Spatial Models Wrap Up

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What are the main points to take away from the lessons we've learned about spatial models and also the combination of spatial and frame models?

I think the first lesson is that simple spatial models can be useful and can be relatively easy to develop, provided one concentrates on objectives. We're back to one of the basic lessons in modeling. It's not the complexity of the model that matters. It's a question of whether the model captures the essence that is required in terms of the objective.

In spatial models, one needs to think very hard about scale and time-step, and the combination of scale and time-step need to match the objective. In other words, you don't look at the quality of data in a GIS to determine what the size of a pixel needs to be when you're developing a spatial model. If you change the objective, chances are you might have to change your spatial scale, and you might have to change your time-step. And if you change your spatial scale and time-step, chances are you're going to have to change what you see and what you do in the model world. So time, space and objective and the description of the model world are closely knit.

How we characterize a pixel in a spatial model has a lot to do with the way in which we think when we use GIS. If we have a five-by-five mile pixel, and we talk of it as being burnt in a fire model, we're definitely not saying that every single tree and blade of grass in that pixel has been burned. What we are saying is that somebody in GIS looking at those data would characterize the pixel as burnt versus unburnt. In practice, maybe, only 50 or 60 percent of the total area has been burned.

In the same way, if one combines spatial models with frame models, and one says a two-mile-by-two-mile pixel is a spruce forest, that doesn't necessarily mean that only spruce trees grow there. It could be much more complicated than that, but for the purposes of the model and for the purposes of a GIS, that pixel would be characterized as spruce forest.

We've seen how cellular automata are sort of the prevailing paradigm that are used with spatial models, but we've also seen how they can be restrictive. And there's absolutely no need to restrict oneself to cellular automata. Again, the purpose of a spatial model and what one does with it is determined by the objectives of the model. One never fits a real problem into a prevailing modeling paradigm if that is going to be a straightjacket.

However, I think you might've realized somewhere along the way, particularly if you're going to be looking at realistically sized landscapes, there's no way you're going to be able to develop landscape models and combinations of landscape and frame models on spreadsheets.

So the modeler is going to have to learn to work with a programmer. The modeler's probably going to also have to learn to work with a GIS expert. And the modeler is probably also going to have to work with biologists and disciplinary experts in relation to the problem that they're dealing with. Think of something like climate change, forest fire, tundra in Northern Alaska. You can't do this by yourself. So modelers have to learn to work in interdisciplinary teams and to work with interdisciplinary teams. And whenever you work with an interdisciplinary team, there is pressure to make the model more and more complicated. So the challenge is to keep the model simple. And the use of rapid prototyping in this type of situation is an absolute must.

Finally, a heuristic. Remember when we were dealing with elephant contraception? We said if we have a management problem in relation to some kind of population, it's very often a good idea to start with a population model. Now if you have a management problem in relation to a population where one of the key issues is habitat for that population, then the heuristic changes. And in that case, it almost always pays to start with a spatial, and perhaps a combination of spatial and frame-based modeling, of the vegetation to identify how habitat might change over time. And once you have that working, add your population to your spatial model.

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