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SURVEY FOR QUERCUS MACROCARPA  
IN THE POWDER RIVER RESOURCE AREA  
MILES CITY DISTRICT  
BUREAU OF LAND MANAGEMENT  
MONTANA

Prepared for:

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## EXECUTIVE SUMMARY

Quercus macrocarpa (bur oak), a sensitive plant species on the draft Bureau of Land Management sensitive plant list for Montana, was systematically surveyed in the Powder River Resource Area of the Miles City District. Scattered BLM tracts in the Alzada area south of Thompson Creek were screened. Four of the BLM tracts in the area contain Quercus macrocarpa, together making up ca. 1% of the local oak stand. The stand was mapped as extending over 10 miles in length, as a series of groves with major discontinuities. Conservation status information for Quercus macrocarpa was compiled in the course of the study and the BLM tracts evaluated relative to conservation concerns and needs.

## ACKNOWLEDGEMENTS

Funding for this project was provided by the Bureau of Land Management. The help and interest of Don Heinze, Dan Bricco, Louise de Montigny, Kent Bowen and Dan Hinckley is gratefully acknowledged. This study builds on the Alzada Oaks stand evaluations originally conducted by Peter Lesica for The Nature Conservancy and the Tenmile Creek Draw stand evaluation conducted by Rob Develice and Lisa Roe through the Montana Natural Heritage Program.

## I. INTRODUCTION

This study was initiated to update conservation status information on Quercus macrocarpa with particular reference to its occurrence on lands administered by the USDI Bureau of Land Management (BLM). The species is ranked as sensitive on the draft list of sensitive plant species by the Bureau of Land Management in Montana (USDI Bureau of Land Management 1992).

Two primary areas were in the original study design, the Alzada area in Carter County and a woody draw on the south side of the Tenmile Creek valley in Prairie County, both in the Powder River District. The latter was omitted when it was determined that the presence of Quercus macrocarpa was the result of planting. A site evaluation memo is provided on the latter separate from this report.

This final report details Alzada area survey procedures and results, statewide species conservation status (modified from Henifin et al. 1981), and significance of results to state species conservation.

## II. STUDY AREA AND METHODS

The study area is located southwest of Alzada and south of Thompson Creek in Carter County, in the far southeastern corner of the state. All BLM tracts south and west of Alzada were considered, but only tracts with trees were evaluated in the field (Figure 1).

Most of the study area is made up of a series of ridges extending into Wyoming. Physical and biological characteristics of the area are described under background species information.

BLM color aerial photographs (2 inches to the mile; flown 7-3-79) were used in conjunction with USGS 7.5' topographic maps to determine the location of forested areas, and tentatively distinguish between deciduous and evergreen canopy. The maps and aerial photograph frame numbers used are listed as follow:

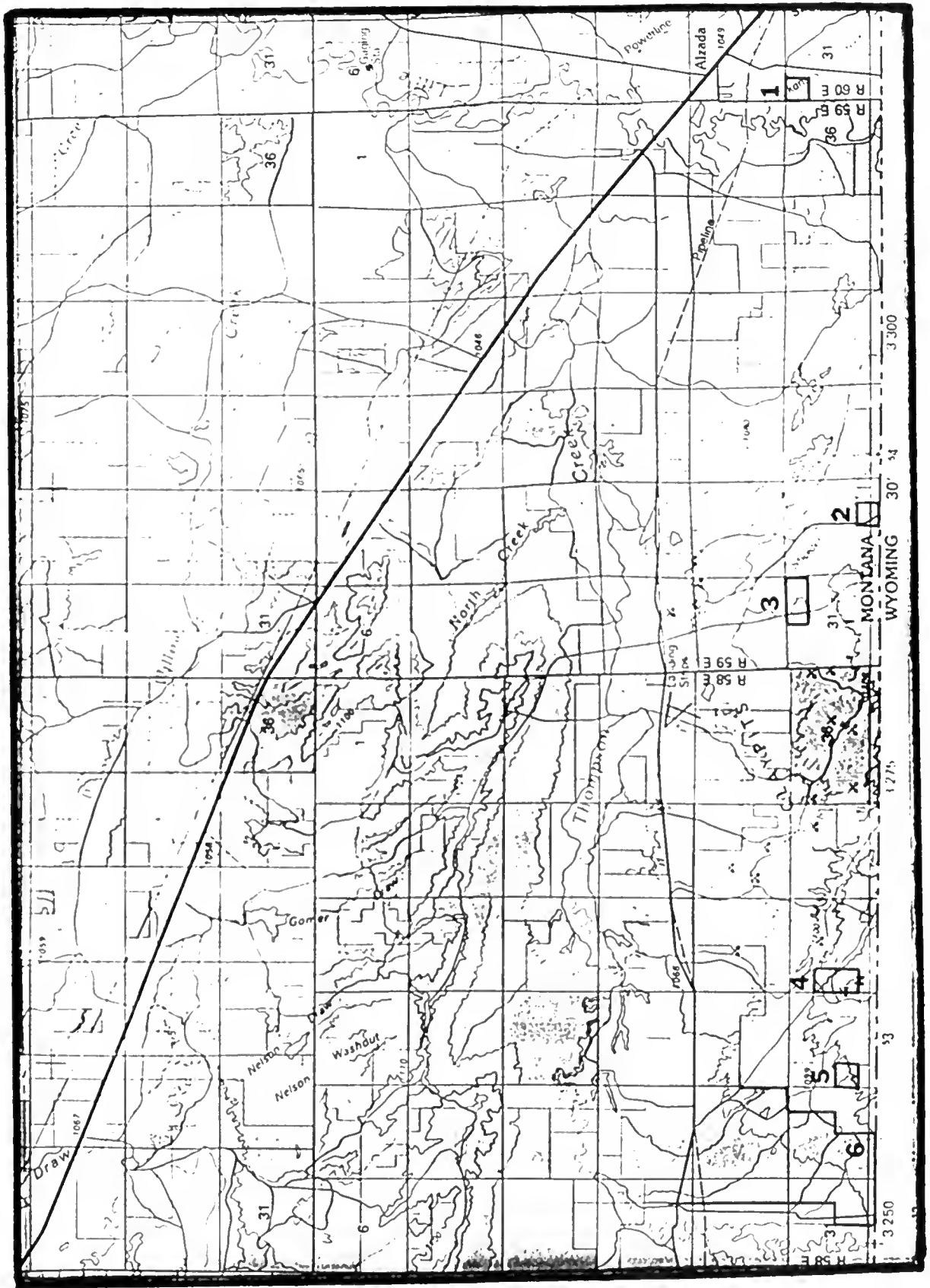
<u>USGS map</u>	<u>BLM aerial photo</u> (Flight line 24 MT 79)
Alzada	1-1-16, 1-1-17
Gomer Draw	gap, 1-1-22, 1-1-24
Cochran Reservoir	1-1-24

In addition, a Nature Conservancy site evaluation of the Alzada Oaks area (Lesica 1986) was consulted for preliminary boundaries, floristic inventory, and conservation observations.

BLM tracts without trees present were deleted from consideration. This included the majority of BLM administered lands in the area.



Figure 1. BLM tracts with woody cover in Alzada Oak area



Almost all wooded BLM tracts are within two miles of the Montana-Wyoming state line, but not all within this zone have trees.

Six tracts with woodland cover were visited on 27 August 1992 to characterize the extent of Quercus macrocarpa and note condition (Figure 1). In the course of this work, stand boundaries were also refined, and consideration was given to the impact of recent mining activity, to update species' and site conservation status information.

### III. GENERAL SPECIES AND SITE INFORMATION

#### A. CLASSIFICATION

1. SCIENTIFIC NAME: Quercus macrocarpa Michx.
2. COMMON NAME: Bur oak, mossy-cup oak
3. FAMILY: Fagaceae (Beech)
4. GENUS: The genus Quercus is a circumboreal genus of temperate and montane-tropical latitudes, spanning the Northern Hemisphere, characterized by a single fruit (acorn) subtended by the cuplike involucre.
5. SPECIES: Quercus macrocarpa is in the Lepidobalanus subgenera commonly referred to as the white oak group, characterized by rounded leaf lobes. Its species name refers the exceptionally large (macro) acorn (carpa; Figure 4).

#### B. PRESENT LEGAL OR OTHER FORMAL STATUS

##### 1. FEDERAL STATUS

- A. U.S. FISH & WILDLIFE SERVICE: None.
- B. BUREAU OF LAND MANAGEMENT: Sensitive on draft list of Bureau of Land Management in Montana (USDI Bureau of Land Management 1992).

2. STATE: Quercus macrocarpa is currently listed by Montana Natural Heritage Program (1993) as endangered in the state (state rank = S1). This is based on the fact that only one native stand is known in the state, and that there are threats to the stand. This recognition does not afford any form of legal protection.

Figure 2. Quercus macrocarpa close up

Figure 3. Quercus macrocarpa habitat in Alzada Oak area

### C. DESCRIPTION

1. GENERAL NONTECHNICAL: Quercus macrocarpa is a tree with a growth form ranging from large, broad and stately growing to heights of 150 ft. to a multi-trunked scrubby stature (Figure 3). Its bark is characteristically rough and deeply furrowed, its lobed leaves are broadest above the middle, usually with a deep indentation near the middle, and the acorn cup has fringes and covers 1/3 to 1/2 of the acorn (from Gleason and Cronquist 1991, Fernald 1970).

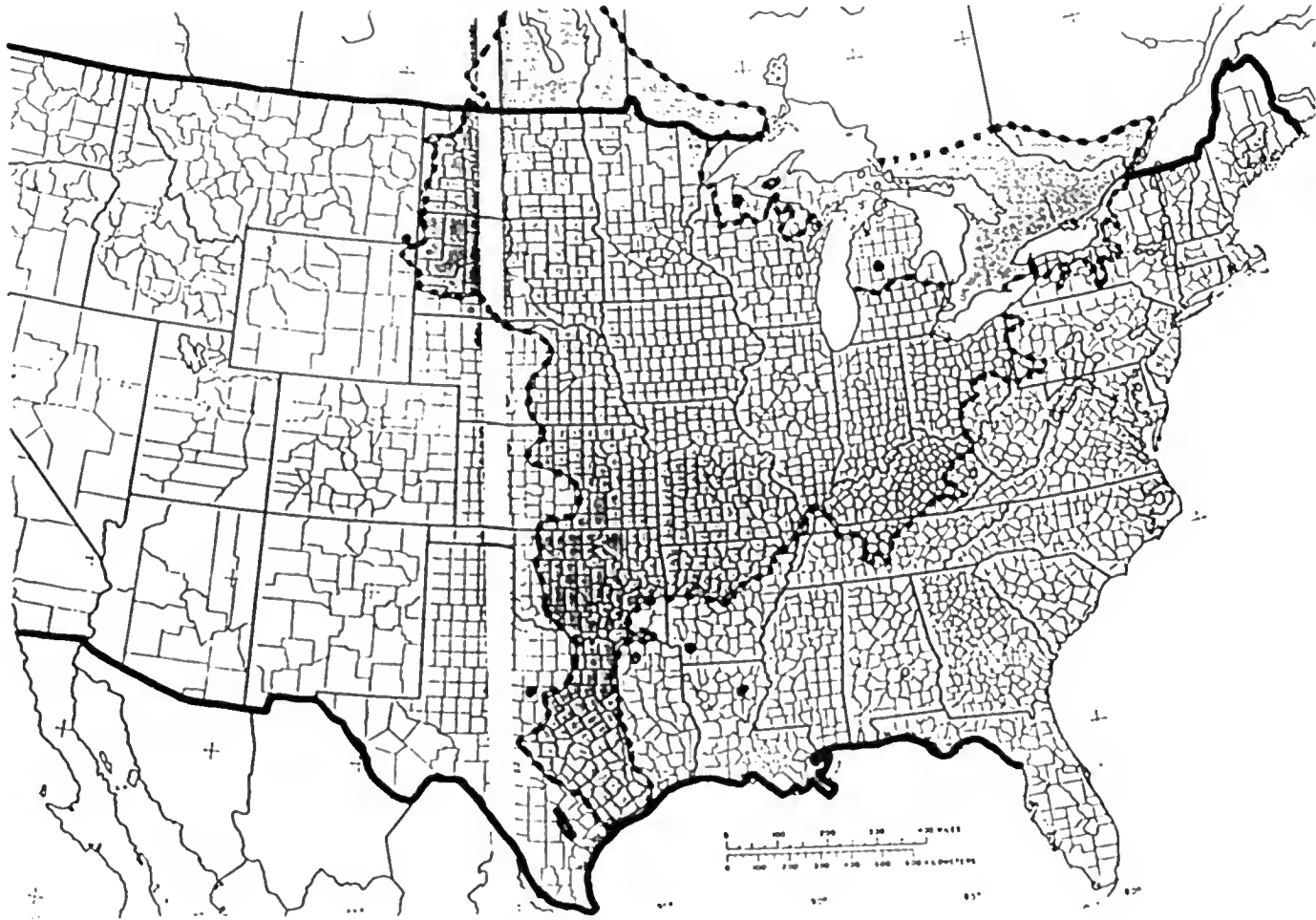
Bur oak is resistant to fire, surviving because of its thick bark and formation of subsurface woody burls from which multiple trunks may grow.

2. TECHNICAL: Tree to 50 m. height with branchlets at first pubescent and orange-tinged, later glabrate and gray, sometimes with cork-wings; leaves at first densely fine stellate pubescent, becoming glabrate and lustrous-green above (Figure 2) and gray or whitish and pubescent to glabrate beneath, obovate-oblong to broadly oblong, in maturity 1-3 dm. long, cuneate to slightly rounded at base,; the basal third with 1-3 pairs of short triangular lobes, these separated from the broader upper half or two-thirds by a well developed sinus, the broad terminal portion bluntly oblong or obovate-lobulate, a pair of sinuses near the middle usually deeper than the others; winter buds pubescent; peduncles short or obsolete, cup deep, 2-5 cm. across, thick and woody, its upper scales tapering to fringe-like tips (from Gleason and Cronquist 1991, Fernald 1950).

### D. GEOGRAPHIC DISTRIBUTION

1. RANGEWIDE: The range of Quercus macrocarpa is centered in the eastern United States (Figure \_\_\_), extending from Quebec through Saskatchewan to Texas, and from Maine to Montana (Great Plains Flora Association 1977, Little 1971). It is among the most widespread members of the genus in North America.

Figure 4. Rangewide distribution of Quercus macrocarpa



(Little 1971)

The Alzada Oaks stand south of the town of Alzada and Thompson Creek, represents the westernmost stand in the country. Major portions of the stand extend into Wyoming. Quercus macrocarpa is a low elevation dominant in foothills of the Black Hills of Wyoming and South Dakota. It has also been collected in escarpment settings from McKenzie and Billings County in western North Dakota.

There are various studies of Quercus macrocarpa species biology, ecology and genetics at the margins of its range (Chechowitz et al. 1987, Osborn et al 1982, Schnabel 1987), though none have included the Montana stand.

In the course of this work, the boundaries of the Alzada Oaks stand were determined. The stand is made up mainly of discontinuous scattered groves within the following sections:

T.9S R.58E Sec. 34, 35, 36  
T.9S R.59E Sec. 28, 29, 31, 32, 33, 34, 35  
T.9S R.60E Sec. 30, 31

Aerial photography resources were not at a scale suited for distinguishing tree species, but tree cover is limited in the study area (Figure 2). Quercus macrocarpa is intermixed with Fraxinus pennsylvanica along the Little Missouri River south of Alzada, is dominant in the open savanna conditions across much of the shale outcrop ridges, and is most common as co-dominant with Pinus ponderosa across the eastern 3/4 of the shale outcrop ridges.

In addition, it is being used increasingly in nursery trade across the state, and many areas of the country are studying it in provenance tests.

2. CURRENT SITES: Alzada Oaks is considered to be the only native stand in Montana. There is also a Gallatin County collection from the Montana State University campus (1971) representing horticultural material (see below).
3. HISTORIC SITES: Three counties are represented in the distribution map for Quercus macrocarpa in Booth (1966): Carter, Powder River and Gallatin. The Carter County record corresponds with the Alzada Oaks site. The Gallatin County site corresponds with a campus planting. The Powder River site

collected in 1941, is noted as having only small saplings and is interpreted as probably planted.

4. UNVERIFIED/UNDOCUMENTED REPORTS: None.

E. HABITAT: In the center of its range, Quercus macrocarpa occupies moist bottomlands, rich woods and fertile slopes (Gleason and Cronquist 1991, Fernald 1970). At the western extension of its range, it is among the most stress-tolerant deciduous tree species, growing in sand dunes, dry foothills of the Black Hills, escarpments, and shale outcrops.

Unless otherwise stated, the following habitat characterizations will refer to the Alzada Oak stand.

1. ASSOCIATED VEGETATION: Quercus macrocarpa occurs as codominant in a woodland community with Pinus ponderosa and Juniperus scopulorum, grading into a localized savanna condition where it is the only tree species. Other associated species include:

Agropyron smithii  
Carex heliophila  
Festuca octoflora  
Plantago aristata  
Poa arida  
Polygonum douglasii  
Stipa comata

The communities have little or no shrub layer except in areas dominated by Pinus ponderosa, and the woodland herbaceous community is not well-represented either.

The flora is relatively depauperate, whether due to the harsh setting or the history of grazing. A general species list for the Alzada Oaks stand is presented in Appendix 2.

2. TOPOGRAPHY: At the Montana site, Quercus macrocarpa is most common on upland settings of ridgetops, upper ridge slopes and rolling uplands. It is present intermittently on exposed south-facing slopes and on toe slopes.
3. SOILS RELATIONSHIPS: At the western margins of its range, Quercus macrocarpa occupies the most dry and often the most infertile of habitats occupied by deciduous tree species. Bedrock at the study site area is Mowry Shale, of silicified shale and claystone with thick beds of bentonite. The study

area extended east to Little Missouri River alluvium derived from shale parent material. Soils are aridisols and entisols. Their low permeability and relatively infertile, acidic composition exacerbate the affects of the harsh climate.

4. REGIONAL CLIMATE: The extreme southeastern corner of Montana has an arid continental climate with a relatively long 120-130 day growing season and extreme temperatures, including some of the state's warmest growing season temperatures (Cunningham 1982).

#### F. POPULATION BIOLOGY

1. PHENOLOGY: The inconspicuous flowers of Quercus macrocarpa emerge in spring before leaf-out and mature as the new leaf buds are beginning to open.

Acorns had almost reached full size by the time of fieldwork in late August, but are not mature until after frost.

2. POPULATION SIZE AND CONDITION: Population size is estimated at roughly 10,000 individuals, present on over 1000 acres, with densities ranging from 1 tree/acre to ca. 20 trees/acre.

Only two trees were cored in the ridge and river settings. Heart rot in the river cores interrupted the record.

The largest tree in the river setting was 18" DBH (4.9' circumference), estimated at 110 years. A "typical" tree in the ridge settings was 6" DBH estimated at 60 years. The former has a faster growth rate and was established before settlement. The latter dates back to the Great Drought.

3. REPRODUCTIVE BIOLOGY

- a. TYPE OF REPRODUCTION: Sexual outcrossing.
- b. POLLINATION BIOLOGY: Wind-pollinated.
- c. SEED DISPERSAL AND BIOLOGY: Squirrels are the most highly adapted seed dispersing vectors. Fox squirrels (Sciurus niger) and red squirrels (Tamiasciurus hudsonicus) are both documented from this area of the state, the former feeding exclusively on deciduous trees, and the latter favoring



evergreen trees (Clark and Stromberg 1974). Both were observed in the study area.

Caches of acorns buried by fox squirrels and left may enhance dispersal. The multi-trunked clustering of oak in the stand may reflect this origin, or else it may reflect a resprouting following disturbance like fire.

#### G. POPULATION ECOLOGY

- a. COMPETITION: All three of the tree species present in the Alzada Oaks stand: Quercus macrocarpa, Pinus ponderosa, and Juniperus scopulorum require high light conditions for establishment. The first two are climax species at the site and do not develop a closed canopy. The Juniperus scopulorum is not a major community component, but in segments of the population, its establishment is centered around the base of Quercus macrocarpa, believed to reflect dispersal by avian vectors that prefer the deciduous tree for perch. Few examples were seen in which the former had overgrown the latter.
- b. HERBIVORY: Leaves of Quercus macrocarpa are most vulnerable to herbivory after they emerge and their concentration of tannins and phenols are lowest.

Defoliating insect activity was not noted, but galls were common and leaf-mining occasional.

Disease warrants mention; heart rot was present in the tree cored along the Little Missouri River, and suspected in the ridge slope trees.

Tree vigor is low in the harsh Alzada Oak setting, and the majority of trees have dead limbs. However, Quercus macrocarpa is a rugged tree and almost no standing dead trees are in the area.

#### IV. RESULTS AND DISCUSSION

This section provides an update to interpretation of the significance of the Alzada Oak stand, its conservation status and needs. Approximately 12 acres with Quercus macrocarpa were found among the 360 acres of BLM tracts evaluated, representing ca. 1% of the stand. It was spread across four of the six wooded or partially wooded tracts evaluated.

The Alzada Oak stand is the only population of Quercus macrocarpa (G5S1) in the state, and a singular plant community (Pinus ponderosa/ Quercus macrocarpa; G2S1). It has state significance in both respects, and potential rangewide significance as a plant community. This plant community or closely related plant communities are also known from Nebraska, South Dakota and Wyoming. The G2 rank (globally threatened) is to be considered preliminary.

The Alzada Oak stand warrants some level of protection. It is recommended that Quercus macrocarpa remain on the BLM state list of sensitive species to avert species threats where it is found on lands administered by the BLM, even though these lands represent less than 1% of the stand, and do not include many individuals. Subsurface rights administered by BLM below the stand may be more extensive.

The long history of grazing by sheep and horses and the harsh environment at the site favor high numbers of introduced species and a relatively impoverished native flora. Further fieldwork is recommended early in the season to make assessments of overall species diversity, successional status and recovery potential.

Two other plant species of state significance grow at the site, Penstemon angustifolius (G5S1) and Linaria canadensis var. texana (G4G5S1). Both are localized within the stand and have fewer than five other records in the state. They were not found on BLM tracts in the stand.

Bentonite mining has developed within the center of the stand, in at least three sections. Quercus macrocarpa trees have been excavated in these sections, including trees at the edge of a grove on BLM stand 4 (Figure 1). Accompanying the mining activity are areas of surface disturbance, major road developments, and spoil piles.

While Quercus macrocarpa has been tested for mine revegetation in the eastern part of the country, mitigation by revegetation in general or with eastern genotypes in particular does not restore stand integrity.

In summary, protection is recommended for Quercus macrocarpa in Montana. Establishment of a buffer in the course of mining permit reviews is to be considered under BLM sensitive species policy towards this goal.

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Appendix 1.

ALZADA OAK  
Status of Quercus macrocarpa on BLM tracts

<u>Tract</u>	<u>Location</u>	<u>Comments</u>
1	T12N R60E Sec. 31 NW/NW	Upland oldfields prevail. Oak is dominant on Little Mo. R. oxbow slopes; also a few in ash bottoms. Heavily disturbed, exotic understory. Oak covers ca. 5 acres.
2	T12N R59E Sec. 32 SW/SE	Open rangeland prevails. Oak is dominant on ridge toeslope grading above into pine side slope. Grazing has altered stand structure. Oak covers ca. 5 acres.
3	T12N R59E Sec. 31 N/NE	Open rangeland prevails. Oak is present on toeslope that barely enters tract. Oak covers ca. 1 acre. Mining is outside of oak area.
4	T12N R58E Sec. 34 SW/NW NW/SW	Open rangelands prevail. The SW 1/3 of this tract is wooded though pine dominates and oak is occasional. Edge of grove taken out by mining. Oak covers ca. 1 acre.
5	T12N R58E Sec. 33 NW/SW	Pine woods prevail. Pine is the sole tree species in this tract.
6	T12N R58E Sec. 32, 31	Open rangelands prevail, with only pine present.

Alzada Oaks Flora (cont.)

Page 2

Linaria canadensis  
Mentzelia albicaulis  
Microseris gracilis  
Mollugo verticilata  
Mulinion divaricatum  
Nemophila breviflora  
Oenothera caespitosa  
Opuntia polyacantha  
Panicum capillare  
Panicum spp.  
Penstemon erianthus  
Penstemon glaber  
Penstemon gracilis  
Penstemon strictus  
Pinus ponderosa  
Plantago aristata  
Plantago purshii  
Poa pratensis  
Polygonum douglasii  
Portulaca oleracea  
Psoralea argophylla  
Quercus macrocarpa  
Silene antirrhina  
Sporobolus cryptandrus  
Stipa comata  
Townsendia spp.  
Vicia americana  
Zigadenus venosus

Appendix 2.

Alzada Oak Flora

From Lesica survey of 15 June 1986,  
and Heidel survey of 27 August 1992

Achillea millefolium  
Agoseris glacua  
Agropyron smithii  
Allium textile  
Alopecurus carolinianus  
Andropogon scoparius  
Androsace septentrionalis  
Anemone patens  
Antenaria microphylla  
Arnica soroia  
Artemisia dracunculus  
Artemisia frigida  
Artemisia ludoviciana  
Artemisia tridentata  
Aristida longiseta  
Atriplex argentea  
Atriplex canescnes  
Beckmannia syzigachne  
Besseyia wyomingensis  
Bouteloua gracilis  
Bromus tectorum\*  
Buchloe dactyloides  
Camelina microcarpa\*  
Campanula rotundifolia  
Carex pensylvanica  
Cerastium arvense  
Chenopodium fremontii  
Chrysopsis villosa  
Collinsia parviflora  
Collomia linearis  
Cryptantha celosioides  
Cryptantha torreyana  
Draba nemorosa  
Eriogonum pauciflora  
Euphorbia esula\*  
Festuca octoflora  
Gaura coccinea  
Geum triflorum  
Grindelia squarrosa  
Gutierrezia sarothrae  
Hedeoma hispida  
Juncus balticus  
Juncus tenuis  
Juniperus scopulorum  
Koeleria cristata  
Lappula redowski  
Lotus purshiana  
Liatris punctata

APPENDIX 3.

QUERCUS MACROCARPA \* 001  
BUR OAK

Global rank: G5 Forest Service status:  
State rank: S1 Federal Status:

Survey site name: ALZADA OAKS  
EO rank: AB  
EO rank comments: EXTENSIVE, THREATENED.

County: CARTER

USGS quadrangle: GOMER DRAW  
ALZADA  
COCHRAN RESERVOIR

Township:	Range:	Section:	TRS comments:
009S	059E	32	W2; 29 S2SE4; 28 S2SW4; ; 31; 33; 34; 35
009S	058E	36	E2SE4; 35 S2S2; 34 S2S2
009S	060E	31	NW4NW4

Survey date:	1986-06-15	Elevation:	3435 -3650
First observation:	194X-05-13	Slope/aspect:	0-20%/ALL ASPECTS, ESPECIALLY NE
Last observation:	1992-08-27	Size (acres):	1200

Location:

FROM ALZADA GO NORTH ON HWY 212 ABOUT 1 MILE, CROSS RIVER,  
TAKE RIDGE ROAD WEST 5.4 MILES. PROCEED SOUTH ON UNIMPROVED  
ROAD ABOUT 2 MILES TO SHELDON CREEK.

Element occurrence data:

EST. 5,000 TO 10,000 TREES AS DOMINANTS OR CO-DOMINANTS  
ACROSS MUCH OF SCATTERED SAVANNA AND SCRUB WOODLAND  
COMMUNITIES; 10-20 FEET TALL, MOSTLY LESS THAN 20 CM DBH,  
MAXIMUM DBH CA. 45 CM. IN LEAF; SEEDLINGS; INSECT DAMAGE,  
EXPRESSWAY-SIZED MINING ROADS, GRAZING, BENTONITE MINING.  
DIMINISHING IN FREQUENCY WESTWARD AND DOWNSLOPE.

General site description:

CONCENTRATED ON EASTERN THREE-FOURTHS OF NW-SE TRENDING  
SHALE RIDGE SYSTEMS, ALSO EXTENDING EAST TO LITTLE MISSOURI  
RIVER. MOWRY SHALE-HEAVY CLAY SOIL; PINUS PONDEROSA/QUERCUS  
MACROCARPA/JUNIPERUS SCOPULORUM WOODLAND WITH ALMOST NO  
SHRUB UNDERSTORY, ALMOST NO WOODLAND HERBACEOUS UNDERSTORY;  
MAINLY CAREX PENNSYLVANICA AND PRAIRIE GRASSES.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)  
BLM: MILES CITY DISTRICT, POWDER RIVER RESOURCE AREA  
STATE LAND - UNDESIGNATED

Comments:

AMONG WESTERNMOST STANDS OF BUR OAK RANGEWIDE; EXTENDING  
INTO WYOMING. ALSO CONSIDERED A COMMUNITY EO.

Information source:

LESICA, P. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF  
MONTANA, MISSOULA, MT 59812.



Specimens:

LESICA, P. (3847). 1986. MONTU. SPECIMEN #104571.

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