Chaffee County Fuel Treatment Prioritization

Benjamin Gannon
Colorado Forest Restoration Institute
December 2019

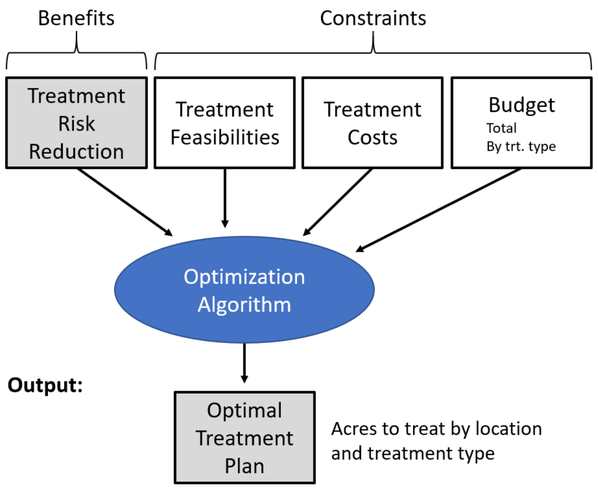
Summary. Fuel treatment priorities were developed with the Colorado Forest Restoration Institute's Risk Assessment and Decision Support (RADS) Tool. RADS uses linear optimization to maximize wildfire risk reduction for decisions of treatment location, type, and area subject to treatment cost and feasibility constraints. RADS was applied as follows:

Processing step	Description
Define decision units	Local stakeholders defined the treatment types to consider and the spatial units for decision-making.
Quantify treatment risk reduction	Risk reduction was estimated by differencing pre- and post-treatment risk for fuel treatments described in terms of their primary effects on surface and canopy fuels. See the *Chaffee County Wildfire Risk Assessment* for details.
Model treatment feasibility	Spatial data on land management designations and forest conditions were used to map the feasible area for each treatment type.
Model treatment cost	Spatially varying treatment costs were estimated based on accessibility and operability.
Parameterize model	RADS was used to attribute the decision units of a linear optimization model with the feasible area, mean risk reduction, and mean treatment cost for each treatment type.
Apply model	The RADS model was run across a range of stakeholder defined budget levels to suggest the treatment locations, types, and areas that maximize wildfire risk reduction.

Objective: maximize risk reduction (minimize risk)

Decisions: acres to treat by location and treatment type

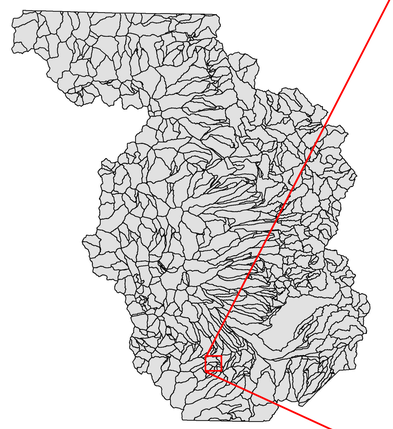
Model:



Output: Optimal Treatment Plan — Acres to treat by location and treatment type

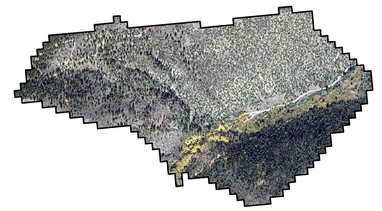
Decision units

830 catchments*



Each catchment is attributed with:

- Area feasible for each treatment type (acres)
- Mean risk reduction for each treatment type (risk/acre)
- Mean cost for each treatment type ($/acre)



Treatment types

- Thinning
- Prescribed fire
- Complete
- Mastication

*Catchments are small watersheds from NHDPlus (USEPA and USGS 2012).

Risk reduction

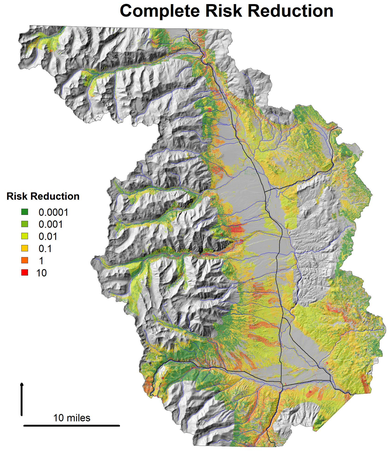
Fuel treatment effectiveness was quantified by simulating the primary effects of treatments on surface and canopy fuels. Proportional adjustment factors were used to estimate post-treatment canopy fuels by treatment type. Surface fuels were assumed to remain constant with thinning, decrease with prescribed fire, and change to a slash/blowdown fuel model after mastication.

Proportional adjustment factors specify how treatments modify canopy fuels.

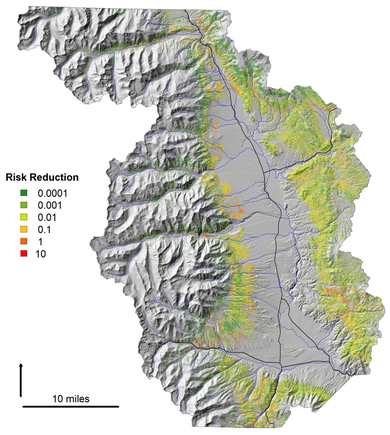
Parameter	Mechanical thinning	Prescribed fire	Complete	Mastication
Canopy base height	1.20	1.09	1.20	0.65
Canopy height	1.20	1.13	1.20	1.00
Canopy cover	0.70	0.95	0.75	0.15
Canopy bulk density	0.60	0.92	0.50	0.22

Risk reduction was then calculated for each treatment type as the difference between pre- and post-treatment wildfire risk (see two examples below). Fuel treatments can reduce wildfire risk by lowering fire intensity as modeled with FlamMap 5.0. Fuel treatment effects on burn probability were not accounted for. The RADS model seeks to maximize wildfire risk reduction, so all other things being equal, treatment types and locations with high risk reduction will be prioritized for treatment.

Complete Risk Reduction



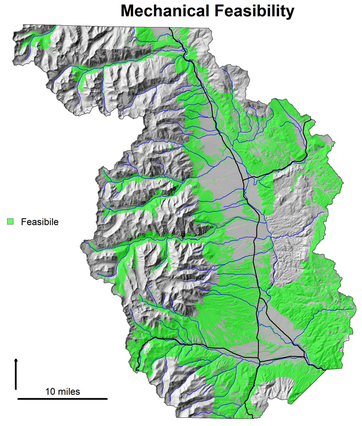
Rx fire Risk Reduction



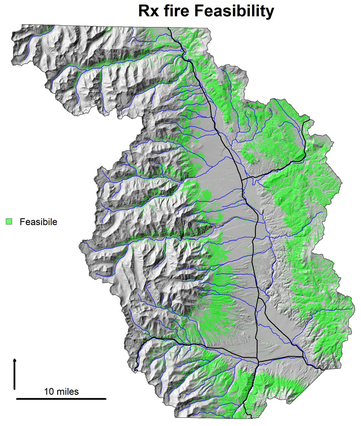
Constraints

Treatment feasibility was mapped based on land management designations (wilderness and roadless), forest presence (≥ 10% canopy cover), appropriate forest types for use, and other constraints on treatment use such as proximity to homes (see two examples below).

Mechanical Feasibility

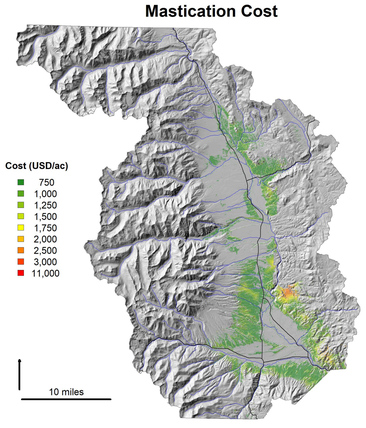


Rx fire Feasibility



Treatment cost was estimated for mechanical thinning and mastication treatments as a function of distance from roads and slope to reflect that costs dramatically increase in areas with poor accessibility and operability (for example, see right). Prescribed fire, including prep work, was estimated at a constant cost. The complete treatment was valued as the sum of mechanical thinning and prescribed fire costs. All other things being equal, the RADS model selects the least costly treatment types and locations.

Mastication Cost



Treatment priorities

Fuel treatment priorities were identified as the optimal treatment locations, types, and areas selected by RADS to maximize wildfire risk reduction. In this case, optimal means the greatest risk reduction possible per dollar spent on treatment. The suggested interpretation is that budgets of $10, $50, $100M, and $200M correspond to highest, higher, high, and moderate treatment priority.

Budget was manipulated to identify treatment priorities ranging from moderate to highest priority. In addition to budget, treatments were constrained to the feasible area for each treatment type in each catchment. At the catchment level, treatments were also limited to between 20 and 5,000 ac. Prescribed fire and mastication spending were also limited to 30% and 20% of the total budget respectively to account for workforce and ecological constraints.

Budget	Risk Reduction (eNVC)	Mechanical thinning (acres)	Prescribed fire (acres)	Complete (acres)	Mastication (acres)	Total (acres)
$10M	1,184	174	3,000	1,484	2,593	7,252
$50M	2,848	141	13,652	8,565	12,361	34,719
$100M	3,873	141	22,180	18,816	24,524	65,661
$200M	4,827	141	44,987	37,615	47,778	130,521

Fuel Treatment Priorities