin: McGarigal: Right, the high level is: Where are the core-buffer connects? Then you can zoom into what's inside.

Next meeting: January 30, 2015