

Appendix 3: Method for Calculating Acres Potentially Available for Mechanical Vegetation Management for Ecological Restoration and Hazardous Fuels Activities

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#### A. Method for Calculating Acres Potentially Available for Mechanical Vegetation Management for Ecological Restoration

Using methods derived from North et al. (2015), we analyzed the GMUG landscape to identify vegetative systems in need of ecological restoration where mechanical operations are viable. We started by identifying areas that are legally available for mechanical vegetation management. We did this by excluding Wilderness, recommended Wilderness areas<sup>1</sup>, legislatively designated areas that disallow timber cutting, and upper tier CRAs.<sup>2</sup> We then excluded areas with physical constraints that preclude timber cutting to yield “operable” areas. This included removing areas with slopes greater than 35%.<sup>3</sup> North et al. (2015) used a 35% threshold because “mechanical equipment is generally prohibited on slopes >35% with unstable soils.” We also excluded areas outside of a 1,000-foot road buffer (ML 1-5)<sup>4</sup> presuming that the GMUG will utilize existing roads as much as possible and not construct new ones. Within these “operable” lands, we selected “restorable” vegetation types where ecological restoration is scientifically justified – e.g., in ponderosa pine and mixed-conifer systems.<sup>5</sup> See Figures 1a and 1b.

**Table 1.** Potential operability constraints on mechanical forest restoration, GMUG National Forests.

Area	Acreage	Percent of GMUG
Wilderness	553,784	17.6
Wilderness + Upper Tier CRAs	684,088	21.7
Wilderness + Upper Tier CRAs + Slopes > 35%	1,363,571	43.2
Wilderness + Upper Tier CRAs + Slopes > 35% + roads outside of 1,000 foot buffers	2,598,807	82.4

<sup>1</sup> We used spatial data of designated wilderness from the University of Montana College of Forestry and Conservation’s Wilderness Institute (available at wilderness.net), which maintains the most up-to-date spatial data on wilderness areas.

<sup>2</sup> 36 C. F. R. § 294.42(b) prohibits tree cutting in upper tier roadless areas for this purpose. Note that we did not eliminate lower tier areas, although the Colorado Roadless Rule constrains where mechanical operations would be viable. See 36 C.F.R. §§ 294(c)(3) and (4) (“Tree cutting, sale, or removal is needed to maintain or restore the characteristics of ecosystem composition, structure and processes. These projects are expected to be infrequent....Tree cutting, sale, or removal is needed to improve habitat for federally threatened, endangered, proposed, or Agency designated sensitive species; in coordination with the Colorado Department of Natural Resources, including the Colorado Division of Parks and Wildlife.”)

<sup>3</sup> We used a digital elevation model to create a percent slope raster for the GMUG, subsequently removing areas with slopes greater than 35%.

<sup>4</sup> We obtained the roads layer from the GMUG in the spring of 2018.

<sup>5</sup> We used data from the USGS Gap Analysis Program (GAP) national land-cover data version 2 at 30-meter resolution (USGS 2011), and conducted the calculations at the 6<sup>th</sup> level of the National Vegetation Classification System (NVCS 2008). The NVCS classifications are as follows: 1) Class; 2) Subclass; 3) Formation; 4) Division; 5) Macrogroup; 6) Group (a.k.a. ecological system, to which we refer in this study as “ecosystem”); 7) Alliance; and 8) Association.

**Table 2.** “Operable” vegetation on the GMUG (areas outside of wilderness and Upper Tier CRAs, on slopes less than 35%, and within 1,000 foot road buffers).

<b>Area</b>	<b>Acreage</b>	<b>% of GMUG</b>
Operable vegetation potentially suitable for restoration	40,395	1.3
Other operable vegetation	515,303	16.3
<b>Total</b>	<b>555,698</b>	<b>17.6</b>

**B. Method for Calculating Acres Potentially Available for Mechanical Vegetation Management for Hazardous Fuels Reduction Activities**

We used the following criteria: located in the Wildland Urban Interface<sup>6</sup>, adjacent to utilities (e.g., transmission lines, cell phone towers, municipal water supply structures)<sup>7</sup>, within or adjacent to campgrounds and popular recreation sites<sup>8</sup>, and within 100 feet of a maintenance level (ML) 3-5 road adjacent to areas of high tree mortality.<sup>9</sup> Finally, similar to the ecological restoration analysis, we excluded areas with slopes > 35% and where mechanical operations are legally prohibited (Wilderness, legislated areas, upper tier roadless areas<sup>10</sup>). See Figure 2.

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<sup>6</sup> We calculated the Wildland Urban Interface by buffering the USFS WUI by ½ mile. Martinuzzi, S. et al. 2015. The 2010 wildland-urban interface of the conterminous United States. Research Map NRS-8. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 124 p.

<sup>7</sup> We used the following data: Municipal water structures downloaded from the Colorado Division of Natural Resources GIS Portal. Cell tower locations were obtained from the Federal Communication Commission. Transmission line data were gathered from the Homeland Infrastructure Foundation-Level Data.

<sup>8</sup> We used the following data: USFS Recreation Activities obtained from the Forest Service’s Geospatial Portal.

<sup>9</sup> We obtained roads data from the GMUG in the spring of 2018. ML 3-5 roads were intersected with areas at risk of mortality according to the 2014 USFS 2013–2027 National Insect and Disease Forest Risk Assessment. Krist, Frank, J et al. 2014. 2013-2027 national insect and disease forest risk assessment. Fort Collins, CO: US Forest Service, Forest Health Technology and Enterprise Team. 199 p.

<sup>10</sup> 36 C. F. R. § 294.42(b) prohibits tree cutting in upper tier roadless areas for this purpose.

Figure 1. Areas Potentially Suitable for Mechanical Vegetation Activities for Ecological Restoration. Figure 1a shows the steps in the process and Figure 1b shows the final map.

Figure 1a.

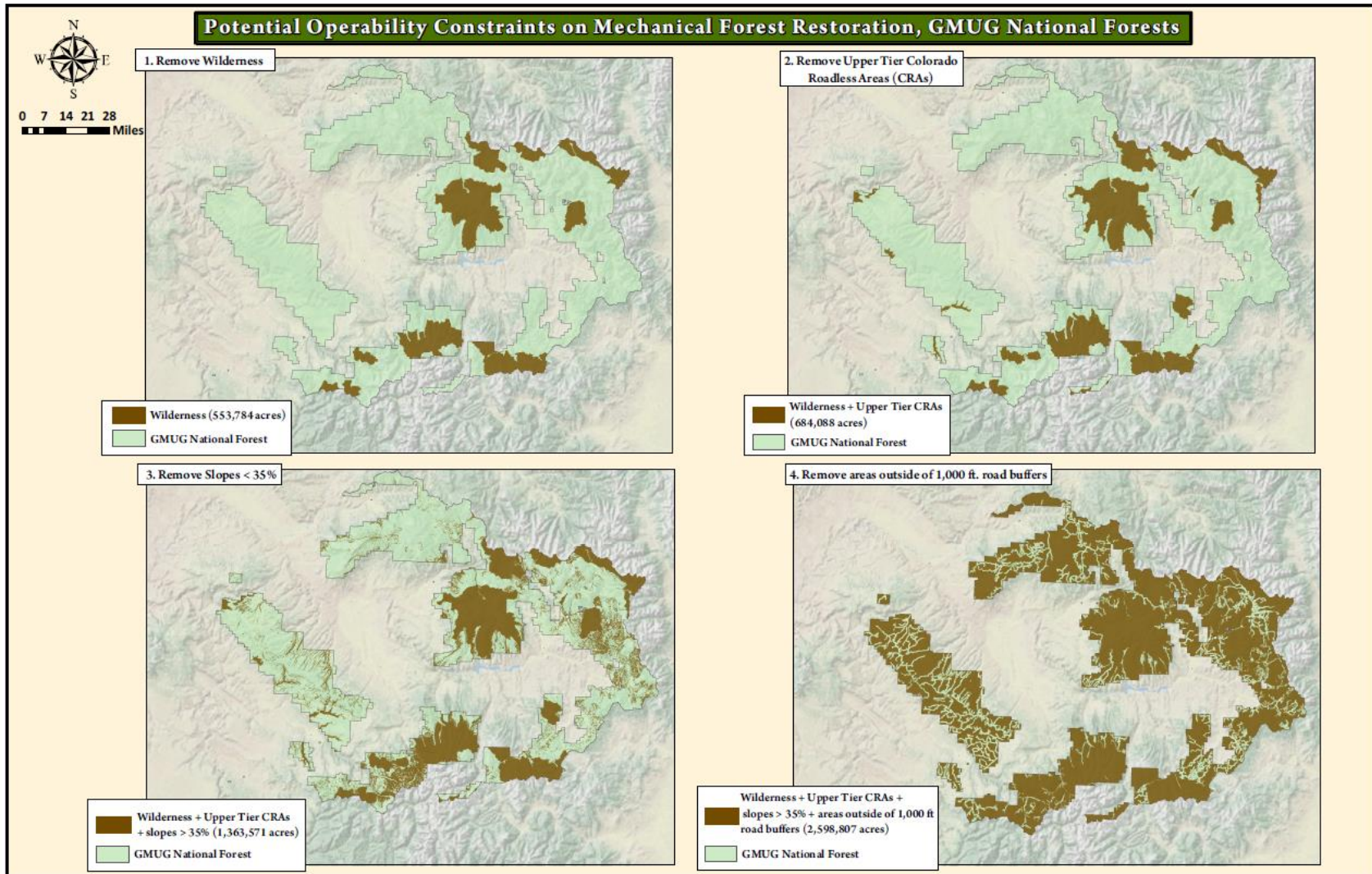


Figure 1b.

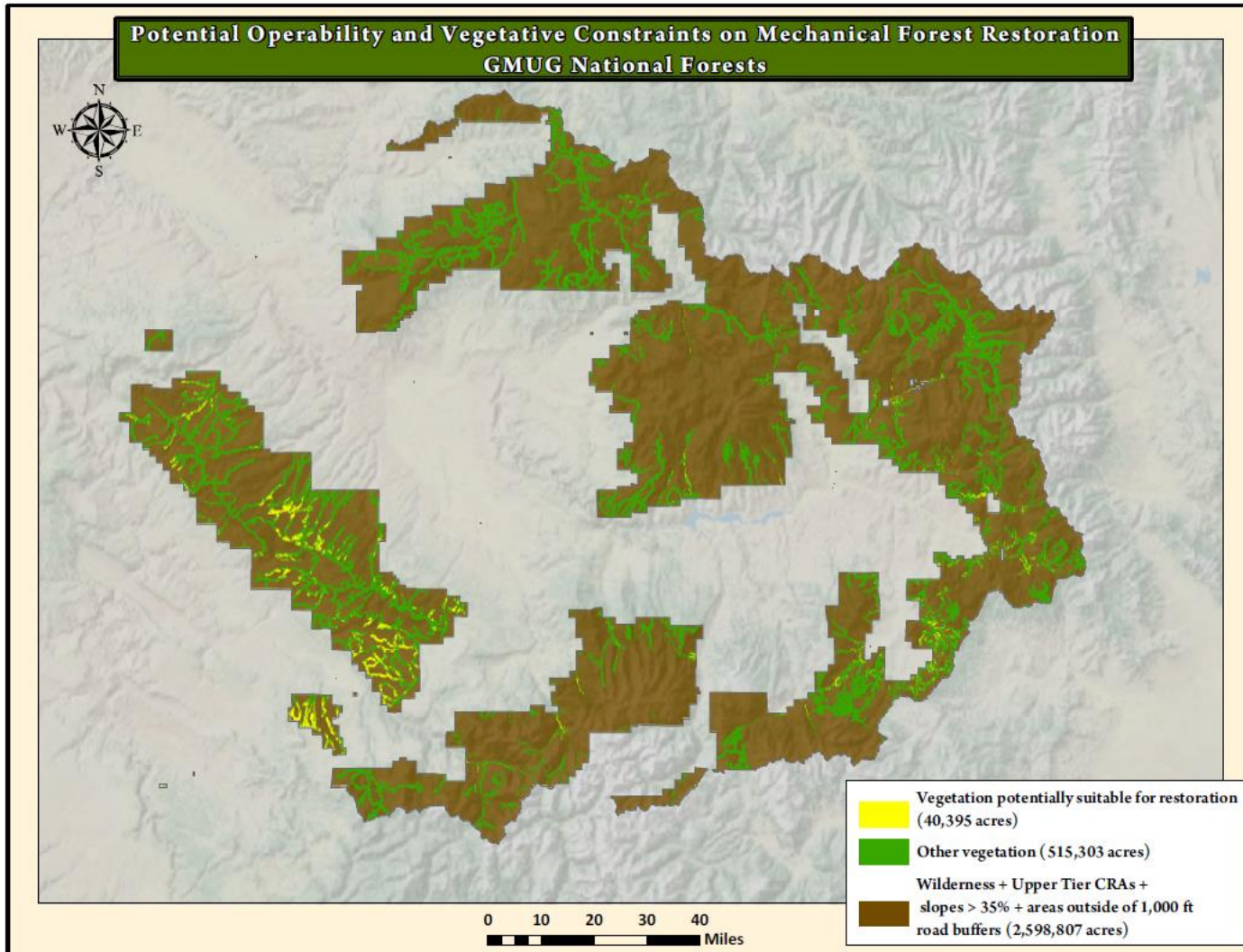


Figure 2. Areas Potentially Suitable for Mechanical Vegetation Activities for Hazardous Fuels Reduction.

