Inundation Mapping

Surface inundation into this unit during spring runoff flows is relatively minor, especially at discharges below 4000 cfs (as measured at the USGS "Rio Grande at Albuquerque" gage near Central Bridge). At these low discharges, what little inundation that occurs is restricted exclusively to lower elevation portions of the bank line. At discharges above 4000 cfs, inundation increases through the unit, though still remains modest. Inundation at these higher discharges is mostly present in the previously constructed flow-through channel that passes through the unit.

Table 1. Acreage of Inundation within the Montaño unit based on satellite image analysis from 2019.

		Discharge (cfs)					
Unit	**Parameter**	**1630**	**1970**	**2560**	**4240**	**4820**	**5020**
Montaño	Inundation (acres)	<1	<1	<1	1.7	3.5	8.1
Montaño	Inundation (%)	<1%	<1%	<1%	1.4%	2.7%	6.4%

The minimal inundation experienced at this location is in large part due to the average elevation above the river surface (4.9 ft above the river surface at ~600 cfs for the entire unit).

Summary of Elevation Trends

There are some slight depressional features in the land surface, however most of the area lies within 3-5 ft above the water surface. The most significant depressional feature in the unit is the flow through channel constructed by the U.S. Army Corps of Engineers in 2008. Besides this channel, and some adjacent depressions likely formed by relict channels, the unit is primarily an elevated floodplain.

General Vegetation Types

This unit is characterized by a mosaic of different forest types, most of which contain substantial understory canopy. There are some dense mixed riparian stands along the bank line, however most contain upper-level forest canopy as well. Additionally, there is a small portion of shrubland immediately adjacent to the bike path atop the levee bordering the unit's east side. Grasslands are restricted to two large, adjacent units in the north-central portion of the unit, while open areas are minimal.

Table 2. Acreage of general vegetation types in the Montaño unit.

Unit	**Dense, tall shrubs**	**Forests with little to no understory**	**Forests with relatively dense understory**	**Grassland**	**Open/barren**	**Short shrubs**	**Grand Total**
Montaño	1.2	6.2	108.6	7.7	0.5	2.5	**126.7**

Forest structure generally gets denser, particularly in the understory, approaching the Rio Grande. Additionally, most of the area near the river also displays significant buildup of dead and downed trees in the understory. These downed snags, combined with a dense understory, present significant ladder fuel risk.

Woody Species Dominance

Rio Grande Cottonwood (*Populus deltoides ssp. wislezeni*) is the most common woody species observed in the overstory throughout the unit, being mapped in nearly every portion of the area. Further, cottonwood is a dominant or co-dominant overstory species in the majority of the mapped forest types. Notably, many cottonwoods showed some signs of canopy dieback throughout the unit, particularly in areas further away from the river. Siberian Elm (*Ulmus pumila*) is also a common component throughout the unit, being present in well over half of the mapped forest types. However, Siberian Elm is not as often a dominant or co-dominant species in the overstory when compared to cottonwood, suggesting a lower overall density.

The understory is dominated largely by Russian Olive (*Elaeagnus angustifolia*) and Saltcedar (*Tamarix* spp.) intermixed with native species like New Mexico Olive (*Forestiera Neomexicana*), Coyote Willow (*Salix exigua*), and others. Both Russian Olive and Saltcedar are present in nearly every mapped forest type, and are dominant or co-dominant in nearly half of all mapped areas. Both species aren't present in monotypic stands, however their density increases near the river and both species contribute to the dense thicket of ladder fuels present near the channel. Tree of Heaven (*Ailanthus altissima*) is widespread through the unit, however in most instances it occurs in small, isolated patches. The density does increase in the northern section of the unit however, where it forms a co-dominant component of the understory in one mapped area.

While not co-dominant in any of the mapped areas, native species like New Mexico Olive, False Indigobush (*Amorpha fruticosa*), and Seep Willow (*Baccharis salicifolia*) are widespread throughout the entire mapped area. The density and vigor of these populations appeared generally healthy, indicating that they are suitable choices for post-clearing revegetation efforts. The short shrubby areas are dominated exclusively by the native Fourwing Saltbush (*Atriplex canescens*) and Sand Sagebrush (*Artemisia filifolia*).

Annual Weeds

The dominant annual weeds in the unit are Kochia (*Bassia scoparia*) and tumbleweed (*Salsola tragus*) which have modest but variable cover throughout the area. Also widely distributed is the non-native sweetclover (*Melilotus officinalis*), though this species generally has lower density than kochia or tumbleweed. Overall annual weed cover in the unit is in the lower density classes (10% cover and below) through more than half the mapped area. Locations with higher weed cover are generally more patchy and isolated, with the highest densities occurring in the most highly disturbed (through foot traffic and previous wildfire) portions of the unit.

Table 3. Acreage of annual weed cover class in the Montaño unit.

Unit	<5%	6-10%	11-25%	26-50%	51-75%	76-90%	Grand Total
Montaño	32.5	45.0	45.0	3.7	0.5	0	**126.7**

Maintenance Recommendations

Priority fuels treatment locations

Fuels reduction treatment locations were prioritized based on a variety of site-specific variables, principally understory canopy density, high cover of exotic woody species, and the presence of ample downed wood snags that form ladder fuels. Exactly half of the unit's acreage lies within the high priority class, with most of this area lying in the portions of the area closer to the river. In these areas, the understory canopy is incredibly dense and dominated by exotic species. Coupled with significant buildup of downed snags and modest annual weed cover, the potential for ground fires to evolve into canopy fires is very high. The lowest priority areas in this unit are those that have an open structure, with little to no presence of ladder fuels.

Table 4. Acreage of fuels reduction priority class in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	63.3	48.4	15.0	**126.7**

Siberian Elm

Current cover and dominance of Siberian elm was used to prioritize management of this species within individual segments of each site (Table 5). Siberian elm is widespread, but with modest cover throughout most of the unit. The vast majority of the mapped acreage has moderate need for management of Siberian elm. Where the species presents the biggest problem is in the portions of the unit with the thickest understory, where Siberian elm acts in conjunction with other exotic species, plus significant quantities of downed wood, to form a large mass of ladder fuels. Immediate treatment in these zones should focus on a combination of mechanical removal and systemic herbicide application to prevent resprouting and reduce seed dispersal. Seed dispersal reduction is especially important while germination safe locations are abundant in the sites following treatment.

Table 5. Acreage of Siberian elm priority classes in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	7.1	88.1	31.5	**126.7**

Tree of Heaven

Tree of heaven priority classes were developed using an identical framework to the one developed for Siberian elm (Table 6). Though widespread throughout the unit, Tree of Heaven is most often growing in small, isolated patches. Larger populations occur in the northern portion of the unit near the river. Targeted herbicide application paired with revegetation using competitive native species is recommended. Seed dispersal reduction is especially important while germination safe locations are abundant in the sites following treatment.

Table 6. Acreage of tree of heaven priority class in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	1.6	92.7	32.4	**126.7**

Annual Weeds

A combination of annual weed, perennial grass, and perennial forb cover was used to prioritize annual weed management by map unit (Table 7). Well over half of the unit lies in the low treatment priority class, and only a small area falls into the highest priority. Long term control of annual weeds will be complicated by regular foot traffic along trails through the area. High and moderate priority treatment areas should be a top focus for early intervention, particularly where annual weeds co-occur with ladder fuels. Incorporating aggressive chemical control techniques and post-treatment monitoring to address root suckering and seedling emergence is required for long term control.

Table 7. Acreage of annual weed priority class in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	4.3	45.0	77.4	**126.7**

Noxious Weeds

Ravenna grass (*Tripidium ravennae*) is the only listed noxious weed found in the unit, with several populations occurring throughout. Most populations are isolated and small, however significant populations occur along sandbars just outside the unit. This nearby seed source will likely contribute to continued population growth if left unaddressed. Other species observed are not currently listed as noxious weeds in New Mexico, but are potentially aggressive enough to warrant treatment. Yellow bluestem (*Bothriochloa ischaemum*) is a watch listed species that aggressively spreads in highly disturbed areas (such as the trailside environment it was observed in here). Left unaddressed, this species will readily spread through the area. Myrtle spurge (*Euphorbia myrsinites*) was also observed and, while not considered a weed in New Mexico, is unusual to see in the bosque. It is a watch listed species in Colorado and readily spreads in arid environments. Spread of this species will likely be low to modest, but its unusual presence and small population does provide an ideal opportunity for early control. Eradication of these species is feasible with repeated mechanical and chemical control and on-going monitoring.

Table 8. Number of noxious weed observations in the Montaño unit.

Unit	Ravenna grass	Yellow bluestem*	Myrtle spurge**	Grand Total
Montaño	10	1	1	**12**

* Yellow bluestem (*Bothriochloa ischaemum*) is a watch-listed species in New Mexico.
** Myrtle spurge (*Euphorbia myrsinites*) is not classified as noxious in New Mexico but is a novel exotic species in the bosque.

Revegetation Recommendations

Seeding

A variety of site conditions were used to prioritize specific locations for seeding within this unit. Seeding is ideally performed soon after fuels reduction treatments in order to compete with resprouting weedy species. The majority of the unit lies in the low priority class, however moderate need does exist in some parts of the mapped area. Seeding in these units can reinforce restoration efforts, suppress undesirable vegetation, and improve species richness across structural layers once fuels management has been completed.

Table 9. Acreage of seeding priority zones in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	4.9	45.9	75.9	**126.7**

Shrub planting density

Shrub planting density was prioritized within individual portions of each site using a combination of environmental conditions, with the goal of increasing native understory cover and diversity once fuels management has been completed. Most of the area lies in the high-density class, due to relatively sparse understory expected after fuels treatments. Much of the unit currently exhibits forest structures with dense understory, however the principal components of this understory are exotic woody species. Revegetation with native shrubs can help boost ecological function and limit the spread of exotic trees that eventually form ladder fuels.

Table 10. Acreage of shrub density classes in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	72.9	18.7	35.1	**126.7**

Shrub mix recommendations for revegetation were developed using a suite of site-specific physical and ecological variables, including relative elevation (based on a high-resolution elevation model), inundation frequency, overstory canopy closure, and current understory composition.

Table 11. Acreage of recommended shrub planting mix in the Montaño unit.

Unit	All Riparian Shrubs	All Xeroriparian Shrubs	Even Mix Riparian and Xeroriparian Shrubs	Mostly Riparian Shrubs	Mostly Xeroriparian Shrubs	Grand Total
Montaño	6.7	1.8	33.7	75.8	8.7	**126.7**

Shrub irrigation intensity

Shrub irrigation intensity recommendations across the project area were guided by a combination of hydrologic and ecological variables, including canopy closure and relative elevation above the river.

Table 12. Acreage of shrub irrigation intensity class in the Montaño unit.

Unit	High	Moderate	Low	None	Grand Total
Montaño	1.7	45.3	79.0	0.7	**126.7**

Tree pole planting

Map units were prioritized for tree pole planting based on existing vegetation type and predicted depth to groundwater. A majority of the project area is considered low priority for pole planting, largely because there is anticipated to be sufficient overstory cover after fuels reduction of exotic woody species. Some moderate priority areas are anticipated however, particularly in areas where the overstory contains a significant portion of exotic species.

Table 13. Tree pole installation priority class in the Montaño unit.

Unit	High	Moderate	Low	Grand Total
Montaño	2.5	47.7	76.5	**126.7**

Pole density

Similar to pole planting priority, pole density estimates are based on existing vegetation type and structure, coupled with anticipated needs after fuels reduction has been completed. As Rio Grande Cottonwood is the most common overstory species, and a species targeted for protection, overall pole density needs are estimated to be low. Higher densities should be prioritized in the small areas with exotic woody species heavily present in the overstory canopy.

Table 14. Tree pole density class acreage in the Montaño unit.

Unit	High	Medium	Low	Grand Total
Montaño	0.6	3.3	122.8	**126.7**

Pole species mix

Table 15 summarizes the mix of tree pole species for installation across project units, distinguishing areas prioritized for tree willow (TW), cottonwood (C), or combinations of the two. These recommendations were developed based on predicted depth to groundwater, soil texture, and the existing species composition, coupled with expected composition post fuels reduction.

Table 15. Acreage of the tree pole installation mix in the Montaño unit.

Unit	All Tree Willow	All Cottonwood	Even Mix Cottonwood and Tree Willow	Mostly Tree Willow	Mostly Cottonwood	Grand Total
Montaño	3.9	1.8	44.9	67.4	8.7	**126.7**

Shrub Planting Quantities

Just over 18,000 riparian shrubs and 10,500 xeroriparian shrubs are recommended for installation as part of the revegetation efforts (Table 16). However, this installation could be phased over several years to provide staffing and budgetary flexibility.

Table 16. Recommended total quantity of shrubs for installation in the Montaño unit.

Unit	Total Number of Riparian Shrubs	Total Number of Xeroriparian Shrubs
Montaño	18008	10521

Tree Planting Quantities

Table 17 summarizes recommended quantities of tree willow (TW) and Rio Grande cottonwood (C) poles to be planted. Like shrubs, tree pole planting could be phased, depending on material and staffing availability. A total of 1,008 TW poles and 578 cottonwood poles are proposed in this unit.

Table 17. Recommended total quantity of tree poles for installation in the Montaño unit.

Unit	Total Tree Willow	Total Rio Grande Cottonwood
Montaño	1008	578