Conservation planning in a changing climate

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Summary

- Harvesting old forest reduces conservation values and carbon values and does not increase resilience or resistance to wildfire—the only reason to harvest is economic
- Post-disturbance harvest "salvage" reduces conservation values and carbon values and does not increase resilience or resistance to wildfire—the only reason to salvage is economic
- For conservation, carbon and resilience, retain sufficient area (>30% of the landscape) in spatial reserves
    - Focus on primary forest (old forest + young natural)
    - If old forest is disturbed, consider it as valuable natural young forest

Context

New Forest Landscape Plans must address the changing climate. **Wildfires have increased** in frequency, severity and extent, globally, in western North America, and in interior BC[1] due to hotter, drier weather[2] and changed landscapes.[3] **Sub-boreal landscapes have become homogenised** due to colonisation, fire suppression and resource management.[4] Homogeneous landscapes are less resistant to wildfire.[5] Planning in this changing world requires strategies to

- promote landscape resilience
- maintain ecological value and
- maintain carbon.

Objective: Promote Landscape Resilience

Historic role of fire

- **Fire shaped the historical sub-boreal landscape**, creating resilient mosaics of forests of different age and type, and leaving structural legacies within stands
    - In interior BC, 33% of plateau SBS forest and 50% of high elevation ESSF forest would naturally be old (>140 years old; 29% of ESSF would be >250 years)[6]
    - Old forest patches are likely refugia from disturbance that vary with topography, moisture and prevailing winds[7]
    - Remaining area would be primary forest "natural young forest" with legacies left from wildfire, indigenous burning and insect outbreaks
        - Fires leave considerable structure in patches of live trees and burned snags that remain for decades[8]
        - Even the recent high intensity wildfires left 10 – 25% of the stand unburned[9]
        - There is no clear interaction between insect outbreaks and fire area or severity.[10]
    - Natural young forests host specialised organisms including beetles, woodpeckers and other birds[11]
    - Burned forests resist wildfire[12] and recover old growth values quickly[13]

Strategies that promote resilience

- **Maintain and encourage deciduous stands**

    - Deciduous stands burn less or at lower severity[14] and are part of a resilient mosaic[15]
- **Use managed fires** when risk of spread is low [16]
    - Learn from indigenous practices
- **Broadcast burn after harvest**
    - Site preparation was consistent with lower probability of burning in recent severe wildfires[17]

Strategies to avoid for resilience

- **Thinning mature stands decreases wildfire resistance**
    - Thinning (without under-burning) can increase surface fuels, increase sub-canopy wind, and dry surface fuels, potentially leading to increased ignition and intensity, particularly under high fire weather conditions[18]
- **Thinning and under-burning mature stands is inappropriate in sub-boreal ecosystems**
    - Thinning of small trees with under-burning reduces short-term wildfire intensity in some ecosystems[19]
    - While thinning with under-burning can be effective in dry forest ecosystems with thick-barked species (e.g., NDT4 forests), it is not appropriate in thin-barked sub-boreal and montane forests,[20] or in conservation zones[21]
    - Thinning with under-burning can decrease long-term resilience by increasing mortality and vulnerability of overstory trees[22]
- **Logging old forest will not decrease wildfire risk**
    - Old forest is not more likely to burn and is less likely to ignite
        - Old forest generally has lower temperatures, higher moisture and lower wind than younger forest[23]
        - In the Pacific Northwest, old forest with the most protection was least likely to burn even though it had higher fuel load; managed forests burned more[24]
        - Old growth was not more likely to burn in a recent severe wildfire in BC[25]
        - Even intense management only reduced modeled burn probability slightly[26]
- **In general, fuel reduction is ineffective**
    - Weather generally overwhelms the effects of fuel on wildfire spread[27]

Objective: maintain and restore conservation values

Strategies that maintain conservation values

- **Maintain sufficient primary forest to allow continued disturbance** (i.e., more than target amount of old growth)
    - At least 30% of the landscape to avoid high risk; see separate note[28]
    - If old forest is disturbed, it becomes valuable natural young forest
- **Develop a spatial conservation network that represents all ecosystems**
    - Emphasise climate and disturbance refugia[29] including riparian ecosystems, moist sites, sites leeward of large water bodies[30] and old forest[31]
    - Spatial networks can be designed to address connectivity (important for migration) and capture climate refugia
- **Maintain existing old forest within spatial conservation network**
    - Old forest is rare and valuable on the landscape and acts as a source for recovery
    - Old growth is not more likely to burn, and is less likely to ignite

- If it does burn, it retains some old growth values and provides natural young forest values

Strategies to avoid for conservation

- **Managing to the minimum will fail to achieve targets**
    - Because conservation areas will be disturbed at natural rates, the amount of old will always be less than the target
- **Aspatial (or dynamic spatial) reserve systems are ineffective**
    - Aspatial targets fail to achieve objectives[32]
    - Harvesting bias will draw down aspatial reserves; old forest will be salvaged and replaced with young already-harvested forest with low conservation value
    - The lack of old forest in interior landscapes precludes options for replacing reserves with others of equal value[33]
    - Aspatial reserves cannot address connectivity or climate refugia

Objective: maintain carbon values

Strategies to maintain carbon values

- **Promote resilient landscape**
- **Use nature-based solutions** where conservation areas also address carbon[34]
    - Proforestation and conservation to maximise carbon stores before 2050
- **Retain productive old forest** with highest carbon stores
- **Retain the biggest trees** during thinning[35]
- **Retain forest less likely to burn**, including deciduous stands, riparian forest, leeward of lakes and old forest

Strategies to avoid for carbon values

- **Do not harvest and plant old forest** (for carbon reasons)
    - Harvest releases ¾ of stored carbon (leaving ¼ in wood products)
    - Plantations support less carbon than the harvested forest[36]
- **Do not harvest post-disturbance** ("salvage")[37]
    - Burned areas resist wildfire[38]
    - Post-burn harvest increases fire risk[39]
    - Post-beetle harvest increases fire risk[40]
    - Snags decay very slowly, storing carbon for decades after disturbance[41]
- **Do not undertake site prep before planting disturbed forest**
    - Site preparation reduces carbon on the site for at least 60 years[42]
    - Planting after disturbance only captures increased carbon if legacies of disturbance remain on site[43]

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