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Research Brief for Resource Managers

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Sensitivity of Fire Succession Models to Fuels and Climate

Cary, G. J., R.E. Keane, R.H. Gardner, S. Lavorel, M.D. Flannigan, I.D. Davies, C. Li, J.M. Lenihan, T.S. Rupp and F. Mouillot. 2006. Comparison of the sensitivity of landscape-fire-succession models to variation in terrain, fuel pattern, climate and weather. Ecology 21:121-137.

Fire simulation models that consider the complex dynamics of weather, fuels, and terrain are essential to forecasting fire behavior. A growing number of such models are available, so understanding the differences in their predictions and sensitivity to drivers of fire behavior is critically important. Geoffrey Cary and colleagues made an extensive comparison of five fire simulation models used in different parts of the world. They studied the sensitivity of predicted area burned to variation in terrain, fuel pattern, climate and weather. Sensitivity was measured as the variance in area burned explained by each of these four drivers of fire behavior.

They compared five models: EMBYR, FIRESCAPE, LANDSUM, SEM-LAND, and LA-MOS(DS). It is of particular interest that for all five models, area burned was most sensitive to climate and weather. Fuel pattern was significant in one model and terrain significant in another model, illustrating the importance of model choice. Surprisingly, interactions between variables were not important except for those between climate and weather.

These findings have significance for fire managers working with global vegetation models at a local level. The lack of sensitivity of area burned to fine scales of fuel pattern indicates that course scale Dynamic Global Vegetation Models (DGVMs) may not need to incorporate fine scale vegetation patterns into simulation cells.

Management Implications

- In these models, weather and then climate are more important than fuel pattern and terrain in explaining the extent of simulated burns (variance in area burned). While the interactions amongst the other factors were generally unimportant, the interactions between climate and weather were the most significant.
- Burned area increased from warmer and wetter landscapes to warmer and drier landscapes in all models but EMBYR.
- Fuel pattern was not very important in any of the models but EMBYR.
- Slope (terrain) had a positive, non-linear correlation to area burned. FIRESCAPE was superior to the other models in its ability to assess the effect of terrain on weather, a complicated interaction between two factors.