**Fuels Reduction Treatments**

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**Outline**

- HFRA
- Fuels reduction treatments (definition)
  - Thinning
  - Mastication
  - Rx
- Thinning
  - Objectives
  - Target cover
  - Impact on fire behavior
  - Impact on fire severity
  - Impact of ecosystem health
  - Cost/Time
  - Limitations
- Mastication
- Rx
- Comparison
- Combination
- Discussion
  - Necessity
  - Effectiveness
  - Summary and Conclusion

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**Healthy Forest Restoration Act of 2003**

Approved hazardous fuels reduction plans for federal lands in the following areas:
1. Land directly around an interface or intermix community
2. Land located close enough to these areas that fire might impact them
3. FRCC condition class 3 or 2 located near municipal watersheds
4. FRCC condition class 3 or 2 where there is a significant threat posed to adjacent forests or rangelands (insects, disease, windthrow)
5. Areas containing threatened or endangered species if the treatment of these sites will improve conditions for the species (includes reducing the threat of catastrophic fire)

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**Fuels Reduction Treatments Why**

- What are we trying to accomplish?
  - Reduce the threat of crown fire
- How?
  - "Two stand structure variables are present in the Van Wagner (1977) crown fire model that can be affected by silvicultural activities to reduce susceptibility to crown fire" – Keyes and Ohara (2002)
  - Crown base height (CBH) – influences ability of fire to climb into the crowns
  - Crown bulk density (CBD) – influences ability of fire to move from crown to crown

What are our management objectives for treating the site?

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**Fuels Reduction Treatments Models**

Models such as FVS-FFE are used to establish a target CBH and CBD
**Fuels Reduction Treatments: Silvicultural methods**

- **Thinning**
- **Mastication**
  - "shred, flail, and crunch canopy and surface fuels into smaller sizes" – USFS RMRS
- **Prescribed burning**

**Thinning**

- **Objectives:**
  - Increase CBH
  - Reduce CBD
  - Offset operational costs by selling timber
  - Restore historical stand structure.

- **Target cover:**
  - Timber
  - Shrubs

- **Methods:**
  - Degree of thinning
    - Intensive harvest with only overstory remaining
    - Selective thinning
    - Hand lop
  - Slash
  - Leave on site
  - Mulch
  - Pile

- **Impact on fire behavior:**
  - Reduced spread into the canopy
  - Reduced occurrence of crown fire
  - Increases surface fire activity and spread

- **Impact on fire severity:**
  - May increase severity on the ground depending on the material left on the site
  - Increases surface fuels in the form of slash

- **Impact on ecosystem health:**
  - Remaining trees have more resources (light, water, nutrients)
    - Some areas may have less resources depending on regeneration of understory vegetation
  - Selective thinning could reduce certain species
  - Equipment impacts
    - Fragmentation (roads, trails)
    - Soil compaction
    - Increased access to the site
  - Nutrient removal

**Mastication**

- **Objectives:**
  - Lower fuel bed depth
  - Reducing potential for crown ignition
  - Reducing potential for crown fire spread
  - Increase decomposition rates
  - Generate more fine materials
  - Replace prescribed fire
  - Restore historical stand structure

- **Target cover:**
  - Shrubs
  - Understory growth

- **Methods:**
  - Define desired fuel outcome
  - Choose the right tool for the job
  - Some tools are faster or better in tight or steep units
  - Replace prescribed fire
  - Restore historical stand structure

- **Impact on fire behavior:**
  - Reduced spread into the canopy
  - Reduced occurrence of crown fire
  - Reduce rate of spread
  - Reduce fire line intensity (compaction)

- **Impact on fire severity:**
  - Increase residence time

- **Impact on ecosystem health:**
  - Soil compaction
  - Residual tree damage
    - Boles
    - Degrade growth impact
  - Relatively unknown effects on nitrogen cycling, soil water availability, and vegetation dynamics
Mastication

- **Cost/Time:**
  - $130 - $255/hr
  - Operation, maintenance, labor, profit, risk, etc.
  - $130 - $1275/acre (from 1 to 0.2 acres per hour)

- **Limitations:**
  - Increase surface fuels in the form of chips
  - No standardized methods to estimate fuel loading
  - Shape is different so hard to predict
  - Little is known about how masticated fuels burn
  - Concern about adding so much carbon that nitrogen becomes very limiting (C:N ratio high)

[Source](http://www.fs.fed.us/rmrs/research/highlights/masticated-fuels/)

Prescribed burning (broadcast)

- **Objectives:**
  - Remove surface fuels
  - Kill small-diameter live stems
  - Recycle nutrients
  - Promote growth of herbaceous plants
  - Increase habitat and food source for animals

- **Target cover:**
  - Understory vegetation and cover (grass, needles, leaves, etc.)
  - Shrubs and small trees

- **Challenges:**
  - Less consistent than mechanical treatments
  - Accepting risk
  - Limited number of days in prescription

[Source](http://www.fs.fed.us/ffs/docs/Chalmers%20&%20Hartsough.pdf)

Prescribed burning

- **Impact on fire behavior:**
  - Reduces surface fuels for a short time
  - Raises CBH

- **Impact on severity of subsequent fires:**
  - Reduced fuel severity reducing duration of fire in case of wildfire
  - May increase fire fuels allowing fire to move through faster

- **Impact on ecosystem health:**
  - Recycling nutrients may lose some N
  - Reduction of herbaceous understory plants
  - Potential defoliation
  - Effect on wildlife
  - Damage to trees from burning
  - Control impacts
  - Frequent fires
  - Negative

[Source](http://www.fs.fed.us/ffs/docs/Chalmers%20&%20Hartsough.pdf)

Prescribed burning: Costs

- **Highly variable**
  - Size of the unit
  - Amount of personnel and equipment needed (complexity)

- **Cleaves et al. (2000) study of USFS**
  - $23 - $223/acre
  - North and West - highest, South and East - lowest

- **Costs are higher when (Cleaves and Brodie 1990)**
  - Fireline construction costs more in rugged terrain
  - High edge-to-area ratio
  - When mop-up requirements are higher
  - High potential damage from escape
  - Smoke management is stringent
  - Aesthetics are a major concern
  - Safety of people and property is threatened
  - Escapes

[Source](http://www.fs.fed.us/ffs/docs/Chalmers%20&%20Hartsough.pdf)

Prescribed burning

- **Limitations:**
  - Risks
    - Escape
    - Burning too intensely
    - Exposure to personnel
  - Not meeting reduction objectives
    - Reducing CBG

- **Costs:**
  - $100 - 1000+
  - Increased surface fuels

- **Mastication:**
  - Reduce spread into canopy
  - Reduce spread from crown to crown
  - Reduced ROS
  - Reduced FLI
  - Better fire spread
  - Reduced spread into canopy
  - Increase surface fire activity
  - Soil compaction
  - Residual tree damage
  - Equipment impacts
  - Nutrient effects
  - Fire intensity
  - Fire severity
  - Ecosystem Health
  - Cost per acre

[Source](http://www.fs.fed.us/ffs/docs/Chalmers%20&%20Hartsough.pdf)
Combination

Most fuels reduction projects involve >1 treatment
- Rx fire is often used after thinning or mastication
- Reasons for not using Rx fire
  - WUI
  - Smoke concerns
  - Manager unwilling to risk escape
  - Concern about intensity and severity of the burn
    - some of these are mitigated by waiting a few years after treatment
- Maintenance:
  - Once treated, many sites are maintained by Rx burning
  - When there are the above concerns, less intense mechanical treatments can be done to maintain.

Idaho Forest Practices Act requires mitigating hazard

Discussion

If management is responsible for the buildup of fuels, can we trust that removing fuels through management won’t have unintended consequences?

Should we just let nature take its course?

Summary and Conclusion

1. Define stand objectives
2. Set target fuel loading
3. Implement appropriate strategies to meet your fuel loading target and other management objectives
4. Make and implement a follow-up treatment plan

Two reasons to maintain stands at or near rather than below calculated density targets (Keyes and Ohara 2002)
1. Higher densities encourage self pruning and rapid crown recession
2. An open overstory allows for more development in the understory

Questions?

References

- Bob Rummer, Mechanical tools for fuels reduction treatments. Southern Research Station.Auburn Alabama.