

### Review of:

Developing and optimizing shrub parameters representing sagebrush (*Artemisia* spp.) ecosystems in the Northern Great Basin using the Ecosystem Demography (EDv2.2) model

By: Karun Pandit et al.

### **General comments**

This article is about the development and the parameterization (through the optimization) of shrubs in the EDv2.2 model. It focuses on two sites in the Northern Great Basin and on the sagebrush. The introduction of new vegetation descriptions in models is a key step to improve and simulate ecosystems more precisely. This article presents at least one first step of the introduction of shrubs in EDv2.2, necessary to represent some ecosystems (present in Great Basin but also throughout the world).

There is an undeniable improvement compared to the first version submitted a few months ago, both in form and content. The title is in accordance with the article, the figures are clearly more readable, more coherent tests were provided and discussion/conclusions are more relevant. However, it seems to me that this could have been the first version submitted. And despite the deep work provided in this version, some comments were quickly replied to and sometimes without real justification (e.g. for the references).

Nevertheless, the paper can still be improved in precision and quality, by adding some coherence to the study with a (relatively) small amount of work. I listed below my comments.

### **Comments**

- 1) There is an important improvement with the use of more yearly data forcing, removing some biases due to random year forcing used between optimisation simulations. The discussion was also clearly improved, taking into account the methodological limits. Nevertheless, the choices of the methods used still have to be better justified in some case. Indeed, as it stands, it is not obvious that all tools are well considered. The main point is the justification of the use of "brute force" for the optimization due to computing limitation (p.9 l.11), while other methods are available especially in order not to try every configuration of the parameter set but to chose a new set of parameters depending the previous sets tested. But for this purpose some assumptions with the variables (mostly the independence between parameters) have to be made (like for your sensitivity test). You can therefore justify you method and discuss about other possibilities and your hypothesis for the sensitivity test in the discussion. Another point is the choice of using an ensemble mean parameter and best cases. Why have you done this choice? For/with which hypotheses? Also in the discussion it could be interesting to compare and discuss the two sets of parameters (differences, results...).
- 2) As proposed before, it seems to me that the discussion could go a little further. For instance, you could compare the two sites and the two sets of parameters to introduce the following

idea: which set of parameters will you use if you need to use your model in another situation or to start another optimisation? It could be interesting also to discuss about the choice to change only the parameters and allometry to discriminate shrubs from trees. Can the important differences with the observations shown be due to a missing process?

- 3) It was a good idea to introduce a table (Table 1.) to present the parameters used in the equations, for the sensitivity test and the optimization. The text would be more readable if you add inside the table the abbreviations used in the text/equations. Moreover, there is still inconsistency in the use of italics for parameter abbreviations (some in italics and other without) and it is still not indicated what the Cs parameter is (equation 2). Note that in the table for the units the exponents disappeared and it could be important to indicate what the "a" unit stands for.
- 4) In this new version, you have changed the number of steps for  $V_{m0}$  (Table 5.) and so the number of simulations (p.12 l.13) but with the same justification as in the previous version. How is it possible? In regards to the substantial changes in the simulations, it is not surprising to change the configurations but the scientific approach can be questioned. This new choice has to be indicated (at least in the authors response).

### **Specific comments**

p.2 l.5. Need for a reference for this sentence.

p.2. l.28. It is important to indicate that Great Basin is in the USA.

p.3 l.13-21. Now better introduced. Do not hesitate to explain why it could be interesting to work with cohort (to insist about the advantages of the ED2 model type).

p.5 Figure 1. It is difficult to read the name of the EC towers inside the figure.

p.13 l.2-3. To be consistent, the SD values have to be indicated in Table S2.

p.13 l.7-8. It could be interesting to compare both cases, and so the simulation with the mean parameters can be added in Figure 3 (which was present in the previous version).

p.15 l.6. Suggested change: remove 'also'.

p.16 l.27. There is no Figure 5. (Fig 3 and 4?).

Fig. S2. The figure is a lot more readable than before. However, it could be probably better if you highlight the best parameters. Another possibility is to show instead of the other 9 curves the mean of the 10 curves with the SD (+ curve of the ensemble parameters).

Fig. S3. It could be very interesting (to support your sentence p.13 l.6) to add in the same type of graph the fraction of shrubs and grasses.