Forest Bioenergy and Biofuels Integration:

Sustainability, Energy Balance and Emissions from Forest Restoration in the Southern Rocky Mountains

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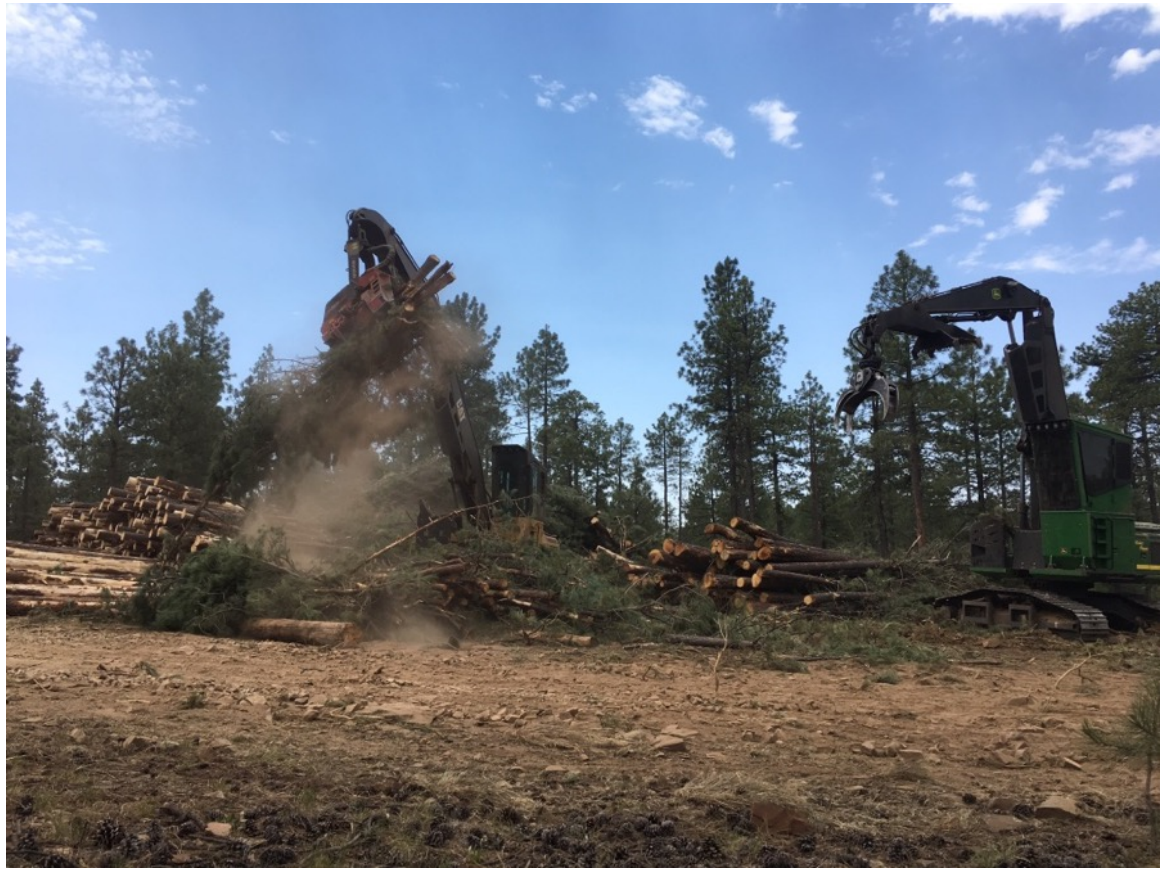
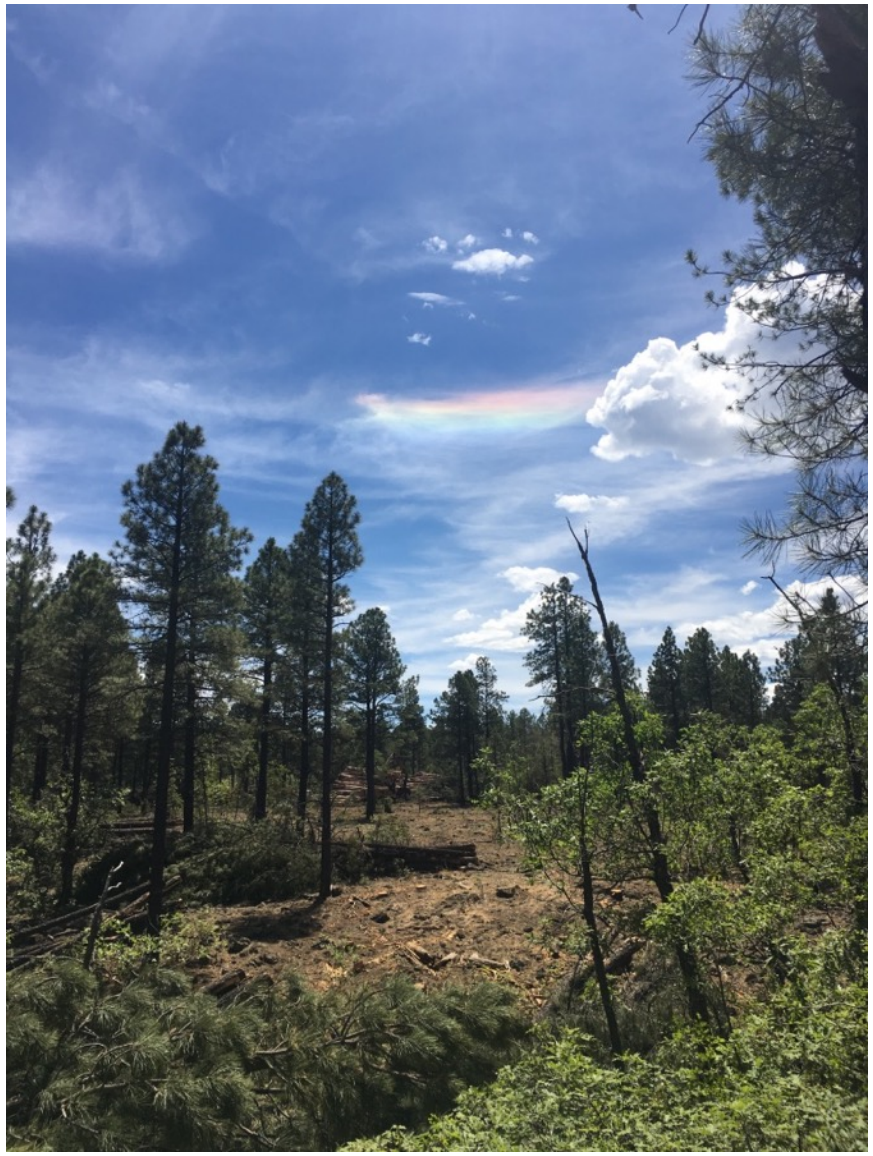
Overview

- Project goals
- Methods
- Early results/observations



ForBio Southwest

- Project Goals:
  - How can biomass from restoration be harvested and processed most efficiently and effectively;
  - How does biomass harvest affect forest ecosystems; and
  - How does harvest and use impact local air quality, greenhouse gas emissions and carbon balance?

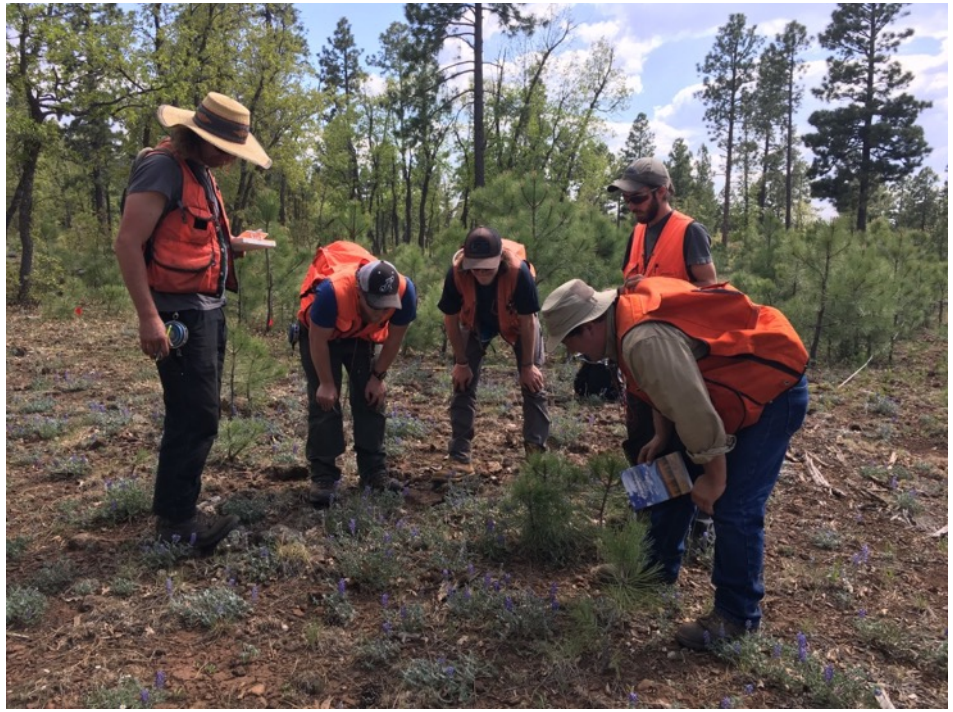


Operations Research

- Summer 2017
  - Spend at least 10 operational days on each of 5 “typical” operations in the Southern Rocky Mountains
  - Estimate current production rates and costs for integrated forest restoration treatments
  - Work with operators on project areas they already have under contract
- January 2018
  - Return to operators with results and suggestions for improvements, including:
    - Changes to increase efficiency/lower costs of production
    - Changes to improve environmental performance
- Summer 2018
  - Return to same 5 operations and observe “improved” harvest operations
- Summer 2019
  - Report results

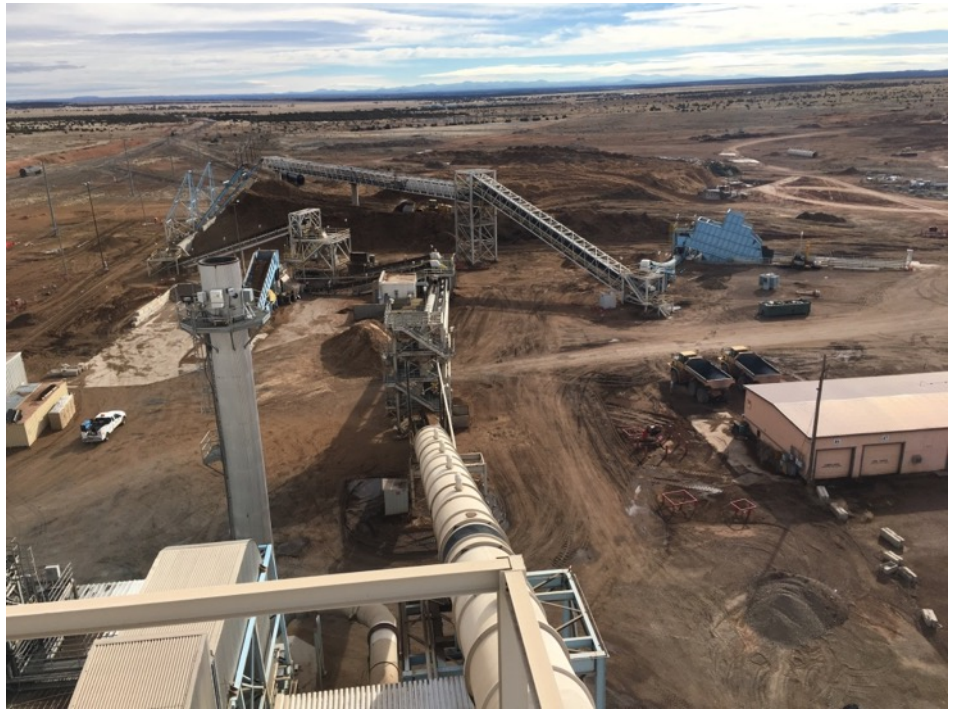
Forest Ecology

- For all operations research sites:
  - Pre-harvest assessment of:
    - Overstory vegetation
    - Understory vegetation
    - Fuels
    - Soil density
    - Disturbance history
  - Post-harvest assessment one year post-treatment (may include a burn treatment)
- Retrospective sites
  - Approximately 5 forest restoration activities completed 5-10 years prior near each active operation
  - Same field protocol is used as in pre- and post-treatment sites
- Control sites
  - At least one control site near each active operation



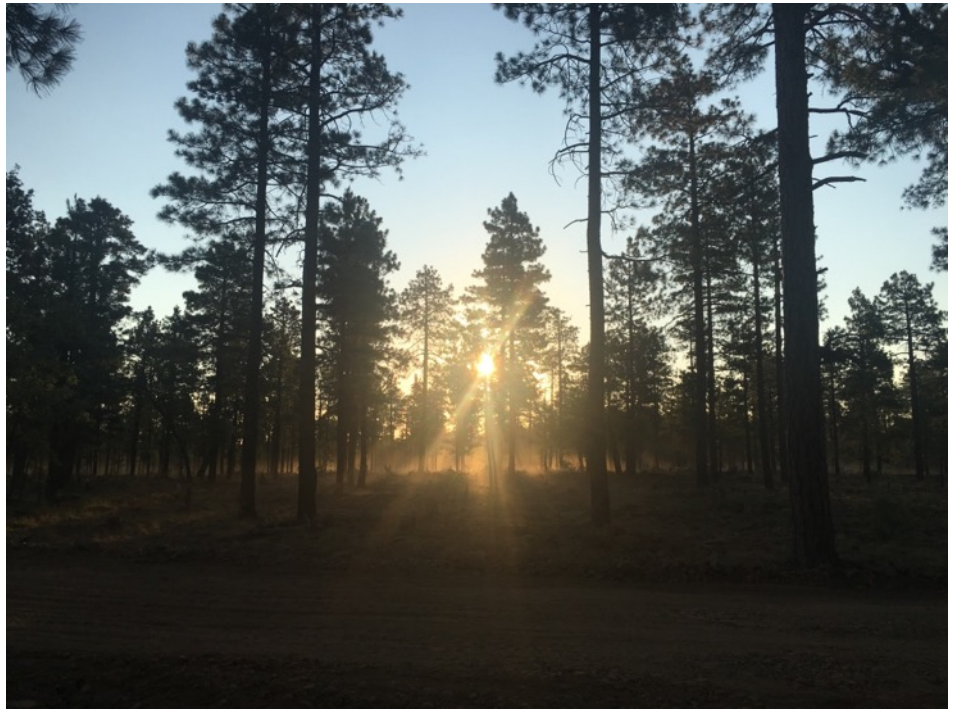
Analysis of Tradeoffs

- Non-market analysis of public health benefits of using forest biomass for energy production versus “standard” fossil fuels



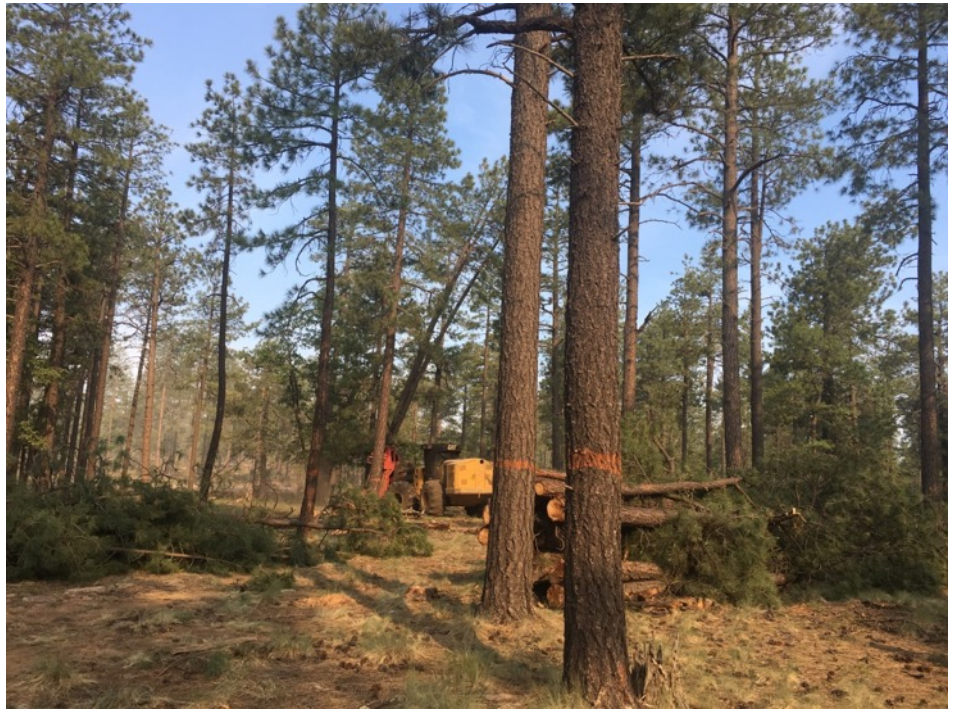
Summer 2017 Observations

- June - 2 operations in northern Arizona
  - "Standard"-sized mechanical whole-tree
  - Large mechanical whole-tree
- July – 2 operations in northern New Mexico
  - Mechanical whole-tree
  - Harvester/skidder
- August – southern Colorado
  - Mechanical whole-tree



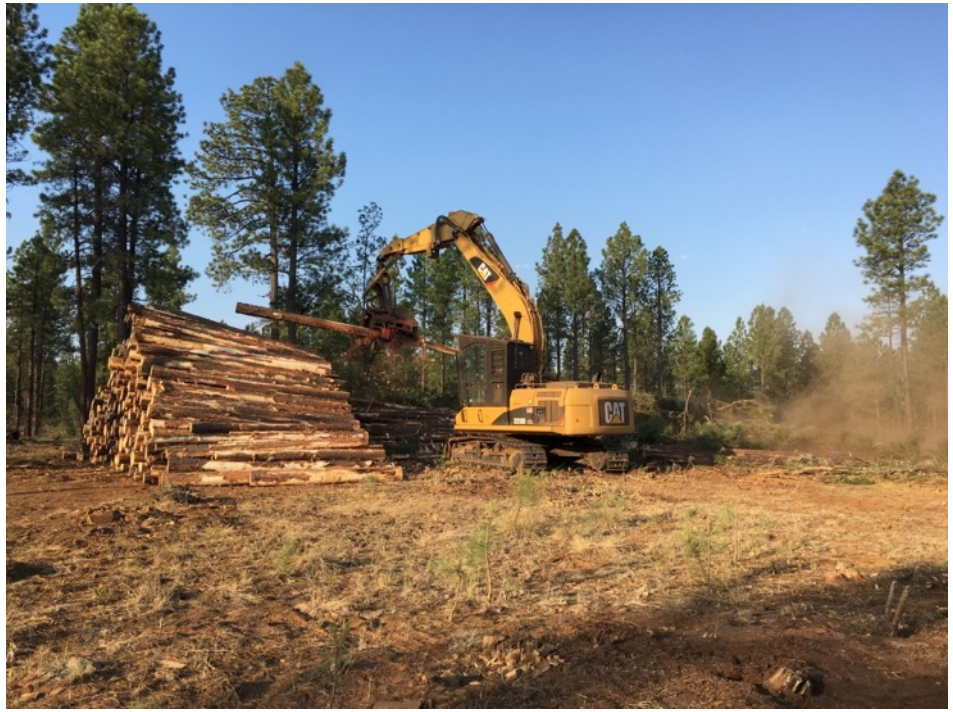
AZ – “Standard” Mechanical Whole-Tree

- Rubber-tired feller-buncher
- Rubber-tired grapple skidder
- Dangle-head processor at landing
- Log loader and double-bunk straight log trucks
- Grinding of residuals, 54’ chip vans



AZ – "Standard" Mechanical Whole-Tree

- Rubber-tired feller-buncher
- Rubber-tired grapple skidder
- Dangle-head processor at landing
  - 4.5"-16"x16' sawlogs: hue saw sawmill producing green dimensional lumber for the Mexican market
  - >16"x16' sawlogs: sawmill producing pallet stock and green dimensional lumber for the Mexican market
  - 2'-4.5" diam logs plus cull logs up to 16': shipped as logs to pellet manufacturer
- Log loader and double-bunk straight log trucks
- Grinding of residuals, 54' chip vans



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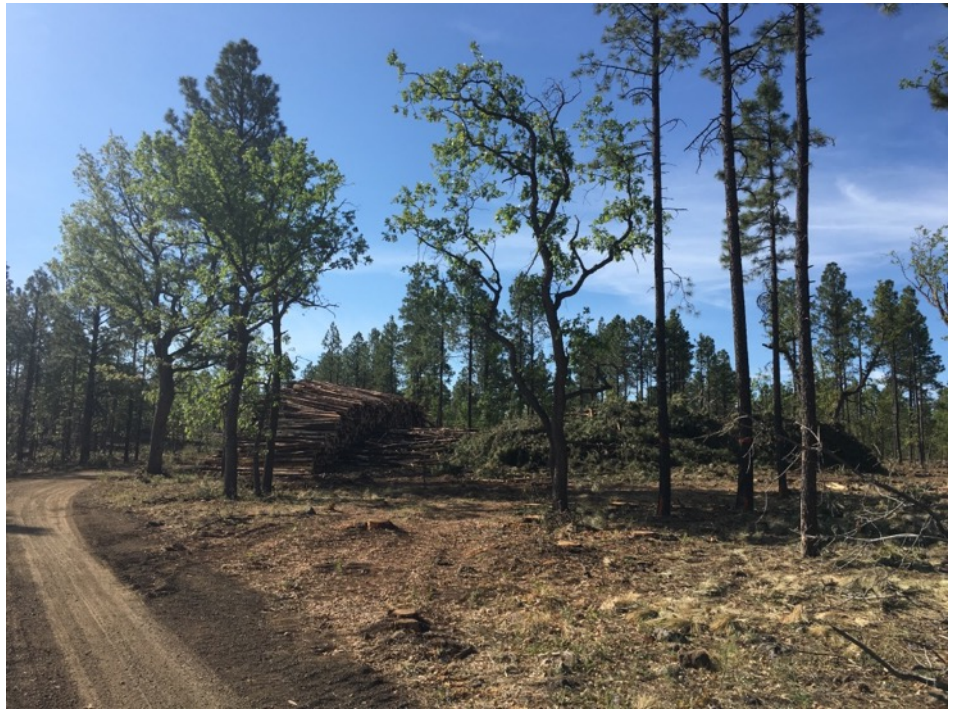
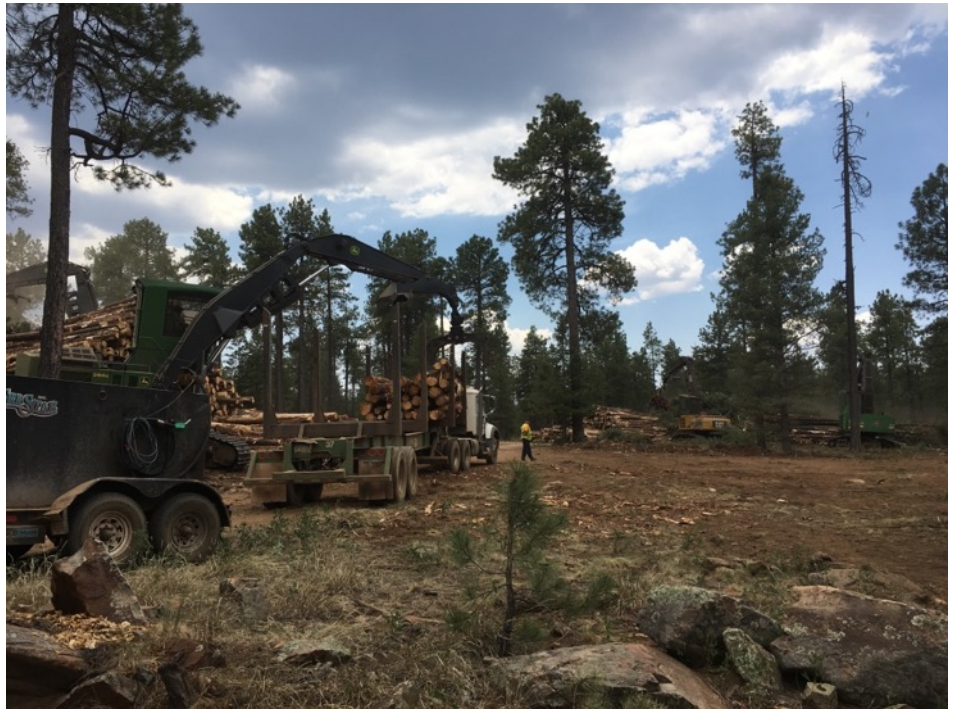


Observations

- Appears to be most efficient crew studied
- Issues maintaining reliable truck drivers

AZ – Large Mechanical Whole-Tree

- (3) Rubber-tired hot saws
- (2) “Large” rubber-tired grapple skidders
  - Skidding of sawlogs
- (2) “Small” rubber-tired grapple skidders
  - Skidding of “PCT” piles (non-sawlog)
- (1) Log loader for sorting at the landing
- (2) Dangle-head processors at landing
  - >16”x16’ sawlogs: railroad tie plant
  - 4.5”-16”x16’ sawlogs: hue saw sawmill producing green dimensional lumber for the Mexican market
- Log loader and double-bunk straight log trucks
- Grinder and 54’ chip vans



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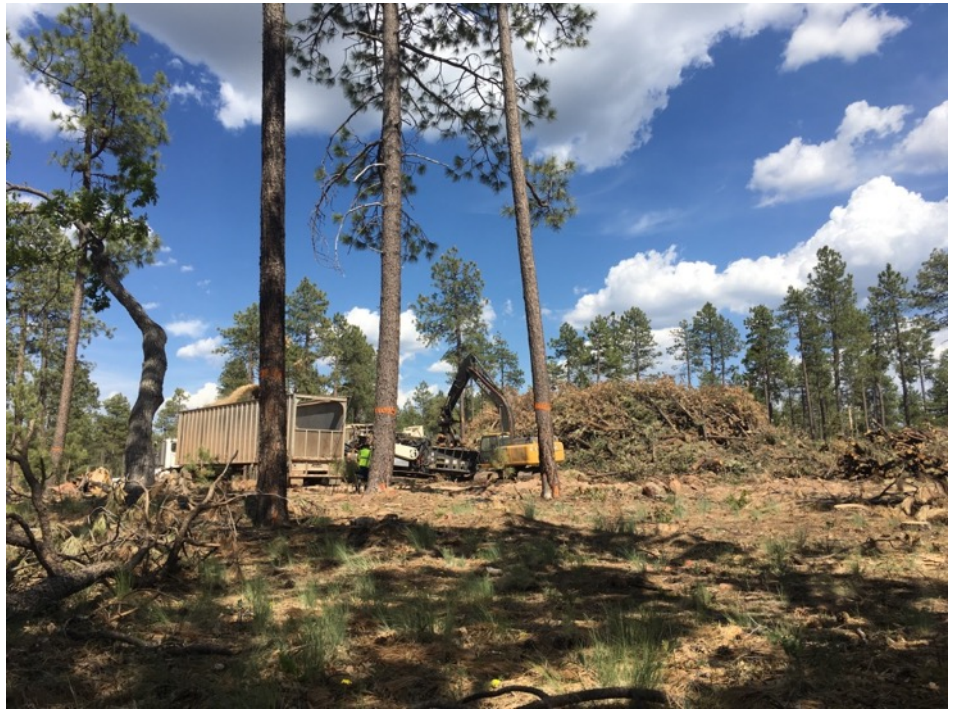


Resulting Analysis Questions

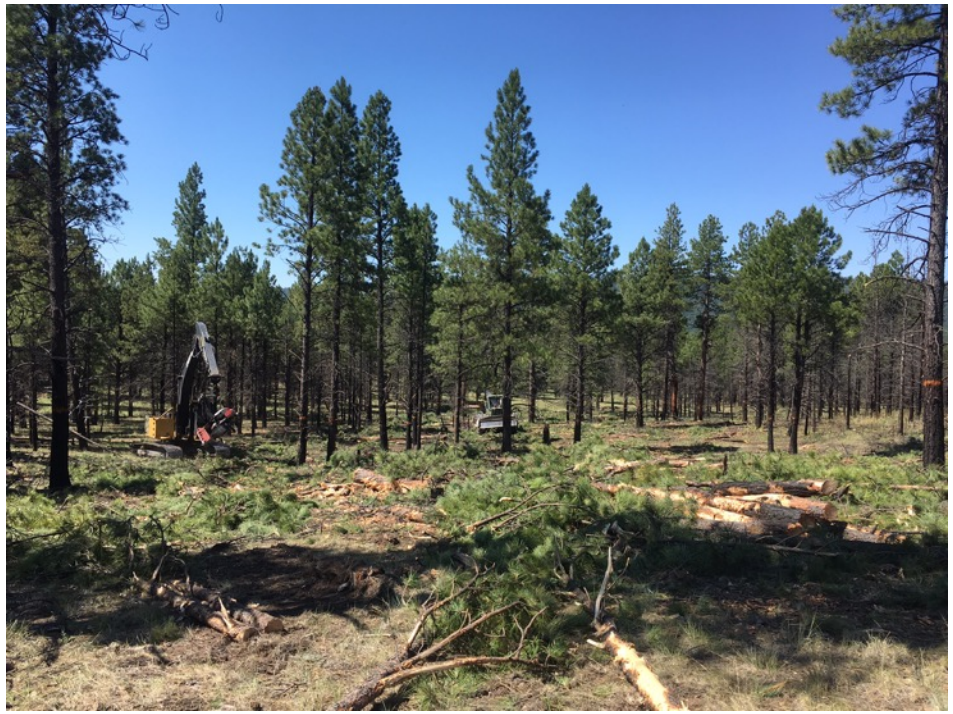
- At what point does it pay to separate the processing and skidding?
- Is it beneficial to separate skidding of logs and non-merch?
- Does Saturday production pay?
- Would a production bonus/incentive program increase worker productivity and efficiency?
- Would cross training improve productivity and efficiency?

Observations

- “Buddy falling”
- Span-of-control issues
- Inefficient machine operators (grinding and skidding in particular)

NM – Harvester/Skidder

- Harvester for felling and processing in-woods
  - >4.5”x>8’ (2’ multiples)
- Rubber-tired grapple skidder
- Dangle-head processor for loading
- (2) stinger-steered long-log trucks, one straight truck for long-logs, one flatbed with double log bunks



Analysis Questions

- How much is slash dispersal for later prescribed burning costing this operation (whole-tree versus log-length)?
- How much is loading with a dangle-head processor costing this operation?
- Would some degree of sorting in the woods benefit efficiency?
- Should this operation switch to a hot saw or use two harvesters?

Observations

- Skidder adjusted production based on available logs
- Mechanical break-downs a significant issue
- Loading involved a great deal of time sorting logs

NM – Mechanical Whole-Tree

- Tracked, self-leveling hot saw
- Rubber-tired grapple skidder
- Dangle-head processor operating both at landing and in woods
  - >2.5”x>8’ (25’, 27’, 29’ preferred) shipped to two integrated mill facilities (pellets, vegas, green dimensional lumber, paneling, post and pole, firewood); other small sawmill operations
- (2) Prentice truck-mounted loaders with (2) stinger-steered log trucks; (1) self-loading log truck

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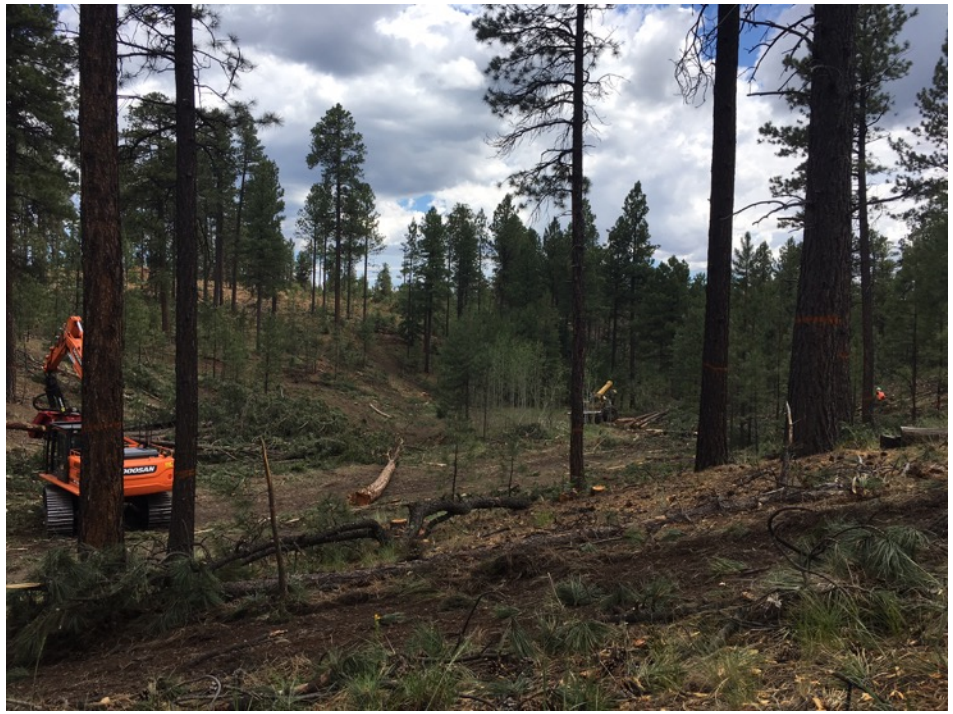

Analysis Questions

- Does in-woods processing from decks (and subsequent re-skidding of logs) make up for reduced slash dispersal cost?

Observations

- Truck-mounted loaders reduced landing configuration options, reducing processor production
- Inexperienced operators confound results
- Mill demand limited in-woods production

CO – Mechanical Whole-Tree

- TBD….

Early Observations

- Markets are currently limiting production
- Most operations are comparably small and consist of a single side
- All operations studied utilized clumpy-gappy silviculture and stewardship contracting authority
- Three out of four operations: incremental improvements to work flow and procedures

Questions?

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