

Assessing the economic feasibility of remote sensing inventory techniques and alternative harvesting methods in western juniper

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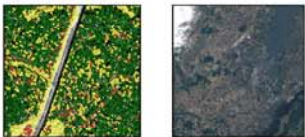
The ecological need

- Due to overgrazing and fire suppression, there has been significant encroachment of western juniper (*Juniperus occidentalis*) on historical grassland savannah and sagebrush-steppe ecosystems.
 - 3 million hectares historically compared to 30 million hectares presently (Johnson and Miller 2006)
- Extremely high water usage
 - In early spring, individual trees can use up to 20 gallons per day; use water earlier in spring before other plants begin to grow (Bedell et al. 1993)
 - On warm summer days, an 18" tree can transpire 30-40 gallons per day (Bedell et al. 1993)
- Increased soil erosion from overland flow due to the lack of ground cover vegetation

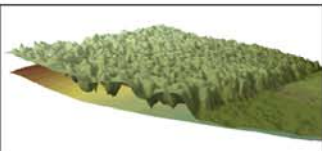
Data options for inventory methods

• Promising data types for forest biomass estimation include:

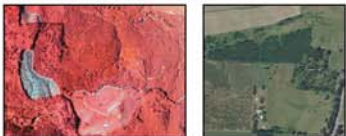
- Satellite imagery



- LiDAR



- Aerial imagery (ortho-rectified)

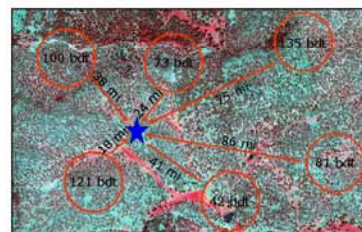


Inventory by remote sensing

- Traditional ground-based techniques are both:
 - Time consuming
 - Costly
- Remote sensing has the potential to add value to the harvest planning process by:
 - Enhancing precision and accuracy of estimates
 - Providing a direct cost savings
 - A combination of the two
- Potential benefits are dependent upon:
 - Cost of imagery at necessary spatial scale
 - Cost of analysis
 - Quality of data
- Remote sensing data is a potential tool to estimate:
 - Stand density
 - DBH
 - Biomass volume based on:
 - Crown area
 - Crown volume
- Remote sensing provides a continuous dataset across a given area of interest
 - Stand-level analysis
 - Landscape level analysis

Predicting cost of biomass supply

Since transportation distance can have a significant effect on the cost of feedstock for a facility, spatially explicit inventory methods could be used to predict the delivered cost of material from a defined area on any temporal scale. This could aid in citing facility locations to determine sustainable supply and economic viability.



Small-scale harvesting options

For the wildland-urban interface, environmentally and socially sensitive areas, or other niche applications where production efficiencies are not of highest priority, equipment utilizing basic harvesting technology can be effective to remove forest fuels

- All-terrain vehicles (ATVs)



- Small farm-based equipment:

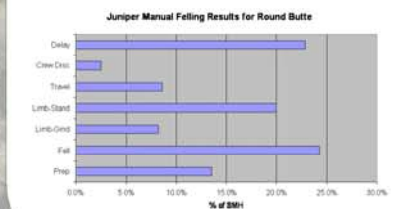


- Benefits of small equipment include:

- Low initial investment cost and operating cost
- Low potential for significant site impacts, both in terms of stand damage and soil compaction
- Enhance utilization of low value products
- Versatility for forest contractor
 - Fuels reduction
 - Wildland firefighting
 - Farm / ranch functions

Example ATV Juniper harvesting project

- Juniper restoration harvest on the Crooked River National Grasslands (USFS)
- Cooperation with GeoVisions, Inc.; a subsidiary of The Confederated Tribes of Warm Springs
- Harvesting operation includes:
 - Manual felling
 - ATV transport w/skidding arch
 - On-site chipping
 - Transport with innovative biomass trailer
- Only manual felling component completed
 - Shift-level studies
 - Activity sampling
- Preliminary activity sampling results for manual felling
 - Scheduled time per tree = 2.1 minutes
 - Trees/hr = 28.6
 - Breakdown of scheduled time below:



For more information

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