CLIMATE CHANGE VULNERABILITY ASSESSMENT

TOT Reviews – Quarter 1 2013

Reviewer #1: These comments follow from the three stated objectives:

1. Prioritizing species and habitats to assess vulnerability to climate change
2. Selecting approaches to carrying out vulnerability assessments
3. Appropriate climate data to use in the assessments

1a. ON THE SELECTION OF SPECIES

This draft provides interesting discussion of the various ways in which species for assessment might be selected, but too often this leads us away from the need to focus and be efficient. The list of potential species is exceedingly large. Some of these criteria are more open ended than others. I am concerned about "importance to the ecological system" as an ecosystem is an open ended concept, and some would argue that if a species isn't functionally important somewhere across its range, it may be so fragile or rare that it should be included on this list based on some other criteria. Ecological science is not capable of distinguishing thresholds of critical importance in all combinations of space and time; we may mistakenly identify species as important, simply because they are common—and common species may be the least vulnerable to climate change; they may be successful because they have great ecological amplitude and adaptability to past climate, making them least representative of the set of species overall.

I am also concerned about using cultural values as a criterion, as there are manifold ways that species are valued that aren't readily addressed: for example, why isn't every commercial tree species considered? Why not include common, native wildflowers that provide beauty? Why not include unvalued or nuisance species here if values are a criterion, as negative value is a value?

Using species to detect climate change may make sense if the goal of the effort is to characterize climate or better document the pattern or functional processes involved. This serves a different purpose than targeting known climate change sensitive species which may or may not be representative of the communities in which they occur. Indicators only make sense when it is clear what they are an indicator of. For example, some species are highly temperature sensitive while others are disturbance sensitive. Some are both; the viability of others is most sensitive to factors that may have nothing to do with climate change, such as the spread of invasive plants. Such multi-sensitive indicators make poor indicators of anything except their own status. How can species be meaningfully filtered so that indicator species are really good indicators of a broader suite of species or communities? The concept of habitat or community indicators is burdened by the well-critiqued assumptions of community ecology, and what is then measured? Their population

densities? Their competitive prowess with respect to their neighbors? One could chance focus on a competitive versus an uncompetitive associated species.

Focusing on T&E species makes sense from a state/federal agency perspective; but those likely require a different approach than what would work for more successful, broad ranging species. They are normally rare or threatened from causes other than climate stress that should be included. For example, fire-dependent species that are rare because of fire exclusion may be favored by climate change, while mesic species populations that are in decline from habitat loss may suffer from further habitat erosion from increased drought. A fundamental need for all T&E species are conceptual models that characterize the likely mechanisms and processes that will affect their viability—this includes climate as a direct and indirect driver. This need extends to any species vulnerability assessments. This provides a mechanism to explore if a candidate species is sensitive to climate (directly or indirectly) or to other drivers.

1b. ON THE SELECTION OF UNITS OF ANALYSIS ABOVE THE SPECIES LEVEL

The diverse set of species selection criteria and the preliminary list of potential species beg the question of whether species are the best unit of analysis for some vulnerability approaches. I don't see this concept well vetted in this draft. To be comprehensive across all species, the individual species-based approach may be doomed unless species are selected randomly. I'd think is a methodological approach worth thinking about, perhaps with pre-filtering. Additionally, other coarse filter approaches that could capture the broader need efficiently might include focusing on disturbance processes and species indirectly, jurisdictional capacity more generally, refugia, land surface phenology or response groups. There are pros and cons for each that could be vetted.

What may be useful is an expanded structured approach to classifying species responses so they can be grouped. We do this with fire effects response groups and there are analogs with bird life strategy classifications among other taxa. This coarse filter approach would emphasis species' life strategies rather than their specific range or range responses, and what could be predicted or modeled is how the need for different life strategies might change. Species would serve a role of informing the conceptual template of which they illuminate. This may be considered a fundamentally different approach to vulnerability assessments than species-based approaches, I would think.

2a. ON THE NEED FOR FOCUSING SELECTION CRITERIA TO DECISIONS

As stated in the draft report, this is a critical need. Will management decisions change from this work, or is this intended for broader cross jurisdictional conservation appeal? Is the purpose of this to prioritize species for monitoring or active habitat management by specific agencies with their species lists? T&E species already are the subject of great focus, though not always with climate response projections in mind. A synthesis approach using foundation species could spur active management; such as the importance of using prescribed fire for retention of drought tolerant oak-hickory forests. Such a management-focused approach leads one toward a different set of solutions than using range-change

forecasts; the former deals with site resilience, the latter with long-distance adaptations. Climate vulnerability and decisions regarding them will often depend on both, so how can they both be addressed here?

2b. ON THE IMPORTANCE OF CUMULATIVE EFFECTS IN VULNERABILITY ASSESSMENTS

Range-based predictions of species regional habitat stress are sometimes interpreted to be predictors of the likelihood of population extirpations, but these models are coarse and population dynamics are complex. Additional stressors contribute to this complexity, and these include disturbances, such as fire, wind, novel insects and diseases, invasives and habitat fragmentation that may individually provide *greater stress than climate change* for many species, but they also interact with climate in important ways. More windthrow from a changing climate could provide important opportunities for the establishment of migrating species or problematic invasives. More wildfire could facilitate restoration of more resilient xerophytic vegetation in fire adapted oak or pine forests. These interactions are critical at the species and community level, and they could be documented with conceptual models for understanding exemplar species, indicator species or multi-species response groups.

See the discussion of T&E species above.

2c. ON THE LIMITATIONS OF SPECIES DISTRIBUTION OR OTHER RELEVANT NON-CLIMATE DATA

Data shortcomings may be a severe constraint on the viability of different approaches. For quantitative modeling efforts, this could result in major make-or-break modeling uncertainties. It would be nice to see this and other core uncertainties addressed in a way that integrates them to the modeling approaches listed and to the available climate data. This could be part of a pros and cons table and insights could help sway the eventual decision as to which approach to follow. Related to this is the need and complexity of modeling for analysis.

3. APPROPRIATE CLIMATE DATASETS

This discussion is heavy on describing GCMs, but it provides little clarity about how GCMs might crosswalk to the various approaches. Historical datasets may be more useful for some approaches—exploiting species responses to observed variation, and making generalized statements about how this may scale out to the future for example using climate projections only tangentially. The section, “baseline time period,” addresses these data only with a climate prediction perspective.

Reviewer #2:

Overall - The draft report represents significant progress since the last quarterly report, and the authors and experts should be commended. The lack of a narrative comparison of the vulnerability assessment methods, highlighting strengths, weaknesses, and applicability is the main area that needs to be addressed in this draft. As a minor point, it needs a read-through for spelling and grammar.

Progress Report

p.9 High conservation significance

In addition to federally listed species and state listed species, it is important to include species that have been ranked by national conservation entities, especially NatureServe. Species with high conservation status ranks at the global level (G1-G3) should be considered as high priorities for assessment.

p. 10 Importance to the ecological system

I expected to see invasive species, pests, and pathogens in this section. They are nicely covered in the section called "Management importance".

p.11 Management importance

I wonder if this section might be re-titled "Game species", with invasives, pests, and pathogens moved to the "importance to ecological system" section?

p.13 Processes

Report organization is not clear. This section looks like a subset of "Habitats", but I think it is probably a stand-alone section? In this section, I'd like to see flood regimes added to the hydrology discussion, so that it is clear that hydrology is more than droughts and storms. The discussion of disturbance needs to include more than fire: windthrow and ice damage have more impacts on higher elevation Appalachian forests than fire. Again, erosion and sedimentation should be included.

p. 17 Index

HCCVI is mentioned in the text, but I did not find it in Appendix 2. Can it be added?

p. 18 Decision support tool

I am not quite sure why a separate decision support tool is needed. The number of methods is not so large that a clearly presented narrative can't explain the relative applicability of each method. Of the 27 methods listed in Appendix 2, I would imagine that only a subset of them are repeatable, documented approaches that would actually be applicable to the entities wanting to do vulnerability assessment in the Appalachian LCC. The lack of a narrative comparison of the methods, highlighting strengths, weaknesses, and applicability is the main area that needs to be addressed in this draft.

p. 24 Spatial climate data…

Nice discussion.

p. 32 No single CVA approach…

Paragraph (b) should include the fact that index assessment of species, especially foundational and keystone species, can also be a critical first step in assessing habitats.

Appendix 1

This appendix seems incomplete. It includes only CCVI species assessment and Galbraith's 2 habitat assessments. Can other species assessment be added? Some of them are broader than the Appalachian LCC, e.g. Iverson's tree and bird assessments, but they cover our area and should be included. Where is Patricia Butler's on-going assessment?

Appendix 2

This is a good compilation and has been much improved since the last quarterly report. It needs a spell check. The information in this appendix needs to become more than just a compilation, though. It needs to be turned into a narrative with strengths and weaknesses of each method. Ideally the narrative would also include the applicability of each method to the Appalachian LCC, whether it has been documented thoroughly enough for others to adopt, and whether more than one organization/entity has already applied it.

Appendix 3

Nice compilation of data. I looked for the dynamically downscaled data from Scott Klopfer (Va Tech) and Chris Burkett (VA DGIF) which covers VA, WV, PA, and MD, and parts of

other states. Maybe it is called something else? I did not see it here. I think it is probably an important data set for the Appalachian LCC. Also, for a non-specialist like myself, it would be helpful to show the major portals for climate data, e.g. climate wizard, in addition to the primary sources.