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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Climate change and climate-driven disturbances in the San Juan River sub-basin of the Colorado River" *by* Katrina E. Bennett et al.

Anonymous Referee #2

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The authors present an interesting analysis into the potential combined effects of climate and land-cover change in a major tributary of the Colorado River. While the paper has sufficient novelty to be of interest to the community, several key oversights need to be addressed. For this reason, I recommend the paper undergo minor revisions prior to publication.

Major points

1. The authors conclude that understory regrowth leads to reduced streamflows. While this is a logical conclusion, additional discussion into other important mechanistic changes is warranted. First, if the model used by the authors doesn't account

for lateral flow (i.e. is it a 1-D model?), then the authors need to acknowledge lack of process representation important for vegetation/hydrology interaction. For example, low-lying vegetation can receive water from wetter-headwaters areas of a catchment (e.g. Troch et al., 2009, Hydrologic Processes; Thompson et al., 2011, WRR). If these dynamics are ignored, then at minimum the authors need to acknowledge how the findings of these earlier works may impact the results in their manuscript.

2. An important missing piece is a justification for the settings used in the 'disturbed' forest scenario. While LAI was changed, the authors need to provide more justification for why the vegetation was modified the way that it was, and how this compares to what previous modeling studies have done. For example, other studies have explored changes in canopy transmissivity associated with forest disturbance (e.g. Bewley et al., 2010, J.HydrologyâĂŤthe authors cite this paper, but do not reference the important 'calibration' to transmissivity that was done) involving calibration of forest parameters to observations, or remote sensing (Baker et al., 2017, RSE)while others have also modified the stomatal resistance, which is critical for accurately modulating ET, that is to say that modifying LAI alone may result in an inaccurate change to the total ET (e.g. Livneh et al.,; J.Hydrology).

3. Along the lines of the previous comment, it is unclear whether the authors validated their model beyond historical streamflow comparison. While streamflow comparison is important, a validation of the impact of imposed vegetation changes is warranted to ensure the settings and modifications are realistic, while challenging, this could be done on historical observations of key model structural components using in situ and remotely sensed observations. Alternatively, if validating the model settings is outside the scope of the present manuscript, then the authors need to clearly state this as a limitation of their study in the discussion.

4. Research now exists that suggests that forests disturbance can cause both increases and decreases in streamflow. While the authors cite part of the literature, they ignore important foundational publications on this topic (see references within Adams

et al., 2012, Ecohydrology). Newer research also exists that uses large-sample catchments to study the effects of forest disturbance and should be referenced here (Buma et al., 2017; ERL), so as to put the findings in a clearer context relative to the literature.

5. More details into the climate of the study basin is warranted, e.g. mean annual precipitation, temperature (include summary numbers in addition to figure 4), mean elevation of the basin, etc. Most importantly, the authors need to comment on how representative this semi-arid basin is of the Colorado basin as a whole and whether the results here are indicative of what other parts of the world might see, or whether this climate/landscape is sufficiently unique.

Minor

Figure 3: this is a nice figure, however the axis labels are way too small and need to be increased, as does the font size in the legend. Furthermore, the green shading should be included in the legend.

Figure 4, the lines are too thin and difficult to see. The authors should increase the line thickness by at least a factor of 2.

Figure 5 is very difficult to follow. First, it seems to me that including multiple colored circles directly on the plot is confusing, since it's unclear whether these are a part of the plot or a legend. To overcome this, the authors should add a color bar and remove these circles. Second, the circles in the upper left of the plot obfuscate the graph, since I cannot find any other circles (other than a small one in the upper right), so instead the authors should state in the caption that the size of the symbols corresponds to the percent forest, there could be a length bar in the legend to show this, but the circles are too distracting/confusing. Lastly, the temperature description in the top center of the plot belongs in a legend.

Figure 6: The lines are very difficult to distinguish, particularly in panel (a). I recommend that the authors avoid using dashed and solid lines of the same color in such

close proximity, i.e. use lines of different colors.

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