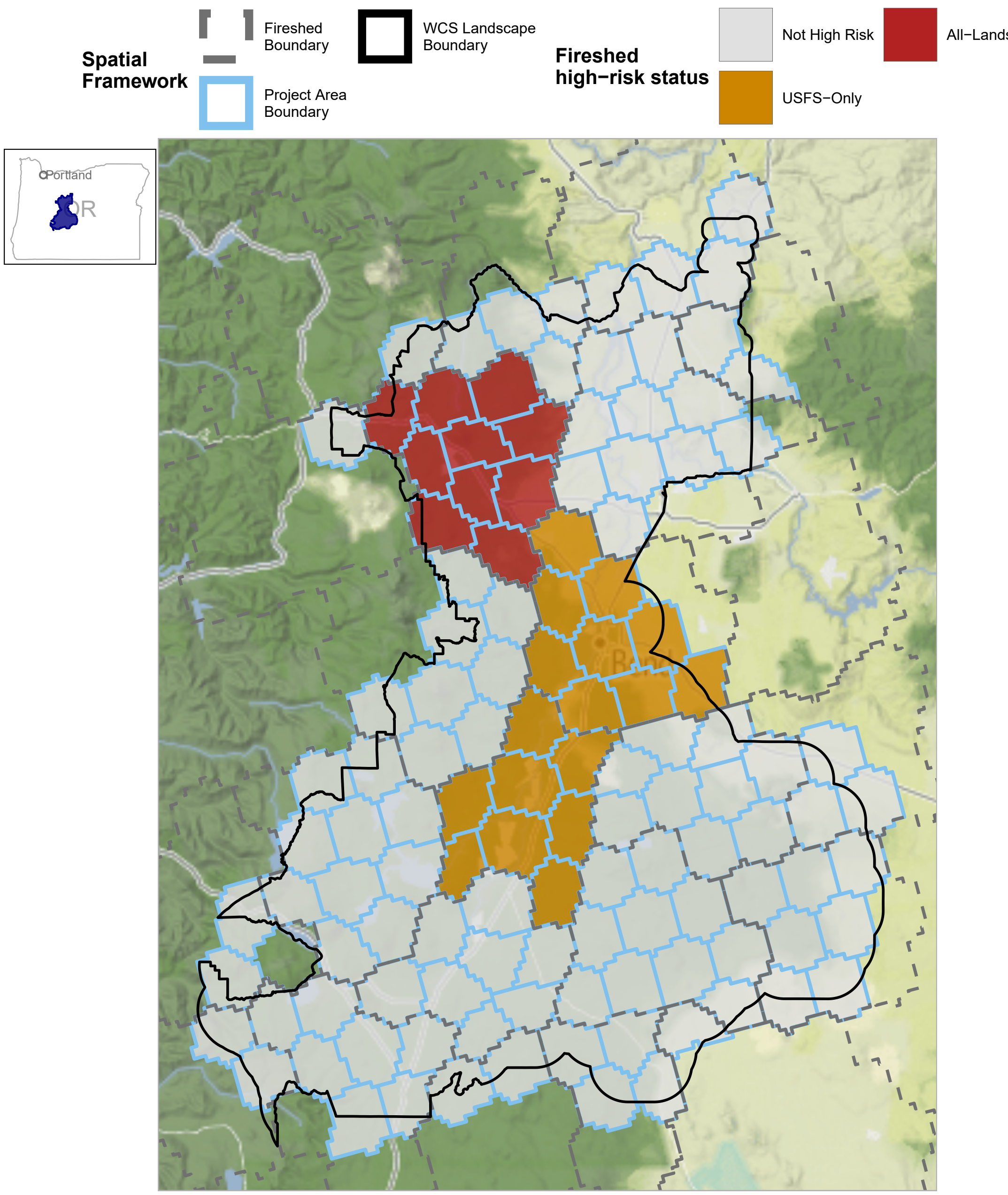
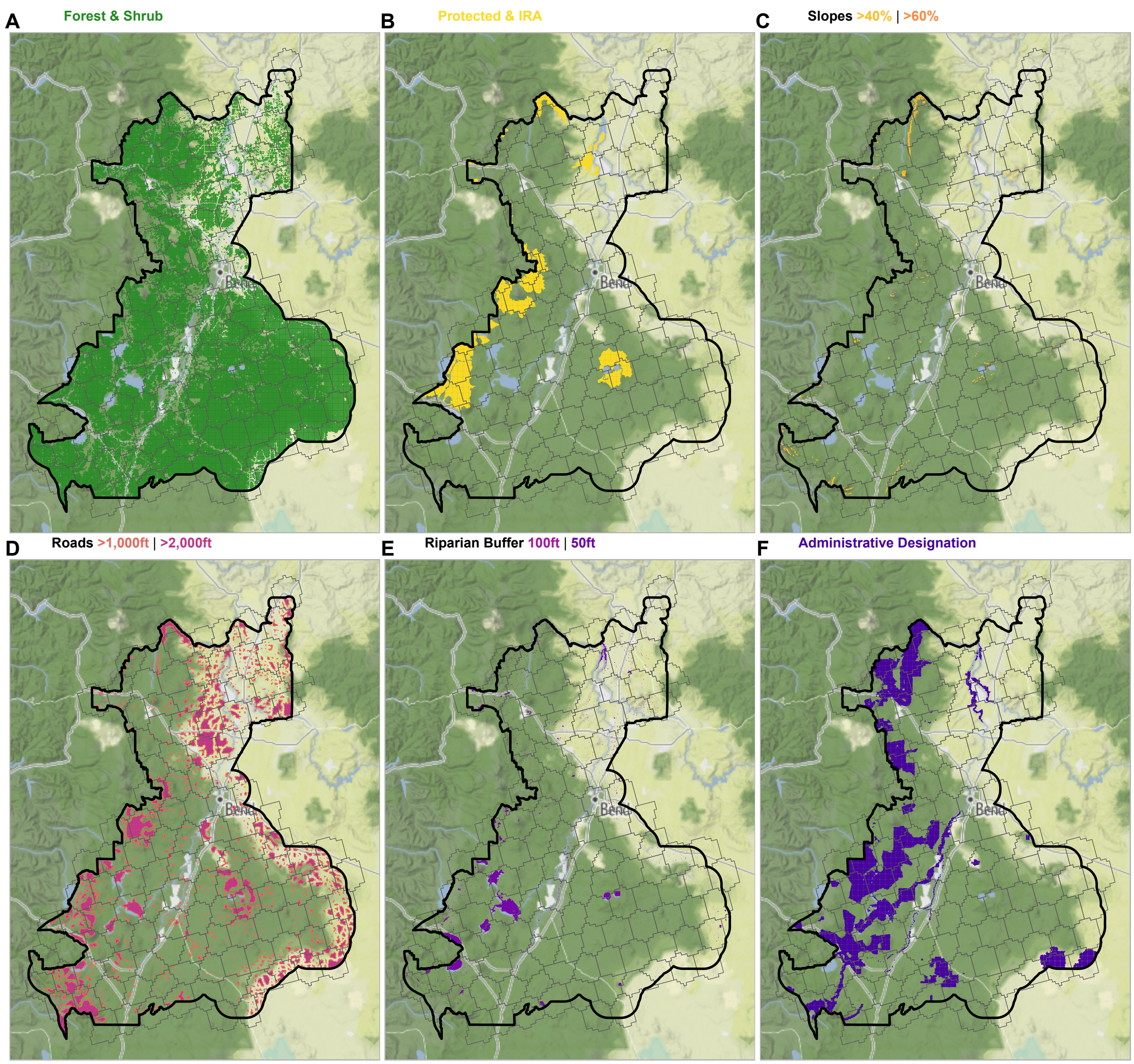
Influence of Physical and Policy Constraints to Mechanical Fuel Operations on the Central Oregon Wildfire Crisis Strategy Landscape



The Central Oregon priority landscape (black outline) identified in the USFS Wildfire Crisis Strategy, hereafter called the Strategy, located in Oregon (see map inset) covers 2,727k acres (1,103k ha). We used the nested spatial framework for firesheds (gray dashed outline; Ager et al. (2021)) ~250,000 acres (100,000 ha) in size which are the broad scale unit of prioritization and nested fireshed project areas (light blue outline) ~25,000 acres (10,000 ha) in size which are used for planning and conducting vegetation management projects. Fireshed project areas are shaded by risk to communities of the parent fireshed with the highest risk firesheds selected in the Strategy shaded red (multiple ownerships) and orange (USFS ownership only).

The Central Oregon landscape includes 27 high-risk fireshed project areas (shaded red and orange) that cover 688k acres (278k ha). There are 17 high-risk project areas managed solely by USFS (shaded orange) that cover 440k acres (178k ha). There are 10 high-risk project areas managed by multiple owners (shaded red) that cover 248k acres (100k ha).

Constraints tested for mechanical operability



The above maps show the layered operational constraints were considered in order to quantify the amount of land avail- able for mechanical forest health and risk reduction fuel treatments. The map identifies (A) forest and shrubland vegeta- tion, (B) protected and inventoried roadless areas, (C) areas exceeding either 40% or 60% slopes, (D) areas greater than either 1,000 ft or 2,000 ft from existing roads, (E) areas within either 100 ft or 50 ft riparian buffers, and (F) areas with administrative designations (e.g., sensitive species habitat, conservation areas).

Layered operational constraints were considered in order to quantify the amount of land available for mechanical forest health and risk reduction fuel treatments. In the Central Oregon landscape, this analysis (A) identified 2,371k acres (959k ha) of forest and shrubland representing the total land available for treatment given no constraints, (B) identified 179k acres (72k ha) of protected and inventoried roadless areas (IRA), (C) classified 92k acres (37k ha) as >40% slope terrain and 21k acres (8k ha) as >60% slopes, (D) determined 551k acres (223k ha) were >1,000 ft and 195k acres (79k ha) were >2,000 ft from existing roads to represent possible equipment haul distance, (E) identified 261k acres (106k ha) as within 100 ft and 195k acres (79k ha) within 50 ft riparian buffers, (F) and identified 410k acres (166k ha) within administrative boundaries.

Scenarios used to determine mechanical operability

A hierarchy of constraints was used to determine whether mechanical equipment was allowed and operationally feasible for this analysis. Spatial constraints were overlaid from L1 through L5 to determine what land is mechanically available or constrained and by what factor.

The table below shows the three scenarios developed to represent a gradient in funding, policy, and management options based on the constraining factors to mechanical operability (e.g., slope, road access, riparian buffers, and administrative designation)

	Constraint type	Scenario 1 most constrained	Scenario 2	Scenario 3 least constrained
L0:	NLCD Cover Type	Forest or Shrubland	Forest or Shrubland	Forest or Shrubland
L1:	Protected or IRA Status	Not Protected	Not Protected	Not Protected
L2:	Slope	<40%	<60%	<60%
L3:	Distance to Nearest Road	<1,000ft	<2,000ft	<2,000ft
L4:	Riparian Buffer	>100ft	>100ft	>50ft
L5:	Administrative Designation	No Designation	No Designation	Any Designation

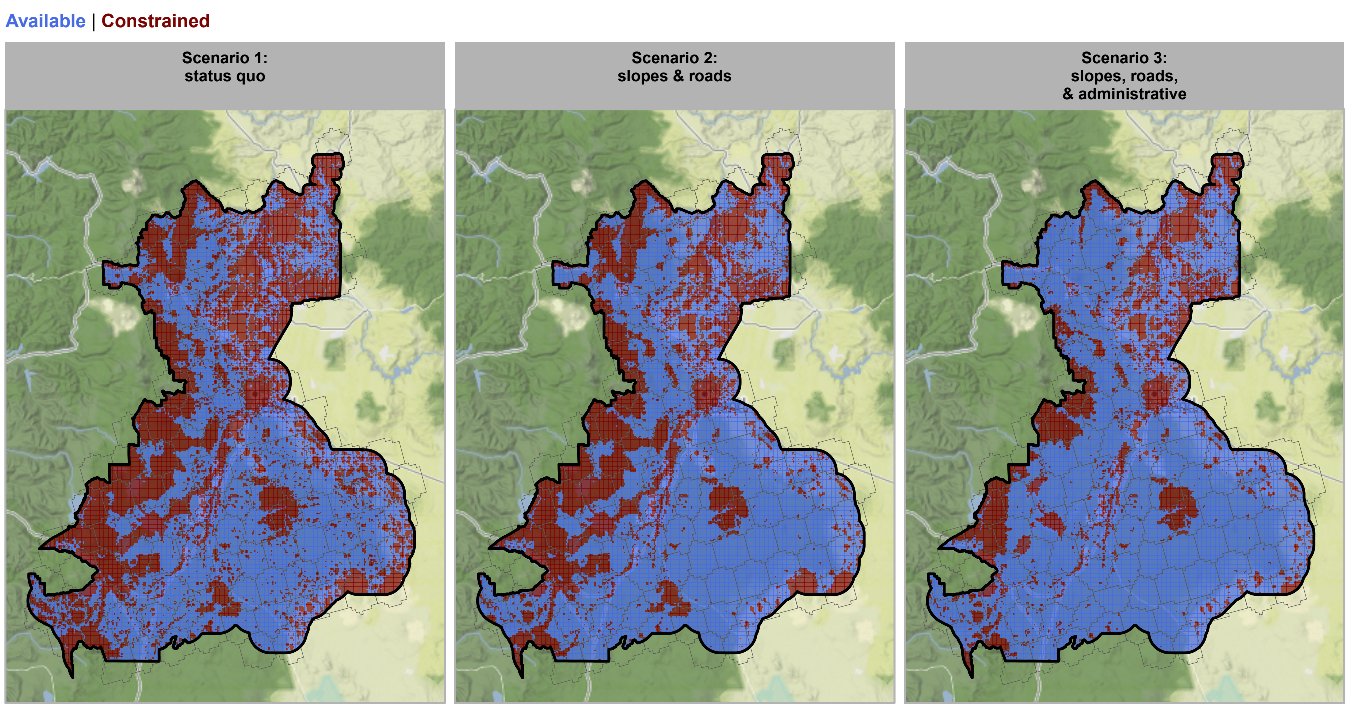
Influence of each constraint on mechanical operations

The table below details the percentage reduction from different types of constraints on mechanical treatment based on the three scenarios of operational constraints detailed above on the Central Oregon landscape.

Scenario	Forest & Shrub (ha)	Forest & Shrub (%)	Protected & IRA	Slope Steepness	Road Distance	Riparian Buffer	Administrative	Mechanically Available (ha)	Mechanically Available (%)
Scenario 1: status quo	959k	87.1%	−7.0%	−2.8%	−15.3%	−5.4%	−10.0%	571k	59.5%
Scenario 2: slopes & roads	959k	87.1%	−7.0%	−0.6%	−5.0%	−6.4%	−11.3%	669k	69.7%
Scenario 3: slopes, roads, & administrative	959k	87.1%	−7.0%	−0.6%	−5.0%	−4.5%	0.0%	796k	83.0%

In the Central Oregon landscape, this analysis identified 59% as mechanically available under the status quo (scenario 1), 70% when increasing slope and road access (scenario 2), and 83% under increased slope and road access and relaxed constraints to mechanical operations in administratively designated areas (scenario 3).

Landscape classified as available or constrained to mechanical operations



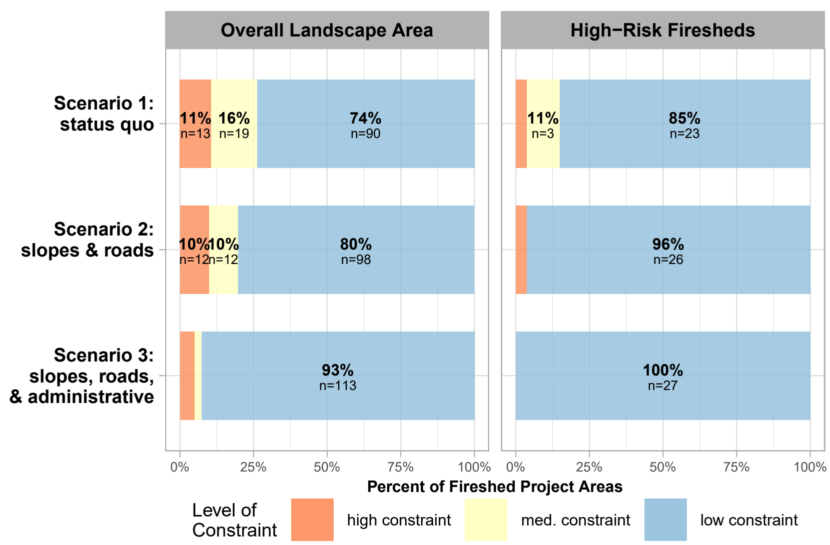
The above maps show how the overlapping spatial constraints were used to classify pixels within the landscape as either available (blue) or constrained (red) for mechanical operations.

Classification of fireshed project areas based on level of mechanical constraint

After identifying the area available for mechanical operations, we used the nested spatial framework delineating firesheds developed by Ager et al. (2021) and described above to characterize the spatial arrangement of mechanically available land. We chose levels of mechanical constraint to classify fireshed project areas based on Strategy objectives and science showing that fuels treatments are more effective as the percentage of the landscape treated progressively increases. After classifying each fireshed project area, we calculated the proportion of fireshed project areas by constraint class both within the overall landscape area and within high-risk firesheds only.

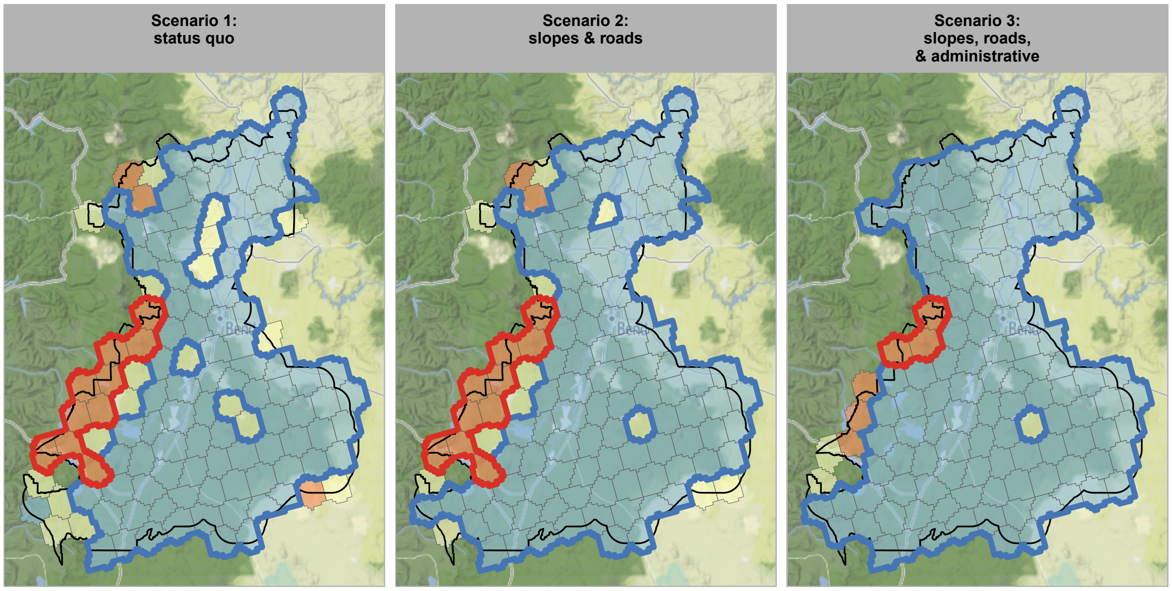
Level of constraint	Mechanically constrained area	Mechanically available area
High constraint	81–100%	0–19%
Medium constraint	60–80%	20–40%
Low constraint	0–59%	41–100%

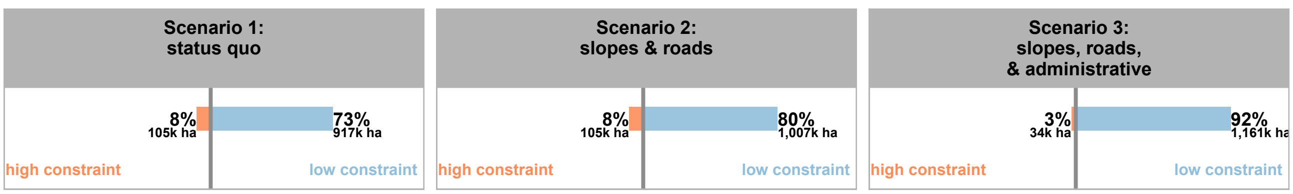
Fireshed project areas of approximately 10,000 hectares (25,000 acres) in size represent the geographic unit at which vegetation and fuel management projects are planned. Fireshed project areas were divided into three classes of mechanical constraint: high, medium, and low.



Spatial arrangement of mechanically available land

The fireshed project areas were then mapped and shaded by level of constraint. We selected the largest patch of interconnected fireshed project areas by constraint class and calculated the percent of the area of the overall landscape comprised by this patch (i.e., largest patch index). Comparison is made between the largest patch of project areas classified as high constraint (100–81% constrained; 0–19% available for mechanical treatment) and the largest patch of project areas classified as low constraint (0–59% constrained; 41–100% available). Extensive patches with little mechanical constraint represent opportunities for land managers to design plans that incorporate the principles of effective landscape-scale fuel treatments.





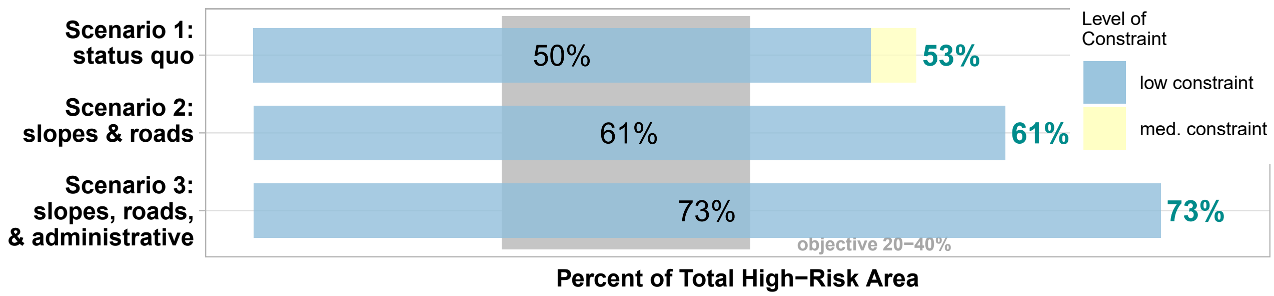
Percent of Overall Landscape Area Comprised by the Largest Patch

The above maps show the largest patch of high constraint (red) and low constraint (blue) fireshed project areas under the three scenarios.

On the Central Oregon landscape, the proportion of total area composed of the largest patch of lightly mechanically constrained project areas was 73% under the status quo (scenario 1), 80% when increasing slope and road access (scenario 2), and 92% under increased slope and road access and relaxed constraints to mechanical operations in administratively designated areas (scenario 3). Conversely, on this priority landscape, the proportion of total landscape area composed of the largest patch of highly mechanically constrained project areas was 8% under scenario 1 , 8% under scenario 2, and 3% under scenario 3.

Mechanically available acreage to meet treatment area objective of 20%–40%

To assess the 20%–40% objective, the amount of mechanically available area within low and medium constraint high-risk fireshed planning areas was aggregated and compared against the total area of high-risk fireshed planning areas.



The above figure shows the percent of total area within high-risk firesheds where there exists the ability to create effective, extensive fuels treatments by mechanical methods alone (low constraint areas: 0%–59% constrained; 41%–100% available for mechanical treatment) or in combination with managed fire (medium constraint areas: 60%–80% constrained; 20%–40% available). The gray area in the plot represents the WCS objective of treating 20%–40% of high-risk fireshed acreage.

On the Central Oregon landscape, over 20% of high-risk acreage is mechanically available in lightly constrained project areas to meet the Strategy treatment objective under the status quo (scenario 1). Expanding mechanical access to steeper slopes, areas more distant from existing roads, riparian areas, and within administratively designated areas are pathways to enhance flexibility to meet additional management objectives.

Work based on:

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