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REVIEW OF: "COMPARISONS OF THREE DIFFERENT METHODS USED TO GENERATE FOREST LANDSCAPES FOR SPATIAL HARVEST SCHEDULING PROBLEMS WITH ADJACENCY RESTRICTIONS"

Anonymous Referee B

Summary and recommendation

The authors compare three methods to create hypothetical forest landscapes for optimization modeling: grids, Voronoi diagrams and random graphs. They apply a standard spatially explicit harvest scheduling formulation to each of the landscapes that were created by the three techniques using different parameter settings. After solving the optimization problems, the solutions are compared based on the resulting objective function values and solution times.

I recommended to the Associate Editor that the following major issues would need to be addressed before I can recommend the manuscript for publication :

1. It is not clear what the authors' objectives are in this study. Comparing three landscape-generating techniques based on the operational "restrictiveness" of the pair-wise adjacency constraints that they lead to makes little sense in my opinion. I think that the idea of comparing these techniques with each other is a good one, however. My problem is with the comparison criteria that the authors used. We need hypothetical landscapes for the purposes of testing and demonstrating various optimization modeling approaches for spatial forest planning. Real forest landscapes might be in short supply or the real datasets are hard to access for intellectual property reasons. More importantly though, we want to have some control over the spatial attributes of the landscape, so that we can evaluate the performance of our methods under a range of different spatial configurations. The spatial attributes that we might want to able to control include the average size of the stands, vertex degrees (the average number of stands that are adjacent to a given stand in the forest), etc. It is the amount of control over these parameters afforded by the landscape-generating techniques that should be the basis of comparison. I recommend that the authors retest the techniques along these lines.

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2. Not only does the treatment of Voronoi tessalation in the ms requires more mathematical accuracy (e.g., x_i, x_j, and set I_n are all undefined), the discussion ignores the existing forestry-related literature and makes no mention of the fact the technique can only generate convex polygons. I suggest that the authors consult Barrett (1997) as a starting point for the existing forestry literature and address the above issues in the revised manuscript.

3. The graph randomization approach that the authors suggest as one method to generate hypothetical forest landscapes is flawed because it lacks an instrument that would ensure that the resulting graphs are planar. As an example of this deficiency, consider the graph on Figure 5. This graph is not planar because it has at least one *subgraph*, {39, 55, 60, 13, 67, 34, 45, 9, 26, 27, 40, 43, 48, 64, 29, 49, 18, 11} that is *homeomorphic* to $K_{3,3}$, a *complete bipartite graph* on six nodes. The significance of this is that forested landscapes are always planar and a generating technique that leads to non-planar landscapes is unrealistic. Planar graphs are sparse; they have few edges relative to the number of their nodes. The randomization process that the authors suggest can lead to very dense graphs if p is even moderately large. The reason why the authors find their random graphs hard to visualize is because non-planar random graphs cannot be visualized as a set of forest polygons on a Euclidean surface. Only the graph on Figure 4 appears to be planar. I recommend that the authors revise their graph randomization technique in such a way that it would guarantee planar landscapes. A thorough review of McDill and Braze's (2000) MakeLand program should be a good starting point.

Other comments/questions

1. Page 4: The discussion of MakeLand needs more detail as it is one of the few, well-documented parts of the forest landscape generating literature.

2. Page 4 bottom: What are the "first and second order adjacency constraints"?

3. Page 5, second sentence from top: Vertex degree is the spatial attribute that the authors are referring to here.

4. Page 9, top paragraph: The function $x^2 + y^2$ cannot generate an initial point set for Voronoi diagrams because, given a pair of coordinates, it maps only scalars. A more rigorous explanation is needed.

5. Page 12-16: There is no need for five figures for the random graphs.

6. Page 18, second line from top: What is "area size"?

7. Page 18, second paragraph: "Formulized"? Shouldn't this be "formulated:"?

8. Page 22, second paragraph, first line should start with "Standard deviations. . . ".

9. Page 22 top: What is "original GIS landscapes"?

References

Barrett, T. 1997. Voronoi tessellation methods to delineate harvest units for spatial forest planning. Canadian Journal of Forest Research. 27: 903.910.

McDill, M.E. and J. Braze. 2000. Comparing Adjacency Constraint Formulations for Randomly Generated Forest Planning Problems with Four Age-Class Distributions. Forest Science 46(3):423–436.