Forest fire prevention efforts will lessen carbon sequestration, add to greenhouse warming

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Widely sought efforts to reduce fuels that increase catastrophic fire in Pacific Northwest forests will be counterproductive to another important societal goal of sequestering carbon to help offset global warming, forestry researchers at Oregon State University conclude in a new report.

Even if the biofuels were used in an optimal manner to produce electricity or make cellulosic ethanol, there would still be a net loss of carbon sequestration in forests of the Coast Range and the west side of the Cascade Mountains for at least 100 years - and probably much longer, the study showed.

"Fuel reduction treatments should be forgone if forest ecosystems are to provide maximal amelioration of atmospheric carbon dioxide over the next 100 years," the study authors wrote in their conclusion. "If fuel reduction treatments are effective in reducing fire severities in the western hemlock, Douglas-fir forests of the west Cascades and the western hemlock , Sitka spruce forests of the Coast Range, it will come at the cost of long-term carbon storage, even if harvested material are used as biofuels."

The study raises serious questions about how to maximize carbon sequestration in these fast-growing forests and at the same time maximize protection against catastrophic fire.

"It had been thought for some time that if you used biofuel treatments to produce energy, you could offset the carbon emissions from this process," said Mark Harmon, holder of the Richardson Chair in the OSU Department of Forest Ecosystems and Society. "That seems to make common sense and sounds great in theory, but when you actually go through the data it doesn't work."

Using biofuels to produce energy does not completely offset the need for other fossil fuels use and completely negate their input to the global carbon budget, the researchers found. At the absolute maximum, you might recover 90 percent of the energy, the study said.

"That figure, however, assumes an optimal production of energy from biofuels that is probably not possible," Harmon said. "By the time you include transportation, fuel for thinning and other energy expenditures, you are probably looking at a return of more like 60-65 percent. And if you try to produce cellulosic ethanol, the offset is more like 35 percent."

"If you take old, existing forests from these regions and turn them into almost anything else, you will have a net loss in carbon sequestration," Harmon said.

That could be significant. Another recent OSU studied concluded that if forests of Oregon and northern California were managed exclusively for carbon sequestration, they could double the amount of sequestration in many areas and triple it in some.

The new study found that, in a Coast Range stand, if you removed solid woody biofuels for reduction of catastrophic fire risks and used those for fuel, it would take 169 years before such usage reached a break-even point in carbon sequestration. The study showed if the same material were used in even less efficient production of cellulosic ethanol, it would take 339 years.

The researchers did not consider in this analysis how global warming in coming years might affect the increase of catastrophic fire, Harmon said. However, "fire severity in many forests may be more a function of severe weather events rather than fuel accumulation," the report authors wrote, and fuel reduction efforts may be of only limited effectiveness, even in a hotter future.

"Part of what seems increasingly apparent is that we should consider using west side forests for their best role, which is carbon sequestration, and focus what fuel reduction efforts we make to protect people, towns and infrastructure," Harmon said. "It's almost impossible anyway to mechanically treat the immense areas that are involved and it's hugely expensive. As a policy question we have to face issues of what approaches will pay off best and what values are most important."

The report was just published in *Ecological Applications*, a professional journal. The lead author was Stephen Mitchell, who conducted the work as part of his doctoral thesis while at OSU, and is now at Duke University. Among the findings:

- Fuel reduction treatments that have been proposed to reduce wildfire severity also reduce the carbon stored in forests;
- On west side Cascade Range and Coast Range forests, which are wetter, the catastrophic fire return interval is already very long, and the additional levels of fuel accumulation have not been that unusual;
- A wide range of fire reduction approaches, such as salvage logging, understory removal, prescribed fire and other techniques, can effectively reduce fire severity if used properly;

- Such fuel removal almost always reduces carbon storage more than the additional carbon the stand is able to store when made more resistant to wildfire, in part because most of the carbon stored in forest biomass remains unconsumed even by high-severity wildfires;

- Considerable uncertainty exists in modeling of future fires, and some fuel reduction techniques, especially overstory thinning treatments, could potentially lead to an increase in fire severity.

The study authors concluded that fuel reduction may still make more sense in east-side Cascade Range and other similar forests, but that the west-side Cascades and Coast Range have little sensitivity to forest fuel reduction treatments - and might be best utilized for their high carbon sequestration capacities.

"Ultimately, the real problem here is global climate change," Harmon said. "Insect epidemics are increasing, trees are dying. There are no quick fixes to these issues."

More information: www.esajournals.org/doi/full/10.1890/08-0501.1

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