Comment on "Prescribed Fire As a Means of Reducing Forest Carbon Emissions in the Western United States"

Wiedinmyer and Hurteau (*1*) present a "preliminary sensitivity analysis" suggesting that a one-to-one replacement of wildfire with low-intensity prescribed fire in western U.S. forests between 2001 and 2008 would have substantially reduced pyrogenic carbon emissions over this period. We agree that prescribed burning is an important tool for restoring certain forests to the fire regimes in which they evolved. We further agree that pyrogenic carbon emissions must be considered in regional carbon accounting and commend the authors for highlighting the spatiotemporal variability and uncertainties associated with emissions estimates.

We have concerns, however, regarding the study's conclusions. Our basic argument is that a one-to-one substitution of prescribed fire for wildfire in both space and time is a fundamentally unrealistic scenario, even for a sensitivity analysis. For prescribed fire to preclude all wildfire, it would have to be applied both over larger areas and more frequently than wildfire would otherwise occur. Although Wiedinmyer and Hurteau (*1*) state that their simulations do not account for the feasibility or cumulative emissions of repeated prescribed burning, simply acknowledging these limitations does not justify the claim that "...Wide-scale prescribed fire application can reduce CO_2 fire emissions for the western U.S. by 18−25%...," even when labeled as an "upper bound." By underestimating the impacts of prescribed fire, the authors present misleading conclusions that could result in flawed forest carbon policies.

In simulating a one-to-one substitution of prescribed fire for wildfire, Wiedinmyer and Hurteau (*1*) take forests that historically experienced frequent, low- to mixed-severity fire and assume that all fires could instead be human-ignited, controlled, and low-intensity. In practice, this approach would require: (1) predicting where and when all wildfires occur; (2) implementing prescribed fire within these perimeters; (3) 100% efficacy of prescribed fire in eliminating wildfires; and (4) 0% escape of prescribed fires. This framework is completely unrealistic. Because wildfires affect a small and largely unpredictable proportion of the landscape, mitigating their impacts with prophylactic prescriptions requires treatment of a much larger proportion of the landscape. Treating this larger area would necessarily reduce the difference between the prescribed-fire and wildfire scenarios.

Even if one could predict where and when wildfires were to occur, the intrinsic reciprocality between fire frequency and intensity further invalidates a one-to-one substitution of low-intensity prescribed fire for high-intensity wildfire. Although low-intensity fire results in lower per-unit-area emissions than high-intensity fire (*2*), cumulative emissions over time are likely similar because high-intensity fire is by nature infrequent, whereas fuel treatment via thinning or prescribed fire must be applied frequently to remain effective (*3, 4*). We suggest that a more realistic temporal framework be based on the mass balance of fuel production and combustion over time. For example, the authors could have compared a single high-intensity wildfire in 100 years with four to five low-intensity prescribed fires over the same time period.

Wiedinmyer and Hurteau (*1*) have made some important improvements over previous studies. For instance, the removal of redundant and low-confidence fire detection by the MODIS sensor reduced estimated regional emissions by 40−56% compared to previous estimates (*5*). Also, the authors' determination that wildfire releases about twice as much carbon per-unit-area as prescribed fire (Table 1 in *1*) greatly improves upon earlier suggestions that high-intensity wildfire released over 10 times more carbon than surface fire (*6*). This correction much better reflects the fact that most pyrogenic emissions arise from the combustion of fine surface fuels, which are readily consumed in both surface and crown fire (*2*).

There is a strong consensus that vast areas of arid forests in the western U.S. have suffered both structurally and compositionally from a century of fire exclusion and that prescribed fire can be an effective tool for restoring historic functionality and resilience to these ecosystems. We agree with concerns that emerging policies aimed at reducing CO_2 emissions could threaten the ability of managers to apply prescribed fire at the spatial and temporal frequency necessary to achieve and sustain desired forest conditions. Nevertheless, unrealistic claims that fuel reduction treatments reduce overall forest carbon emissions do not serve this cause. It is more useful to demonstrate and champion the restoration of fire-prone forests despite what may be net carbon losses. While there do exist some negative feedbacks among thinning, prescribed fire, and wildfire, the increase of any of these will almost certainly lead to an overall reduction of carbon storage. More importantly, increases in all three may be necessary to bring about desired future conditions.

Literature Cited

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