**Technical Oversight Team Comments**

**3rd Quarter Report, 2013 – The Nature Conservancy, Energy Forecast Project**

**Assessing Future Impacts of Energy Extraction in the Appalachian LCC**

**Grant Receipt/Organization: The Nature Conservancy (NTC)**

**Reviewer #1** -

Date: November 15, 2013

I have examined the 2013 3rd quarter progress report submission and the timeline of deliverables.

According the timeline of deliverables, three major interim deliverables were scheduled to be completed by now:

* Wind Development and Shale Gas Models Summary Report which includes a brief description of the modeling methods, model variables used, and derived products of the analyses including GIS layers of model output, build-out scenario, and assessment of resource impacts.
* A web-based server hosting all the GIS data for the wind and shale gas models, along with select resource layers. The server will publically available on the internet and a link will provided to the Appalachian LCC
* Full Coal Model Summary Report which includes which includes a brief description of the modeling methods, model variables used, and derived products of the analyses including GIS layers of model output, build-out scenario, and assessment of resource impacts.

The final technical report with detailed descriptions of the data, methods, and key findings for wind , natural gas, and coal analyses is due to be delivered to the Appalachian LCC on December 31, 2013. The NTC anticipates a small delay and the final report will be delivered on February 14, 2014.

The following is my assessment of the status of each of three major interim deliverables.

The Wind Development and Shale Gas Models Summary Report has been completed although the shale gas output is restricted to a subset of the Appalachian LCC study area in which detailed information occurs for the Marcellus and a more limited area for Utica Shale plays. NTC identified other shale gas plays but NTC could not incorporate these plays in the gas model because of the paucity of drilling into these plays and geospatial data. The wind model covers all of the Appalachian LCC study area but a more detailed analysis has been done overlain by the Marcellus shale play. Given the limitation of data in shale gas plays aside from the Marcellus, the wind development and shale gas model summary report appear adequate but will need to expanded in the future as additional shale plays are developed since ≈ two third of Appalachian LCC study area is not incorporated in the analyses.

I examined the GIS data for the coal, wind, and shale gas model at: <http://s3.amazonaws.com/DevByDesign-Web/MappingApps/CentralApps/demo/central_apps.html> . I am impressed: very nice. There is a minor issue of correcting with spelling (e.g. “Cummliative”). I recommend changing the color of those areas “Most likely Coal Development” from gray to a color more apparent and reduce the size of circles of the existing gas wells and wind turbines. Overall, the viewer works really well!

The Development of a Spatially Explicit Surface Coal Mining Predictive Model draft report dated October 30, 2013 and found at <http://www.nrac.wvu.edu/private/jackie/DownloadFiles/TNC_COAL/TNC%20Final%20Report%20October%2030%202013%20With%20Figures.pdf> was reviewed. Previous comments and suggestions were provided in writing and at the technical review team meeting in Charlottesville in September 2013. The coal model team of Michael Strager, Jacquelyn Strager, Wesley Burnett, and Aaron Maxwell considered previous comments and suggestions but were unable to fully incorporate all the suggestions due to inadequate geological information. The coal model team did provide additional statistical and graphical support for prediction outputs based on the variables used in the coal model. The draft report does a good job describing the variables used and those considered but not used. The process of using the probabilistic Random Forests predictive modeling technique was also very well described as well as statistical analyses conducted estimated the accuracy of the predictions and predictive mapping under the two scenarios: low coal production and high coal production. Finally, within the draft report the coal model team provided a comparison of model predictions to specific geologic information (coal seam overburden) where available, remaining coal reserves, and newly permitted areas to show the reasonableness of the model’s predictions. Regarding the latter, from my perspective, it appears that coal model predictions are reasonable particularly at a landscape scale.

**Reviewer #2** - 12/4/13

I have two thoughts on this.

1. I have been as clear as I know how with respect to my concerns about the use of coal-fired power plants as a predictive variable in the coal model and I don’t know how to be any clearer in that regard.  I am glad they ran a sensitivity analysis to see how the model performs without that variable, but I don’t this it is sufficient to just keep a variable in because it has some (unnamed) quantitative effect on the model’s performance.  I think there needs to be an examination of the contribution to model performance in relation to a non-quantitative judgment on keeping the variable in the model.  We don’t have the information for that judgment and I’m not sure it is TNC’s intent to allow the LLC to make that call.  But in my mind the power plant locations are not a variable that is independent of the mining locations and on that basis should not be used as a predictive variable. Not to mention the causal relationship runs in the opposite direction (as confirmed by the gentleman from the coal industry who sat next to me at the review committee meeting held over the summer). So, I personally remain unsatisfied with that aspect of the effort, but I don’t know that we’d gain anything by bringing this up again.  I would, however, like for the LLC oversight team to have access to the interim report on this subject that was mentioned in what they sent us so that we are knowledgeable about what they found when they assessed model performance without the powerplant variable.
2. I think that TNC probably did all they could with the data that was available for the shale formations during the timeline of this project, but it is disappointing that this left us without any real projections for the Utica shale and for portions of the LCC geography.  I would be interested in knowing whether TNC thinks this data would be available in, say, 12 months and what it would cost to re-run the projections with new data now that the model parameters have been worked out.  I also have a question for them on the map:  if they were constrained by data availability, is the map as it is now configured a good representation of development threat or should the blue areas be at least partially left blank to represent the lack of data?  Right now a visual read suggests low threats across a wide swath but I suspect that is partially due to a lack of data.

I meant to attach my annotated version of the proposal which highlights key elements of the scope of work.  (Makes it easier to cross check promises made and delivered.)

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Thanks for letting me add a few more comments.

Okay, so there still is not any discussion of the impacts to natural resources in the materials we have been given.  This needs to be in the final report AND the LCC needs to be given the opportunity to review and provide input on this part of the project. Yes, the GIS tool does have some natural resource data layers which can be overlaid with the energy buildout projections, but this does not appear to be fully functional (it failed to generate a report when I tried to run one today) and in any event does not actually provide us with the analyses and measurements promised in the scope of work.

Here is language from the TNC proposal which I am concerned has not been satisfied:

“We then propose to measure the impacts of the build out scenario on habitat fragmentation of forest resources, relating these impacts as a function of effects to biodiversity as well as effects to water production for human populations.” (p. 4)

“Our intent in the scenario modelling is … to address regional-level buildout intensities and impacts. We will use indicators such as forest fragmentation and ecosystems services (i.e., water availability) to assess regional impacts, and will report these impacts using metrics such as percent loss of important resource areas.” (p. 5)

Having these analyses spelled out in the final report is an important part of the value of this project and needs to be provided.

I have reservations that all of the natural resource data layers applied to this project are TNC data layers.  That leaves out a lot of other resource priority considerations certain to be of concern to the LCC partners and so seems to fail to serve the client here.  What steps does TNC plan to take to address this?

Lastly, the final report should include recommendations for next steps.  Jean had asked for this in prior discussions and it’s a pretty standard item to include in a final report.

Can we see a proposed outline for the final report and get a short memo from TNC on how they plan to handle these other items?  Some of this was brought up half a year ago and the conversation was deferred at that time. It’s time now to resolve the gaps in the project deliverables.

As always, feel free to call if you have any questions with my feedback

**Reviewer #3** - 12/9/2013

My review of the attachments was a great surprise.  I think the methodology and models used by Dr. Strager et al. are right on the money and make great sense.  I did not see any areas needing reworking or additional detail.

If you have other questions, please let me know.

**Reviewer #4** - 12/9/2013

I agree with Reviewer #1 that the mapper itself looks good and addresses the first element of the task, given some of the known limitations.  I noticed that I cannot report by watershed, yet.  I also have to agree with other comments by Reviewer #2 that the resources only include TNC properties.  That is fine for the initial development of the mapper, but we have many other considerations that would increase the value of the mapper.  For example, the National Wildlife Refuge System has a Conservation Design for each Refuge that defines how it will address Strategic Habitat Conservation.  I cannot find the Refuge on the map, much less do anything else with it.  Even providing a link to the Refuge would be helpful.  The same could be said for State Wildlife Action Plans and other plans.  I like that the map displays an energy forecast; that is helpful for land use planning. However, it doesn't give us much more information on what it means to be in a Forest Conservation Priority area, etc.  You asked about biodiversity - it is difficult to tell how this will impact species or ecosystem diversity.  Can other agencies import these layers into their systems so they can use it as part of their decision support tool kit?  Much of this may be answered when the reporting option is active.

I really do like the mapper and see it as a good first step.  I recommend getting everyone together to discuss how to illustrate the impact to biodiversity and re-examine how this tool will actually be used now that we have the mapper.  For example, the report narrative may have much more detail that addresses biodiversity than can be shown on the map.  I am interested in hearing what the next steps will be.

**Reviewer #5** - 12/10/2013

In the viewer for the Marcellus Assessment, the most likely shale development area is different than the most likely shale development area for the AppLCC. I understand they created different models for each but I find it a little troublesome that the results for the AppLCC boundary are missing areas identified in the Marcellus Assessment boundary since the AppLCC includes the entire Marcellus Assessment area.

It would help and I’m assuming they will do this, but the viewer should have metadata/description of the data – ie what does intact eastern forest, CWP and the CWP scenario 4 & 8, etc mean to a user?

I like the locate and the reporting features of the viewer. Since the reporting feature doesn’t appear to work at the moment, what would the results be in the report? For the reporting feature, I suggest adding a drop down of the counties once you select a state. Also, it would be good to have the watershed reporting by huc 8 and huc 12 – include the code and name. It would be helpful to include an option to import your area of interest – i.e. refuge or state wildlife management areas – to overlay and report. This is available in other data viewers. If it’s too much for this project, then I suggest adding these layers to the resource tab. It may also help to include EPA impaired waters. I don’t want to overload the viewer because it can get out of control but perhaps we can discuss. Right now, I like the viewer and usually I’m not a fan of viewers.

In previous comments I suggested some ways they could analyze biodiversity impacts and I’m still unclear if they did it or plan to do anything more than having resource layers in the viewer that you can overlay with development scenarios. I think in previous meetings in their presentations, they had some slides with impacts of well pads on forest and interior forest. It would be great if they could do that for the entire area. Simplistically speaking, it seems they could determine intact or interior forest as of now (appears a layer like this exists in the viewer now) then overlay forest cover and one of the energy development results and calculate intact or interior forest given that development result. I’m sure they have folks who can do this and I think it was done in PA when they first did this type of work. If they want an easy and quick way to do it, they can check out this tool - <http://clear.uconn.edu/projects/landscape/forestfrag/index.htm> . I have used it in the past to do similar work in the area.

 For true cumulative impact, they should look at water and forest resources together and not separately at it appears in the viewer. I am not clear on how they did the cumulative scenarios and remember it being glossed over in previous meetings due to time constraints. Also, why are the cumulative impacts only done in the Marcellus Assessment area? They could be done in the AppLCC boundary too.