Stevens, Jens <jtstevens@usgs.gov>

R code for irregular patches

Alan Tepley <alan.tepley@colorado.edu> Sun, Apr 14, 2019 at 7:00 PM
To: "Stevens, Jens" <jtstevens@usgs.gov>

Hi Jens,

Here is a script I wrote for generating random burn patterns. I'm not sure if it does what you want, but you might be able to tweak it to get it to do something close to what you are looking for. As written, the script does not allow you to set clump sizes directly, but you can set the scale of spatial autocorrelation when you generate clusters of burned cells, and the output will give you the sizes of each clump of contiguous burned cells.

The script generates a continuous Gaussian random field, which I convert to a binary grid representing the proportion of a landscape that burned (or it could represent the proportion burned at high severity). The Gaussian random fields are generated using the nlm_gaussianfield function in the 'NLMR' package. The main variables to specify are the size of the grid (xmax and ymax on lines 16-17 of my script), the scale of spatial autocorrelation based on the range of the variogram (pct on line 29 in my script), and the proportion of the landscape burned (prop.burned on line 55 of my script). For the range of the variogram, you could set it in number of pixels (line 33 of my script), but I found it more intuitive to set it as the radius of a circle with an area equal to a certain percentage of the simulation grid. For example, if I use a 200 x 200-cell grid, and I set "pct <- 5" on line 29, then this percentage is used to calculate the range of the variogram on line 30. In this case, a circle with an area equal to 5% of a 200 x 200-cell grid will have a radius of 25 cells. I did it this way because it allows me to increase the grid size without having to re-calculate the range of the variogram. For example, if I wanted to increase the grid size to 500 x 500 cells, I could keep pct <- 5 on line 29, and the range of the variogram would automatically increase to 63 cells, which represents the radius of a circle with an area equal to 5% of a 500 x 500-cell grid.

The script will plot the continuous grid first. Then you specify the proportion of the landscape that you want to be burned, and it will convert the continuous grid to a binary grid where burned cells have a value of 1 and unburned cells have a value of 0. For example, if you want 20% of the landscape to be burned (or burned at high severity), you can set "prop.burned <- 0.2" on line 55. Then, the script will select the highest 20% of values from the continuous grid and convert them to 1s, and the rest of the cells will be converted to 0s.

After producing a binary grid, the script calculates the patch sizes for all clumps of burned cells. It uses the clump function from the 'igraph' package to identify all contiguous cells with a value of 1. Then, it counts the number of cells per clump. I generated a 'patch.size' data frame that sorts the clumps from largest to smallest and provides the clump sizes in

number of cells and as a proportion of the grid area.

I would try running the script as is, but vary the scale of autocorrelation on line 29 (e.g., pct <- 0.05 to pct <- 50 and a few values in between). Then you can look at the types of patterns it produces at different scales of autocorrelation. You can also vary the proportion of the landscape burned on line 55 and the landscape extent (xmax and ymax on lines 16-17). When you increase the grid size, the step that generates the Gaussian random fields slows down, so I would keep the grid size at about 200 x 200 cells at first.

I don't know if this will do what you are looking for, but it seems like it could be incorporated into a simulation to evaluate the creation/persistence/loss of fire-scarred trees in fire regimes with different patch sizes for high-severity fire.

Let me know if you have any problems getting the script to work or if you have questions about how to revise it to make it more useful for your analyses.

Alan

From: Stevens, Jens <jtstevens@usgs.gov>
Sent: Wednesday, April 10, 2019 4:58 PM
To: Alan Tepley
Subject: R code for irregular patches

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Generate_random_burned_patches.R
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