



<u>Emma-Oak Grove Rare Plant</u> <u>Survey</u>

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A=abundant, C=Common, U=Uncommon, S=Sparce	9



INTRODUCTION

GeoSystems Analysis, Inc. (GSA) conducted a rare plant survey on and around Freeport McMoRan Tyrone Inc. (Tyrone) property in Grant County, NM. The survey was conducted within the Emma-Oak Grove Site (or "site" in this report) proposed for Tyrone Mine expansion with a total area of approximately 421-acres. Tyrone Mine lies approximately 12 miles southwest of Silver City, New Mexico (NM); a map showing the location of the site is provided as Figure 1. The northernmost extent of Emma-Oak Grove lies just 1,000 feet south of the Continental Divide and is bisected by Oak Grove Creek, an intermittent wash that likely flows during summer monsoonal storm events. Fieldwork was completed during early October 2020 and no rare plant species were encountered.

According to Environmental Protection Agency Eco-Regions delineations, the survey location falls within a band of Madrean Lower Montane Woodlands that serves as a transition zone between the Chihuahuan Desert and Montane Coniferous Forest Eco-Regions. Similarly, Brown (1994), characterizes the site as Madrean Evergreen Woodland, dominated by alligator juniper (*Juniperus deppeana*), piñon pine (*Pinus edulis*) and oak (*Quercus spp.*), with elements of Interior Chapparal as indicated by a scattering of manzanita (*Arctostaphylos pungens*), sotol (*Dasylirion wheeleri*), and Wright's silktassel (*Garrya wrightii*).

Elevations within the site range from approximately 6,000 to 6,300 feet. Per the Natural Resources Conservation Service (NRCS) digital soil survey data (SSURGO), soils within the project site are predominantly rock outcrop associations (84% of the total area), including: Santana-Rock outcrop complex, 15 to 35% slopes (34.2% of the site); Santa Fe-Rock outcrop complex, 20 to 45% slopes (33.9% of the site); Gaddes-Santa Fe outcrop complex, 15 to 45% slopes (12.2% of the site); and Santana-Rock outcrop complex, 1 to 25% slopes (3.2% of the site). These soil types comprise alluvial fans, hillslopes, terraces, mountain slopes and ridges and all are derived of mixed alluvium and/or colluvium derived from igneous, metamorphic, and sedimentary rock. Soils described for the site align with observed field conditions and the mapped terrain, which is a variable mix of steep hillslopes, terraces and ridges with most slopes ranging 15 to 45%, and few slopes less than 15%.

Also per the NRCS, remaining soils are loam types (16% of the site by area), including: Lonti gravelly loam, 15 to 35% slopes (9.7% of the site), Lonti gravelly clay loam, 0 to 8% slopes (2.6% of the site); Manzano loam, 1 to 3 % slopes (3.9% of the site). Manzano loam comprises drainageways, intermittent streams and valley floors, and is found in the bottom tiers of Oak Grove Creek. The loams in this type are derived from mixed alluvium and/or residuum from weathered sandstone and shale. Lonti loam types comprise pediments and hillslopes, and like the outcrop types described above, are derived from alluvium and/or colluvium derived from igneous, metamorphic, and sedimentary rock. These soil types are present on the eastern edge of the Emma site, as slopes begin to level out and grade into the adjacent desert grassland.





FIGURE 1. PROJECT AREA MAP



Methods

The Emma-Oak Grove site was surveyed on October 7, 8 and 9, 2020. The survey was completed within a predetermined boundary provided to GeoSystems Analysis. Prior to fieldwork, evenly spaced transect lines were plotted across the site in ArcGIS Desktop to serve as a transect orientation guide during the field survey. The electronic map was exported into a position enabled .pdf file, so the field botanists could plot their location in relation to the evenly spaced transects while onsite. As previously noted, the pre-plotted transects were only meant to serve as an "orientation guide" with recognition that the actual survey intensity would be adjusted during implementation based on the distribution of suitable habitat, surveyor safety, and assurance that the survey needed to be completed within the time allocated. Due to rugged, uneven, and often steep terrain, slippage concerns, and subsequent reductions in survey efficiency, it was not possible to traverse the site along each of the pace transects. Survey transects were traversed in a roughly east-west orientation, with a spacing ranging from 30- to 100-meters depending on habitat potential and navigability. Transect spacing increased slightly more at Oak Grove (to approximately 100-m apart), due to much steeper terrain. A representative photo of most survey transects was taken and Global Positioning System (GPS) tracks were logged to confirm and document sufficient survey coverage.

Species lists developed and managed by the New Mexico Rare Plant Technical Council (https://nmrareplants.unm.edu/) provide a well-organized, expertly vetted, and regularly updated list of "rare" species known to occur within a particular county in NM. The NMRPTC lists taxa that are either narrowly endemic to a specific geographic feature (e.g., mountain range; geologic outcrop) or subset area of a phytogeographic region (e.g., southern Rocky Mountains, northern Chihuahuan desert); NMRPTC listed species can be locally abundant within a narrow range or more widespread but numerically rare. NMRPTC designates a species as "rare" when a particular epithet meets the following criteria (per NMRPTC; https://nmrareplants.unm.edu/about):

- Species lists developed and managed by the New Mexico Rare Plant Technical Council (https://nmrareplants.unm.edu/) provide a well-organized, expertly vetted, and regularly updated list of "rare" species known to occur within a particular county in NM. More specifically, NMRPTC designates a species as "rare" when a particular epithet meets the following criteria: Critically Imperiled Species are those ranked G1 globally and/or S1 statewide by Natural Heritage New Mexico and NatureServe.
- Imperiled Species are those ranked G2 globally and/or S2 statewide by Natural Heritage New Mexico and NatureServe.
- Vulnerable Species are those ranked G3 globally, and/or S3 statewide by Natural Heritage New Mexico and NatureServe.
- Threatened or Endangered Species are those that are federally listed and protected under the U.S. Endangered Species Act (ESA) by the U.S. Fish and Wildlife Service.
- State Endangered Plants are those listed as Endangered by the State of New Mexico and are protected under state law.
- Navajo Nation Endangered Species are those listed by the Navajo Nation as threatened, endangered or candidates for listing and are protected by the Navajo Nation Endangered Species Act.
- Sensitive Species or Species of Concern are not necessarily included on the above lists, but may be included on lists of Sensitive Species by the U.S. Fish & Wildlife Service, the Division, the Navajo Nation, the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and other tribes and pueblos. Only the BLM and the USFS provide some protective measures for sensitive species and species of concern, including policies and guidelines.
- Endemic Species are those whose entire distribution is restricted to a relatively small geographic region. These species occur nowhere else in the world and are often, but not necessarily, vulnerable to extinction.



• Rare Species typically have small numbers of individuals worldwide, narrow geographic ranges, and/or few localized populations, making them more vulnerable to extinction than common species. These include all plants reviewed and listed by the New Mexico Rare Plant Technical Council.

According to NMRPTC, there are a total of 22 rare plant species known to occur in Grant County. The species have varying sensitivity status as indicated on Table 1. As indicated in the Results section of this report, no rare plant species were detected during the survey. If a rare plant species would have been suspected or confirmed, the observation location would have been marked as a point or area with the GPS, depending on the number of individual plants within the population. Additionally, phenology, vigor, soil type, landform, slope, and aspect would have also been recorded as supplemental site attributes associated with the observed rare plant species. However, as presented in the results section of this report, no rare plant species were encountered during the survey. As transects were traversed, a list of all species encountered was logged, and general abundance noted in a field book. Thus, presence of noxious and/or other invasive, non-native plant species was also ancillary recorded and noted (if observed), along with a comprehensive plant species list for all plant species observed during the survey. If an unknown species was encountered that appeared to be in the same genus as a rare plant, the plant was collected and identified to species to determine the specific epithet.

The primary field data collection elements included:

- Logged GPS tracks of coarse survey grid
- Digital photographs representative photos of transect grids
- List of species encountered during the survey
- Location of rare plant species, if encountered:
 - Population details, number, extent, vigor, phenology
 - Assessment of potentially suitable habitat for rare species
 - Observer name
 - Notes of threats and/or disturbance
 - Aspect, elevation and landform
 - Soil type and associated plants
 - Representative digital photographs of each found population

TABLE 1. RARE PLANT SPECIES KNOWN TO OCCUR IN GRANT COUNTY, NM (NMRPTC) NOTE: R = RARE ACCORDING TO NMRPTC "RARITY CRITERIA", S1 AND G1 = CRITICALLY IMPERILED, S2 AND G2 = IMPERILED, S3 AND G3 = VULNERABLE, T = INTRASPECIFIC TAXA, ? = QUESTIONABLE TAXONOMY, SNR = STATE RANK NOT YET ASSESSED, SH = POSSIBLY EXTIRPATED (HISTORICAL)

Scientific			State			Navajo		Global
Name	NMRPTC	FWS	of NM	USFS	BLM	Nation	State Rank	Rank
Agastache								
cana	R						S3	G3
Agastache								
mearnsii	D						S2	G3
Asclepias								G3G4T2T
uncialis	D			SEN				3
Brickellia								
chenopodina	R						SNR	GHQ



Scientific			State			Navajo		Global
Name	NMRPTC	FWS	of NM	USFS	BLM	Nation	State Rank	Rank
Carex		-	Ĩ	<u> </u>	ſ			
amplifolia							S1	G4
Crataegus								
wootoniana	R			SEN			S2	G2
Cymopterus								
davidsonii	R						S2	G2
Cypripedium								
parviflorum								
var.								
pubescens	D		E	SEN		GP 4	S2?	G5T5
Desmodium								
metcalfei	R			SEN			S1	G3?
Draba								
mogollonica	R						S3	G3
Euphorbia								
rayturneri	R						S1	G1
Grindelia								
arizonica var.								
neomexicana	R						SNR	G4T3?
Grindelia								
decumbens								
var. subincisa							S3?	G4T3?
Peniocereus								
greggii	R		E		SEN		S3	G3G4T3
Penstemon								
linarioides								
ssp. maguirei	R			SEN			SH	G5T1
Peritoma								
multicaulis	R		E				SH	G2G3
Phemeranthu								
s humilis	R			SEN			S2	G2
Puccinellia								
parishii	R		E	SEN	SEN	GP 4	S1	G2G3
Scrophularia								
macrantha	R			SEN	SEN		52	G2
Silene thurberi	R						\$3?	G4
Silene wrightii	R						S2	G2
Stellaria								
porsildii	R			SEN			S1	G1



RESULTS

No rare plant species were encountered during the survey; however, potential suitable habitat was present for six species, habitats for these species are listed below and specific areas with potential habitat within the site are shown on Figure 2.

- 1. Mogollon whitlowgrass (*Draba mogollonica*) grows in cool, moist northern slopes of mountains, ravines and canyons on volcanic rocks and soil in montane forests at elevations ranging from 5,000 to 9,000 ft. (NMRPTC 1999).
- Grayish-white giant hyssop (*Agastache cana*) grows in crevices and bases of granite cliffs and in canyons with small-leaved oaks in the upper edge of desert and lower edge of piñon-juniper at 4,600 to 5,900-ft. (NMRPTC 1999).
- 3. Davidson's cliff carrot (*Cymopterus davidsonii*) grows in cool, rocky places in piñon-juniper woodland and lower montane coniferous forest at 6,500 to 8,000 ft. (NMRPTC 1999). Note that elevations at this site rise to approximately 6,300 ft.
- 4. Mimbres figwort (*Scrophularia macrantha*) grows in steep and rocky, usually north-facing, igneous cliffs and talus slopes, and occasionally in canyon bottoms in piñon-juniper woodland and lower montane coniferous forest at 6,500 to 8,200 ft. (NMRPTC 1999). Note that elevations at this site rise to approximately 6,300 ft.
- 5. Wright's campion (*Silene wrightii*) grows in cliffs and rocky outcrops in montane and subalpine conifer forest at 6,800 to 8,000 ft. (NMRPTC 1999). Note that elevations at this site rise to approximately 6,300 ft.
- 6. Pinos altos fame flower (Pheramanthus huhmilis) grows in shallow, gravelly clay soil over rhyolite on rocky benches in sloping terrain. It occurs in Madrean grassland, oak woodland and pinon-juniper woodland, often associated with beargrass (Nolina macrocarpa), and Parry's agave (Agave parryii) (NMRPTC 1999).

There is an east-west running drainage in the southeast portion of Emma, which eventually drains into Oak Grove Creek (Figure 2) that contains potential habitat for these five species but as stated previously in this report, no rare plant species were detected. Just one closely related species (shared genera) was identified - Bill Williams Mountain giant hyssop (*Agastache pallidiflora*) occurred within the project site. A. *pallidiflora* is differentiated from the rare *A*. *cana* by having flowers less than 20 mm long which are less than twice the length of the calyx. No other species within any of these genera were present in the survey area.





FIGURE 2. MAP SHOWING LOCATIONS WITH HABITAT POTENTIAL FOR VARIOUS RARE PLANT SPECIES



Emma-Oak Grove Rare Plant Survey

Additionally, potentially suitable habitat for Pinos altos fame flower (Pheramanthus huhmilis) was present at the site (as described above), these conditions were found on the small ridge above along the east edge of the site. Maguire's beardtongue (*Penstemon linaroides* subsp. *maguirei*) grows on limestone cliffs in pinon-juniper woodland at elevations between 6,000 and 6,500 ft. It has only been collected once in New Mexico in canyons near the Gila River in 1880 (NMRPTC, 1999). This type of habitat was not present in the project area. Penstemon specimens present at the site had linear leaves, and not oblanceolate leaves, and were determined to be the more common toadflax beardtongue (*Penstemon linaroides* subsp. *linaroides*).

A total of 114 species were encountered at the site (Table 2). The site is dominated by gray oak (*Quercus grisea*), Emory oak (*Quercus emoryi*), alligator juniper (*Juniperus deppeana*) in the overstory; shrub live oak (*Quercus turbinella*), beargrass (*Nolina microcarpa*), broom snakeweed (*Gutierrezia sarothrae*), Wright's silktassel (*Garrya wrightii*), three-leaf sumac (*Rhus trilobata*), manzanita (*Arctostaphylos pungens*) and younger oaks are the dominant species in the shrub layer. Black grama (*Bouteloua eriopoda*), blue grama (*B. gracilis*) sideoats grama (*B. curtipendula*), sand dropseed (*Sporobolus cryptandrus*), purple threeawn (*Aristida purpurea*) and Carruth's sagewort (*Artemisia carruthii*) dominate the herbaceous layers.

No state or federally listed noxious weeds were detected during the survey.

TABLE 2. I	PLANT SPECIES	OBSERVED .	AT THE SITE	E SORTED B	BY LIFEFORM.	RELATIVE .	ABUNDANCE A	AS FOLLOWS,
A=ABUND	ANT, C=COMM	ON, U=UNCC	MMON, S=S	PARCE				

Scientific Name	Common Name	Relative Abundance			
Trees					
Juglans major	Arizona walnut	S			
Juniperus deppeana	alligator juniper	С			
Pinus edulis	piñon pine	С			
Prunus serotina	chokecherry	S			
Quercus emoryi	Emory oak	С			
Quercus grisea	gray oak	А			
	Shrubs				
Agave parryi	Parry's agave	S			
Ageratina herbacea	fragrant snakeroot	U			
Arctostaphylos pungens	manzanita	U			
Atriplex canescens	fourwing saltbush	U			
Baccharis pteronioides	yerba de pasmo	С			
Brickellia californica	California brickell bush	С			
Coryphantha vivipara	Arizona spiny star	S			
Cylindropuntia spinosior	cane cholla	U			
Dasylerion wheeleri	sotol	U			
Ericameria laricifolia	turpentine bush	S			
Ericameria nauseosa	rubber rabbitbrush	С			
Cercocarpus montanus	Mountain mahogany	С			
Fallugia paradoxa	Apache plume	С			
Eriogonum wrightii	Wright's buckwheat	С			



Scientific Name	Common Name	Relative Abundance
Garrya wrightii	Wright's silktassel	С
Gutierriezia sarothrae	broom snakeweed	А
Isocoma tennuisecta	burroweed	U
Lonicera albiflora	western white honeysuckle	S
Lycium pallidum	pale wolfberry	S
Mimosa biuncifera	catclaw mimosa	А
Nolina microcarpa	beargrass	U
Opuntia chlorotica	pancacke pricklypear	U
Quercus turbinella	shrub live oak	С
Rhus trilobata	three-leaf sumac	С
Yucca bacata	banana yucca	U
Yucca elata	soaptree yucca	U
	Forbs	
Acmispon (syn.= Lotus) wrightii	Wright's deervetch	U
Ambrosia acanthicarpa	flat-spine burr-ragweed	U
Argemone pleiacantha	southwestrn pricklypoppy	U
Artemisia carruthii	Carruth's sagebrush	А
Artemisia dracunculus	tarragon	U
Artemisia ludoviciana	silver sagewort	U
Astragalus mollossimus	woolly locoweed	U
Bahia absinthifolia	hairyseed bahia	S
Baileya multiradiata	desert marigold	S
Cirsium neomexicanum	New Mexico thistle	U
Comandra umbellata	bastard toadflax	S
Croton texensis	doveweed	S
Cryptantha cinerea	James' cryptantha	S
Cucurbita foetidissima	buffalo gourd	S
Dalea sp.	prairie clover	S
Datura wrightii	sacred datura	S
Dieteria asteroides	fall tansy-aster	С
Dyssodia papposa	fetid marigold	U
Bouchera sp.	rockcress	U
Brickellia eupatorioides	false boneset	U
Brickellia floribunda	Chihuahuan brickellbush	U
Brickellia lemmonii	Lemmon's brickellbush	U
Chaetopappa ericoides	rose heath	U
Erigeron neomexicanus	New Mexico fleabane	S
Eriogonum alatum	winged buckwheat	S
Eriogonum jamesii	James' buckwheat	U



Scientific Name	Common Name	Relative Abundance
Eriogonum polycladon	sorrel buckwheat	S
Euphorbia albomarginata	whitemargin spurge	S
Euphorbia revoluta	threadstem spurge	S
Euphorbia serpillifolia	thyme-leaf sandmat	S
Evolvulus sericeus	silver dwarf morningglory	S
Glandularia bipinnatifida	Dakota mock vervain	U
Grindelia arizonica	Arizona gumweed	U
Heliomerus longifolia	longleaf false goldeneye	U
Heterotheca subaxillaris	camphorweed	U
Hymenopappus filifolius	fineleaf hymenopappus	U
Hymenothrix wrightii	Wright's thimblehead	U
Hymenoxys richardsonii	pingue	U
Lactuca serriola	prickly lettuce	U
Lappula occidentalis	flatspine stickseed	U
Lepidium sp.	pepperweed	S
Machaeranthera tanacetifolia	tanseyleaf tansyaster	U
Marrubium vulgare	horehound	S
Mentzelia multiflora	Adonis blazingstar	S
Mentzelia pumila	dwarf mentzelia	S
Noccaea fendleri	alpine pennycress	U
Packera neomexicana	New Mexico groundsel	U
Pectis angustifolia	lemonscent	S
Pectis filipes	five-bract chinchweed	S
Penellia micrantha	mountain cross	S
Penstemon barbatus	beardlip penstemon	S
Penstemon linarioides	toadflax beardtongue	S
Physaria sp.	bladderpod	S
Plantago patagonica	woolly plantain	S
Salsola tragus	Russian thistle	U
Senecio flaccidus	threadleaf groundsel	S
Solanum elaeagnifolium	silverleaf nightshade	S
Sonchus asper	spiny-leaf sow-thistle	S
Sphaeralcea digitata	juniper globemallow	S
Sphaeralcea fendleri	Fendler's globemallow	S
Sphaeralcea laxa	caliche globemallow	S
Stephanomeria pauciflora	brownplume wirelettuce	S
Verbascum thapsus	common mullein	U
Verbesina encelioides	golden crownbeard	S
Xanthisma gracile	grass-leaf sleepy daisy	U



Scientific Name	Common Name	Relative Abundance				
Xanthisma spinulosum	lacy sleepy daisy	S				
Zinnia grandiflora	Rocky Mountain zinnia	U				
Gram	Graminoids (grasses and grass-like plants)					
Aristida purpurea	purple threeawn	С				
Bothriochloa barbinodis	cane bluestem	U				
Bouteloua curtipendula	sideoats grama	С				
Bouteloua eriopoda	black grama	А				
Bouteloua gracilis	blue grama	С				
Bouteloua hirsuta	hairy grama	U				
<i>Carex</i> sp.	sedge	S				
Festuca arizonica	Arizona fescue	U				
Muhlenbergia emersleyi	bullgrass	С				
Muhlenbergia longiligula	long-tongue muhly	U				
Muhlenbergia torreyi	ring muhly	S				
Piptochaetium fimbriatum	piñon ricegrass	S				
Schizachyrium scoparium	little bluestem	S				
Scleropgoon brevifolius	burro grass	S				
Sporobolus cryptandrus	sand dropseed	С				
Relative Abundance: A=Abundant; C=Common; U=Uncommon; S=Sparse						

CONCLUSIONS

A total of 114 plant species were observed during an early October 2020 survey at the Emma-Oak Grove site. No rare plants were detected during the survey; however, potential suitable habitat was observed for six species: *Agastache cana, Cymopterus davidsonii, Draba mogollonica, Scrophularia macrantha*, and *Silene Wrightii*. All potential suitable habitat was surveyed, and we did not detect any rare species. However, precipitation during the spring and summer of 2020 (including monsoons) was substantially below average near the site and throughout the Southwestern U.S. Plant diversity and abundance was also below average.

REFERENCES

- Brown, David E. 1994. Biotic Communities: Southwestern United States and Northwestern Mexico. University of Utah Press. Salt Lake City, Utah
- New Mexico Rare Plant Technical Council (NMRPTC). 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. <u>https://nmrareplants.unm.edu</u> (Latest update: 13 Nov 2020)

