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Ecological Impacts of Alaskan Forest Fuel Treatments

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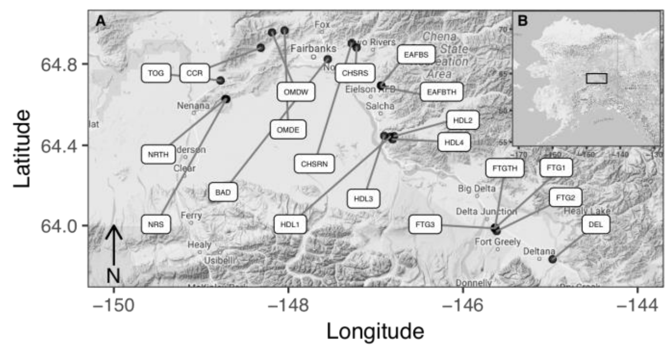
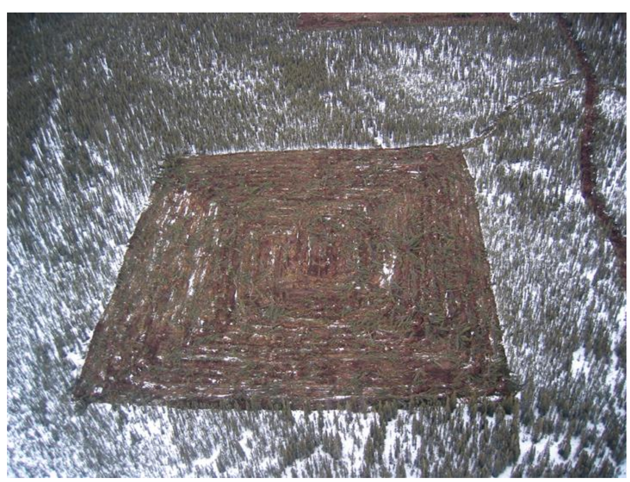
Clearing and forest thinning are increasingly seen as strategies to protect private property and infrastructure from boreal wildfires. Property sited in natural spruce-dominated forests are often considered high risk due to the intensity of fires in this fuel type when it burns. Although vegetation treatments can reduce fire potential, they may have unintended ecological effects, but there has been little published on possible impacts—especially for Alaska. So the recent publication (Melvin, *et al.* 2017) of a study on sites managed as fuel treatments by an interdisciplinary team of researchers is an important addition to regional management resources. In fact, it probably represents the FIRST paper specifically on how fuel-reduction affects carbon and nutrient pools, permafrost thaw, and successional trajectories. However, the authors also summarize some published impacts from related management actions like boreal logging and bulldozed firelines.

Thinning treatment near Delta, Alaska, 4 years post-treatment (J. Hrobak, 2006).



Interior Alaska Study Location

The 19 sites in the study (above: Figure 1 from Melvin, *et al.* 2017) are managed by numerous Alaska agencies covering a large swath from Nenana to Deltana, and were sampled at various ages from 2-12 years post-treatment. The most common operational fuel reduction treatments use hand thinning or winter bulldozer clearing—called "shearblading" (intended to clear trees and brush but leave the organic soil and moss mat relatively intact). Mechanical thinning tends to be faster and less expensive than hand thinning, but comes with other trade-offs. A concurrent research project (Little, et al. JFSP 14-05-01-27) is studying the duration of effectiveness and economic impacts of various forest treatments in Alaska.



Shear-bladed experimental fuel treatment at Nenana Ridge site (D. Haggstrom, 2006).

Summary of Results

It should come as no surprise that shearblading eliminated virtually all of the above-ground storage of carbon (C) during the first decade post-treament, as these treatments aim to reduce biomass. C storage in the organic layers of moss were reduced by about half in shearbladed treatments. Thinned treatments were intermediate in carbon storage between shearbladed and untreated stands, but notably most of the organic layer carbon storage—the largest C reservoir-was mostly preserved.

Deciduous seedlings (mostly birch) were most numerous in shearbladed stands (averaging 6/m^2) whereas in thinned stands conifer/deciduous seedlings were about equal in numbers. Unmanaged stands had by far the most conifer seedlings (or "layering" trees)—just over 1/m^2. An important finding was the documentation of impacts of seasonal thaw depth (active layer): thinned stands were thawed about 13 cm deeper than adjacent undisturbed forest. In contrast, shearbladed treatments were thawed an average of 46 cm deeper by mid-July or August. The management implication is that shearblading may not be the treatment of choice where adjacent infrastructure or watersheds rely on keeping permafrost intact. It is also important to remember that climate warming itself is warming permafrost and some areas may be very close to thaw temperature (Lara, et al. 2016)—so fuel reduction treatments are not the only threat to destabilization, but it would be negligent not to consider potential impacts while planning fuel management activities. Differences in understory plant composition were also documented, which will be important for determining potential positive or negative impacts on wildlife habitat and subsistence activities.

Management Implications

While fuel reduction treatments are important for lessening wildland fire risks, they do represent a novel disturbance to the forest inducing changes in forest structure, carbon storage and nutrient dynamics, and permafrost stability. These impacts should be considered in planning treatments.

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Firefighters burn debris piles in a thinned fuelbreak strip to protect a neighborhood outside Ft. Wainwright's Badger Road gate in the fall (R. Jandt, 2000).

Citation

Lara, M.J.; Genet, H., McGuire, A.D.; Euskirchen, E.S.; Zhang, Y; Brown, D.R.N.; Jorgenson, M.T.; Romanovsky, V; Breen, A; Bolton, W.R. 2016. *Thermokarst rates intensify due to climate change and forest fragmentation in an Alaskan boreal forest lowland.* Global Change Biology 22(2):816-829.

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