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A Comparative Floristic Study of Mount Taylor and Redondo Peak, New Mexico

Neal L. Osborn

FLORISTIC STUDY OF MOUNT TAYLOR AND REDONDO PEAK - OSBORN

A COMPARATIVE FLORISTIC STUDY OF MOUNT TAYLOR AND REDONDO PEAK, NEW MEXICO

By

Neal L. Osborn

A Dissertation

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Art Stege
DEAN

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By

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A COMPARATIVE FLORISTIC STUDY OF MOUNT TAYLOR AND REDONDO PEAK, NEW MEXICO

INTRODUCTION

For several years, there has been an intensified interest and activity in floristic studies of various areas in New Mexico, especially of certain well-isolated mountain masses characteristic of many mountainous areas in New Mexico. Many of these mountain masses are, in effect, islands of montane biota separated from other islands by lower and drier mesa and valley barriers. Botanists realize a need to investigate thoroughly the floras of these mountain localities and to compare the floras of these areas with one another to reveal possible modifications in flora composition or species differences that may have arisen as a result of geographic isolation and subsequent changes in gene frequencies. Cain (1944) states that "mountains on land are in many respects like islands in the seas, because their isolation is relatively complete for reasons of climates and climaxes."

A portion of this study is a comparison of the floras of Redondo Peak and Mount Taylor and is an enlargement of a floristic investigation of Mount Taylor begun in the summer of 1960.

Another portion of this investigation is the morphological comparisons of population samples of three selected species common to Mount Taylor and Redondo Peak. Because of the apparent isolation of these two areas from each other and from other mountainous regions since mid-Pleistocene, it is important to know if this isolation has been a significant factor in the development of morphological

A COMPARATIVE FLORISTIC STUDY OF MOUNT TAYLOR AND REDONDO PEAK, NEW MEXICO

by

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DIFFERENCES IN VARIOUS TAXA.

REDONDO PEAK WAS CHOSEN AS THE COMPANION STUDY AREA TO MOUNT TAYLOR BECAUSE OF SIMILARITIES OF GEOLOGIC ORIGIN, ELEVATION, AND GEOGRAPHIC LOCATION. IN ADDITION, LITTLE FLORISTIC RESEARCH HAS BEEN DONE ON REDONDO PEAK.

MOUNT TAYLOR, THE HIGHEST PEAK IN THE SAN MATEO MOUNTAINS, IS IN THE CIBOLA NATIONAL FOREST OF NORTH-CENTRAL VALENCIA COUNTY IN NORTHWESTERN NEW MEXICO. THESE SAN MATEO MOUNTAINS SHOULD NOT BE CONFUSED WITH THE SAN MATEO MOUNTAINS IN SOCORRO AND SIERRA COUNTIES.

MOUNT TAYLOR AND THE ADJACENT PEAKS FORM A HORSESHOE-SHAPED RIDGE WHICH BORDERS A LARGE DEPRESSION, THE WEST END OF WATER CANYON. THIS RIDGE IS THE REMNANT OF AN EXTINCT VOLCANIC CONE, DATING FROM THE MIOCENE, AND MOUNT TAYLOR, THE HIGHEST POINT ON THIS RIDGE (11,389 FT), WAS A SECONDARY VENT OF THE MAIN VOLCANO (ANDERSON, 1961).

REDONDO PEAK IS LOCATED IN THE MIDST OF THE JEMEZ MOUNTAINS, A LARGE MOUNTAIN RANGE IN NORTH-CENTRAL NEW MEXICO. THE PEAK IS PART OF A PRIVATELY OWNED TRACT OF LAND, FORMERLY THE BACA LAND GRANT LOCATION NO. 1, NOW OWNED BY THE BACA LAND AND CATTLE COMPANY, JAMES P. DUNIGAN, PRESIDENT.

REDONDO PEAK, ONE OF SEVERAL PEAKS IN THE JEMEZ MOUNTAINS AND THE HIGHEST POINT (11,254 FT) ON A PILE OF TERTIARY AND QUATERNARY ORIGIN, IS IN THE MIDDLE OF A NEARLY CIRCULAR DEPRESSION, THE VALLES CALDERA. THIS CALDERA, REPUTED TO BE THE LARGEST IN THE WORLD, IS COMPOSED OF SEVERAL MONTANE VALLEYS, THE VALLE GRANDE BEING THE MOST EXTENSIVE (ROSS ET AL., 1961).

THE VOLCANIC ACTIVITY IN THE JEMEZ AREA BEGAN IN THE MIOCENE AND

AND CULMINATED IN THE PLEISTOCENE, WITH A CATASTROPHIC ERUPTION AND SUBSEQUENT COLLAPSE OF THE ROOF OF A HUGE MAGMA CHAMBER, THUS FORMING THE VALLES CALDERA. FURTHER ACTIVITY RESULTED IN AN UPLIFT OF THE CALDERA FLOOR FORMING REDONDO PEAK AND THE REDONDO BORDER, THE LATTER COMPOSED OF HIGH RIDGES SURROUNDING THE CALDERA (ROSS ET AL., 1961).

A MAJOR REASON FOR SELECTING REDONDO PEAK FOR THIS STUDY IS ITS NEARLY UNTOUCHED CONDITION IN RESPECT TO LUMBERING, GRAZING, AND SCIENTIFIC INVESTIGATION. UNTIL THE BACA LAND GRANT LOCATION NO. 1 CAME UNDER THE OWNERSHIP OF THE BACA LAND AND CATTLE COMPANY, IT WAS DIFFICULT TO OBTAIN ACCESS TO THIS LAND.

MATERIALS AND METHODS

MOST OF THE MAJOR COLLECTION SITES ON MOUNT TAYLOR WERE READILY ACCESSIBLE VIA THREE UNIMPROVED ROADS, SEVERAL TRAILS, AND EXTENSIVE MEADOW AREAS. IT WAS A RELATIVELY SIMPLE MATTER TO SELECT SPECIFIC STUDY AREAS IN EACH LIFE ZONE ON ALL APPROACHES TO MOUNT TAYLOR. THESE AREAS WERE THEN ACCURATELY PLOTTED ON TOPOGRAPHIC MAPS (LOBO SPRINGS AND MOUNT TAYLOR QUADRANGLES) TO FACILITATE RESAMPLING WHEN NECESSARY.

REDONDO PEAK PRESENTED A MORE DIFFICULT PROBLEM IN THE SELECTION OF COLLECTION SITES. A JEEP TRAIL FOLLOWS THE PEAK'S EAST AND SOUTH APPROACHES, BUT THERE ARE NO ROADS ON THE PEAK PROPER AND THE SINGLE HORSE TRAIL TO THE SUMMIT IS NOW OBSCURED. THE PEAK IS FORESTED WITH EXTREMELY DENSE STANDS OF SPRUCE AND FIR. THE FOREST FLOOR IS SO STREWN WITH STUMPS AND LOGS THAT IT IS NEARLY IMPENETRABLE IN PLACES. IN ADDITION TO FEW MEADOWS THE FEW OPEN AREAS ON THE PEAK ARE THE RESULT OF FALLEN TREES AND ROCKSLIDES. BECAUSE OF A DENSE

STAND OF FOREST, FEW OPEN AREAS, AND A LACK OF ROADS OR TRAILS ON THE PEAK, RESAMPLING OF A SELECTED COLLECTION SITE WAS SOMETIMES IMPOSSIBLE. FOR THE MOST PART, BROAD TRANSECTS WERE RUN FROM THE BASE TO THE SUMMIT ON ALL SLOPE EXPOSURES EXCEPT FOR THE NEARLY INACCESSIBLE NORTHWEST SLOPE. IT WAS DIFFICULT TO PLOT ACCURATELY SOME TRANSECTS ON THE TOPOGRAPHIC MAP AND TO RELOCATE THEM WITH PRECISENESS FOR RESAMPLING, THUS A FEW TRANSECTS WERE APPROXIMATED WHEN RECOLLECTED. THE ACCURATELY PLOTTED STUDY SITES WERE THE RANCH HEADQUARTERS AREA, LA JARA CREEK, TWO UNNAMED CREEKS, THREE MEADOWS, AND THE SUMMIT.

A TOTAL OF 10 TRANSECTS AND SPECIFIC COLLECTION SITES WERE SELECTED. EACH OF THESE WAS, AS ACCURATELY AS POSSIBLE, PLOTTED ON THE UNITED STATES GEOLOGICAL SURVEY TOPOGRAPHIC MAP, JEMEZ SPRINGS QUADRANGLE. MOST AREAS WERE SAMPLED A MINIMUM OF THREE TIMES TO OBSERVE THE FLORISTIC CHANGES THROUGHOUT THE GROWING SEASON, BUT, BECAUSE OF THE RUGGED APPROACHES, THE WEST AND SOUTHWEST SLOPES WERE SAMPLED ONLY TWICE.

SAMPLES WERE TAKEN AT REGULAR INTERVALS DURING JUNE, JULY, AUGUST, AND THE FIRST HALF OF SEPTEMBER, 1963 AND 1964. WITH FEW EXCEPTIONS, AT LEAST TWO SPECIMENS OF EACH SPECIES WERE COLLECTED FROM EACH STUDY AREA ON REDONDO PEAK. ALL PLANTS WERE PRESSED, DETERMINED, PROCESSED, CATALOGED, AND ACCESSIONED INTO THE UNIVERSITY OF NEW MEXICO HERBARIUM. A TOTAL OF 1335 SPECIMENS, REPRESENTING 50 FAMILIES AND 231 SPECIES, WERE COLLECTED FROM THE PEAK. THE ALGAE, FUNGI, MOSSES, LIVERWORTS, AND LICHENS WERE OMITTED FROM THIS STUDY.

IN ADDITION TO COMPREHENSIVE SAMPLING, COLLECTIONS OF A MINIMUM

of 100 specimens of each species from each mountain were collected from populations of Iris missouriensis, Helenium hoopesii, and Campanula rotundifolia, with about equal number of collections from Mount Taylor and Redondo Peak. The sites of these population studies were chosen from areas of similar elevations, slope exposures, and habitats on both peaks. All plants from the mass collections were processed in the same manner as were plants of other collections.

From 50 to 53 specimens of each population from each peak were randomly selected for the analysis of various characteristics. Anderson (1929) and Turrill (1936) state that the reproductive parts of plants are more reliable than vegetative parts in studies involving the genetic composition of populations because the former are less sensitive to environmental influences. Nevertheless, the writer chose to examine both reproductive and vegetative structures. The data accumulated from these population samples were analyzed statistically and presented graphically.

Sources consulted for the identification of specimens included general family descriptions (Benson, 1957; W.C. Martin, unpublished), area and state floras (Coulter, 1909; Dittmer, Castetter, and Clark, 1954; Gould, 1951; Harrington, 1954; Hitchcock, 1950; Kearney and Peebles, 1951; Tidestrom, 1941; Vines, 1960; Wooton and Standley, 1915), and monographs and an unpublished key (W.C. Martin, unpublished; Naylor, unpublished; Nisbet and Jackson, 1960).

LIFE ZONES OF MOUNT TAYLOR AND REDONDO PEAK

There is never a distinct banding of life zones around any mountain peak, but rather a gradual blending and unequal distribution

OF THESE ZONES IN RESPECT TO ELEVATION AND SLOPE EXPOSURE. A SPECIES TYPICAL OF A CERTAIN ZONE WILL OFTEN BE FOUND IN AREAS OUTSIDE THAT ZONE IF THE HABITAT IS CONDUCIVE TO SURVIVAL. THEREFORE, IT IS COMMON TO FIND SPECIES CHARACTERISTIC OF ONE ZONE EXTENDING INTO ADJOINING ZONES, A CONDITION PRONOUNCED ON MOUNT TAYLOR BUT ALSO EVIDENT ON REDONDO PEAK. BAILEY (1913), CAIN (1944), AND OOSTING (1958) WERE CONSULTED AS THE AUTHORITIES FOR LIFE-ZONE DESCRIPTIONS AND CRITERIA.

LIFE ZONES OF MOUNT TAYLOR

THE BASE ELEVATION OF REDONDO PEAK RANGES FROM 8,500 FT TO 8,800 FT. THEREFORE, FOR AN ACCURATE ELEVATIONAL COMPARISON, ONLY THE LIFE ZONES FROM 8,500 FT TO THE SUMMIT OF MOUNT TAYLOR WILL BE DISCUSSED.

THE TRANSITION ZONE, CHARACTERIZED BY PINUS PONDEROSA, IS THE MOST EXTENSIVE ZONE ON MOUNT TAYLOR. THIS PINE IS THE DOMINANT TREE AT THE 8,500-FT LEVEL ON ALL SIDES OF THE PEAK. QUERCUS GAMBELII COMMONLY OCCURS IN LARGE PATCHES OF DENSE GROWTH AT ELEVATIONS OF 8,600 FT TO 9,800 FT. STANDS OF PINUS PONDEROSA COVER ALL THE HIGH MESAS AND THE DRY SOUTH-, WEST-, AND SOUTHWEST-FACING SLOPES UP TO 9,800-10,000 FT ELEVATION. ON THE MORE MESIC NORTH-, EAST-, AND NORTHEAST-FACING SLOPES, PSEUDOTSUGA TAXIFOLIA INVADES PINUS PONDEROSA AT 8,600-8,800 FT ELEVATION. THE UPPER REACHES OF THE TRANSITION ZONE END ABRUPTLY IN DRY, HIGH MEADOWS AND THICK STANDS OF PICEA ENGELMANNII AND ABIES LASIOCARPA VAR. ARIZONICA.

THE CANADIAN ZONE OR THE MIXED CONIFER ZONE IS THE LEAST WELL-DEFINED ZONE ON MOUNT TAYLOR. BECAUSE THIS ZONE IS SO FRAGMENTED, THERE IS SOME DOUBT THAT IT SHOULD BE DESIGNATED AS A DISTINCT LIFE

ZONE ON MOUNT TAYLOR. PICEA PUNGENS, ABIES CONCOLOR, AND PSEUDOTSUGA TAXIFOLIA, SOMETIMES ACCOMPANIED BY SCATTERED PINUS PONDEROSA ON THE DRIER SLOPES, ARE THE USUAL CLIMAX SPECIES OF THIS ZONE. POPULUS TREMULOIDES IS THE SUBCLIMAX OR POSTFIRE DOMINANT. THE CANADIAN ZONE ON MOUNT TAYLOR IS UNIQUE WITH THE ABSENCE OF ABIES CONCOLOR. THE WRITER, AFTER AN INTENSIVE SEARCH, DISCOVERED NO ABIES CONCOLOR IN THE ENTIRE AREA.

THE CANADIAN ZONE APPEARS IN COOL, MOIST CANYONS AND RAVINES AT ELEVATIONS OF 8,700-9,500 FT AND IS MOST EXTENSIVE IN UPPER WATER CANYON AT 9,300-9,500 FT WIIERE IT APPEARS AS FRAGMENTS MIXED WITH PINUS PONDEROSA ON THE DRIER SLOPES. AT 9,300-9,350 FT, PICEA PUNGENS SHOWS MORPHOLOGICAL CHARACTERISTICS INTERMEDIATE BETWEEN PICEA PUNGENS AND PICEA ENGELMANNII. ABOVE 9,400 FT ELEVATION, PICEA ENGELMANNII SOON REPLACES PICEA PUNGENS. PSEUDOTSUGA TAXIFOLIA IS UNCOMMON ABOVE 9,600 FT ELEVATION. IN ADDITION TO THE CANADIAN ZONE IN WATER CANYON, SMALL AREAS OF THE CANADIAN ZONE ARE FOUND AT SAN MATEO SPRINGS AND IN UPPER LOBO CANYON, COLORADO CANYON, AND NUMEROUS RAVINES ON THE NORTH, NORTHWEST, AND NORTHEAST SLOPES OF MOUNT TAYLOR.

THE SUBALPINE ZONE IS RESTRICTED TO ELEVATIONS ABOVE 9,700 FT ON THE NORTH AND NORTHEAST EXPOSURES, ABOVE 10,000 FT ELEVATION ON THE NORTHWEST AND WEST EXPOSURES, AND ABOVE 10,400 FT ELEVATION ON THE SOUTH EXPOSURES. THE CLIMAX SPECIES ARE PICEA ENGELMANNII AND ABIES LASIOCARPA VAR. ARIZONICA.

THIS ZONE IS DIVIDED INTO TWO DISTINCT COMMUNITIES, THE DENSE CLIMAX FOREST AND THE POSTCLIMAX WINDSWEPT GRASSLAND OF POA

FENDLERIANA, POA INTERIOR, DANTHONIA CALIFORNICA, FESTUCA ARIZONICA, CASTILLEJA SP., POTENTILLA SP., AND PSEUDOCYMOPTERUS MONTANUS. ABOVE 11,200 FT ELEVATION ON MOUNT TAYLOR PEAK, PICEA ENGELMANNII BECOMES STUNTED AND GNARLED AT THE FOREST EDGE ON THE EAST AND WEST SLOPES.

THERE IS NO ALPINE ZONE ON MOUNT TAYLOR. THIS IS EVIDENCED BY DENSE STANDS OF ENGELMANN SPRUCE GROWING WITHIN 20 FT IN ELEVATION OF THE SUMMIT. IN ADDITION, MOUNT TAYLOR IS TOO LOW TO BE ABOVE TIMBERLINE AS UPPER TIMBERLINE FOR THIS PART OF NEW MEXICO USUALLY BIGINS ABOVE 12,000 FT.

LIFE ZONES OF REDONDO PEAK

THE TRANSITION ZONE IS FRAGMENTARY ON THE PEAK. THE ONLY STANDS OF PINUS PONDEROSA ENCOUNTERED WERE LOCATED AT ELEVATIONS OF 8,500-8,700 FT ON SOUTH SLOPES, 8,800-9,000 FT ON SOUTHEAST SLOPES, AND 8,900 FT IN A SMALL MATURE STAND NEAR THE RANCH HEADQUARTERS. COMMONLY, SCATTERED PONDEROSA PINES ARE FOUND IN THE LOWER RANGE OF THE CANADIAN ZONE ON THE EAST AND NORTHEAST SLOPES AT APPROXIMATELY 8,800 FT ELEVATION. A FEW PONDEROSA PINES INHABIT DRY RIDGES AT ELEVATIONS AS HIGH AS 9,500 FT ON THE SOUTH SLOPES AND ON THE EAST SLOPES.

THE CANADIAN OR MIXED-CONIFER ZONE IS WELL REPRESENTED ON REDONDO PEAK BY THE CLIMAX SPECIES ABIES CONCOLOR, PICEA PUNGENS, PINUS FLEXILIS IN THE UPPER PORTION, AND PSEUDOTSUGA TAXIFOLIA, SOMETIMES ACCOMPANIED BY PINUS PONDEROSA, ON LOWER AND DRIER EXPOSURES. POPULUS TREMULOIDES IS A POSTFIRE OR SUBCLIMAX DOMINANT IN A PORTION OF THIS ZONE.

THE CANADIAN ZONE BEGINS AT ELEVATIONS OF 8,900 FT ON THE EAST, NORTHEAST, AND NORTH SLOPES AND AT 9,300 FT ON THE SOUTH AND WEST SLOPES. AT 9,600-9,700 FT ELEVATION ON THE EAST, NORTHEAST, AND NORTH SLOPES AND ON THE SOUTH SLOPE AT 9,750 FT, PICEA PUNGENS EXHIBITS MORPHOLOGICAL CHARACTERISTICS INTERMEDIATE BETWEEN PICEA PUNGENS AND PICEA ENGELMANNII. ABOVE THESE ELEVATIONS, PICEA ENGELMANNII REPLACES PICEA PUNGENS. ABIES CONCOLOR IS UNIFORMLY UNCOMMON ON THE PEAK ABOVE 9,550-9,600 FT ELEVATION AND PSEUDOTSUGA TAXIFOLIA IS UNCOMMON ABOVE 9,700 FT WITH THE EXCEPTION OF A FEW DEPAUPERATE SPECIMENS IN SUBALPINE MEADOWS AT ELEVATIONS OF 10,200-10,500 FT.

THE CANADIAN ZONE MERGES WITH THE SUBALPINE ZONE AT ELEVATIONS OF ABOUT 9,600 FT ON THE EAST, NORTHEAST, AND NORTH SLOPES AND 9,800 FT ON THE SOUTH AND WEST SLOPES AND EXTENDS TO THE SUMMIT. THIS ZONE IS CHARACTERIZED BY THE CLIMAX SPECIES ABIES LASIOCARPA VAR. ARIZONICA, PICEA ENGELMANNII, AND IN LOWER PORTIONS OF THE ZONE OCCASIONAL SPECIMANS OF PINUS FLEXILIS. IN ADDITION TO THE EXTENSIVE SPRUCE-FIR CLIMAX FOREST, SMALLER AREAS OF POSTCLIMAX MEADOW ALSO EXIST IN THE SUBALPINE ZONE. COMMON TAXA IN THESE MEADOWS INCLUDE BLEPHARONEURON TRICHOLEPIS, DANTHONIA INTERMEDIA, FESTUCA ARIZONICA, KOELERIA CRISTATA, POA FENDLERIANA, P. INTERIOR, PSEUDOCYMOPTERUS MONTANUS, AND SEVERAL SPECIES OF POTENTILLA.

THERE IS NO ALPINE ZONE ON REDONDO PEAK. WITH THE EXCEPTION OF SEVERAL GRASSLAND AND ROCKSLIDE AREAS, THE PEAK IS HEAVILY FORESTED FROM THE BASE NEARLY TO THE SUMMIT. THE THIN-SOILED, ROCKY, WIND-SWEPT SUMMIT SUPPORTS ONLY SCATTERED MATURE ENGELMANN SPRUCE AND

ALPINE FIR. WITH THE POSSIBLE EXCEPTION OF CAREX BELLA, C. SICCATA, AND SOLIDAGO DECUMBENS, CONSIDERED ALPINE SPECIES BY BAILEY (1913) AND HARRINGTON (1954), ALL THE TAXA GROWING ON THE SUMMIT ARE PLANTS OF SUBALPINE AND CANADIAN ZONES.

DESCRIPTION OF COLLECTION AREAS AND SPECIES CHECK LISTS OF REDONDO PEAK

BECAUSE OF THE NEARLY UNIFORM FOREST COVER ON THE PEAK, THE COLLECTION AREA DESCRIPTIONS ARE BRIEF. THE DESCRIPTIONS PRESENTED INDICATE LOCATION, ELEVATION, ANY OUTSTANDING GEOLOGICAL FEATURES, LIFE ZONES, AND DOMINANT SPECIES. A CHECK LIST OF ALL SPECIES COLLECTED IN EACH STUDY AREA IS INCLUDED. IF A COLLECTION AREA EXTENDS INTO SEVERAL ZONES, EACH ZONE, ALONG WITH ITS ACCOMPANYING CHECK LIST, IS TREATED SEPARATELY.

A. BACA RANCH HEADQUARTERS (ELEVATION 8,800-9,000 FT)

THE RANCH HEADQUARTERS COMPRISES AN AREA APPROXIMATELY 1 MILE SQUARE AND IS LOCATED 1.3 AIR MILES EAST OF THE SUMMIT (LAT 35°64'N LONG 106 31'W). THE SOUTHERN PORTION OF THIS AREA SUPPORTS A PURE STAND OF PINUS PONDEROSA. THE REMAINING PORTION OF THIS LOCATION IS COVERED BY AN OPEN STAND OF ABIES CONCOLOR, PICEA PUNGENS, PINUS PONDEROSA, AND PSEUDOTSUGA TAXIFOLIA. JUST SOUTH OF THE PONDEROSA PINE IS A SMALL, SPRING-FED STOCK TANK PARTIALLY BORDERED WITH TYPHA LATIFOLIA. THIS AREA ABRUPTLY SLOPES TO THE EAST INTO THE VALLE GRANDE AND IS TREATED SEPARATELY IN THE SPECIES CHECK LIST.

Species Check List

(1) Ranch Headquarters, Immediate Area

BORAGINACEAE

Hackelia floribunda (Lehm.) Johnst.

CAMPANULACEAE

Campanula parryi Gray
Campanula rotundifolia L.

CARYOPHYLLACEAE

Arenaria fendleri Gray var. *brevifolia* (Maguire) Maguire

CHENOPODIACEAE

Chenopodium albescens Small
Chenopodium capitatum (L.) Asch.

COMPOSITAE

Achillea lanulosa Nutt.
Artemisia carruthii Wood.
Erigeron canus Gray

CRUCIFERAE

Sisymbrium altissimum L.

CUPRESSACEAE

Juniperus communis L.

CYPERACEAE

Carex scoparia Schkuhr.

GERANIACEAE

Geranium caespitosum James
Geranium fremontii Torr.

GRAMINEAE

Agrostis exarata Trin.
Bromus tectorum L.
Festuca arizonica Vasey
Poa interior Rydb.

BORAGINACEAE

CARYOPHYLLACEAE

CHENOPODIACEAE

COMPOSITAE

CRUCIFERAE

CYPERACEAE

GERANIACEAE

GRAMINEAE

LABIATAE

Moldavica parviflora (Nutt.) Britton

LILIACEAE

Allium geyeri Wats.

LORANTHACEAE

Arceuthobium vaginatum (H.B.K.) Eichler

PINACEAE

Picea pungens Engelm.
Pinus ponderosa Lawson
Pseudotsuga taxifolia (Poir.) Britton

POLYGONACEAE

Rumex acetosella L.

ROSACEAE

Potentilla pulcherrima Lehm

SALICACEAE

Populus tremuloides Michx.

SCROPHULARIACEAE

Verbascum thapsus L.

UMBELLIFERAE

Pseudocymopterus montanus (Gray) Coult. & Rose

(2) Ranch Headquarters, Stock Tank Area

GRAMINEAE

Deschampsia caespitosa (L.) Beauv.
Phleum pratense L.

GUTTIFERAE

Hypericum formosum H.B.K.

JUNCACEAE

JUNCUS CONFUSUS COVILLE
JUNCUS MARGINATUS ROSTK.

LABIATE

MENTHA ARVENSIS L.
PRUNELLA VULGARIS L.

LEGUMINOSAE

TRIFOLIUM LACERUM GREENE

ONAGRACEAE

EPILOBIUM CALIFORNICUM HAUSSKN.

TYPHACEAE

TYPHA LATIFOLIA L.

B. THE SOUTH SLOPE

(ELEVATION 8,800-10,900 FT; LAT 35°64'N LONG 106°32'W)

WITH THE EXCEPTION OF SEVERAL SMALL ROCKSLIDES, A SEEP AT 9,700 FT ELEVATION, AND A MEADOW RANGING BETWEEN 10,900 FT ELEVATION AND THE SUMMIT, THE SOUTH SLOPE IS DENSELY FORESTED. THE COLLECTION TRANSECT TRAVERSES THE UPPER TRANSITION ZONE, AS WELL AS THE CANADIAN AND SUBALPINE ZONES. PLANTS AROUND THE SEEP ARE LISTED SEPARATELY.

SPECIES CHECK LIST

(1) TRANSITION ZONE (ELEVATION 8,800-9,300 FT)

COMPOSITAE

CIRSIUM PARRYI (GRAY) PETRAK.

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

GRAMINEAE

Bromus tectorum L.
Festuca arizonica Vasey
Poa interior Rydb.

MALVACEAE

Sidalcea candida Gray

PINACEAE

Pinus ponderosa Lawson
Pseudotsuga taxifolia (Poir.) Britton

ROSACEAE

Potentilla pulcherrima Lehm.

SAXIFRAGACEAE

Ribes montigenum McClelland

SCROPHULARIACEAE

Penstemon barbatus (Cav.) Roth.

(2) CANADIAN ZONE (ELEVATION 9,300-9,800 FT)

BERBERIDACEAE

Berberis repens Lindl.

BORAGINACEAE

Hackelia floribunda (Lehm.) Johnst.

CAMPANULACEAE

Campanula rotundifolia L.

COMPOSITAE

Achillea lanulosa Nutt.
Erigeron subtrinervis Rydb.
Hymenoxys richardsonii (Hook.) Cockerell
Senecio macdougalii Heller

CRUCIFERAE

Capsella bursa-pastoris (L.) Medic.

GRAMINEAE

Phonus tectorum L.
Festuca arundinacea Vasey
Poa interior Hyde.

MALVACEAE

Sidalcea ca.-lyra Davy

PINACEAE

Pinus ponderosa Laws.
Pseudotsuga taxifolia (Poir.) Britt.

ROSACEAE

Potentilla pulcherrima Lehm.

SAXIFRAGACEAE

Ribes montigenum McClatchie

SCROPHULARIACEAE

Pedstemon barbatus (Cav.) Ker.

(?) CAMPANULACEAE (*Lysimachia ciliata* L.-*Steironema ciliatum*

BERBERIDACEAE

Berberis repens Lindl.

BORAGINACEAE

Hackelia floribunda (Lehm.) I.M.Johnst.

CAMPANULACEAE

Campanula rotundifolia L.

COMPOSITAE

Achillea lanulosa Nutt.
Erigeron subtrinervis Rydb.
Hymenoxys richardsonii (Hook.) Cockerell
Senecio macounii Greene

CRUCIFERAE

Capsella bursa-pastoris (L.) Medic.

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

FAGACEAE

QUERCUS GAMBELII NUTT.

GERANIACEAE

GERANIUM EREOMOPHILUM WOOT. & STANDL.
GERANIUM FREMONTII TORR.

GRAMINEAE

AGROPYRON PSEUDOREPENS SCRIBN. & SMITH
BROMUS CILIATUS L.
DESCHAMPSIA CAESPITOSA (L.) BEAUV.
FESTUCA THURBERI VASEY
HORDEUM BRACHYANTHERUM NEVSKI
KOELERIA CRISTATA (L.) PERS.

HYDROPHYLLACEAE

PHACELIA MAGELLANICA (LAM.) COV.

LEGUMINOSAE

LUPINUS AMMOPHILUS GREENE
ROBINIA NEOMEXICANA GRAY
VICIA AMERICANA MUHL.

LILIACEAE

ALLIUM CERNUUM ROTH. VAR. *OBTUSUM* COCKERELL
ZIGADENUS ELEGANS PURSH

PINACEAE

PICEA ENGELMANNII PARRY
PICEA PUNGENS ENGELM.
PINUS FLEXILIS JAMES
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

POLEMONIACEAE

GILIA AGGREGATA (PURSH) SPRENG.

ROSACEAE

FRAGARIA BRACTEATA HELLER
HOLODISCUS DUMOSUS (NUTT.) HELLER

Prunus virginiana L.
Rubus strigosus Michx.

Rubiaceae

Galium aparine L.

Salicaceae

Populus tremuloides Michx.

Scrophulariaceae

Castilleja confusa Greene
Penstemon whippleanus Gray
Verbascum thapsus L.

Umbelliferae

Pseudocymopterus montanus (Gray) Coult. & Rose

(3) Subalpine Zone (Elevation 9,800-11,000 ft)

Seep Area (Elevation 9,800 ft)

Betulaceae

Alnus oblongifolia Torr.

Boraginaceae

Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Compositae

Helianthella quinquenervis (Hook.) Gray
Rudbeckia laciniata L.
Senecio macdougalii Heller
Senecio wootonii Greene

Cyperaceae

Carex festivella Mackenz.

Labiatae

Prunella vulgaris L.

RUBIACEAE

SALICACEAE

SCROPHULARIACEAE

Verbascum thapsus L.

UMBELLIFERAE

BETULACEAE

BORAGINACEAE

CAMPANULACEAE

COMPOSITAE

CYPERACEAE

LABIATAE

LILIACEAE

Allium cernuum Roth. var. *obtusum* Cockerell

MALVACEAE

Sidalcea candida Gray

ONAGRACEAE

Epolobium californicum Hausskn.

POLYGONACEAE

Rumex occidentalis Wats.
Rumex triangulivalvis (Danser) Rech.

RANUNCULACEAE

Aconitum columbianum Nutt.

ROSACEAE

Fragaria bracteata Heller
Geum macrophyllum Willd.
Prunus virginiana L.

SCROPHULARIACEAE

Mimulus guttatus DC.
Penstemon whippleanus Gray

UMBELLIFERAE

Heracleum lanatum Michx.
Ligusticum porteri Coult. & Rose

URTICACEAE

Urtica gracilis Ait.

Rockslide (Elevation 9,800 ft)

COMPOSITAE

Brickellia grandiflora (Hook.) Nutt.

ROSACEAE

Holodiscus dumosus (Nutt.) Heller

SAXIFRAGACEAE

JAMESIA AMERICANA TORR. & GRAY

(4) ENGELMANN SPRUCE-ALPINE FIR FOREST

AND SMALL OPEN AREAS (ELEVATION 9,800-11,000 FT)

ACERACEAE

ACER GLABRUM TORR. (LIMITED TO 9,800-10,300 FT ELEVATION)

FAGACEAE

QUERCUS GAMBELII NUTT. (LIMITED TO 9,800 FT ELEVATION)

GRAMINEAE

BLEPHARONEURON TRICHOLEPIS (NASH.) TORR.
KOELERIA CRISTATA (L.) PERS.

PINACEAE

ABIES LASIOCARPA NUTT. VAR. *ARIZONICA* (MERRIAM) LEMMON
PICEA ENGELMANNII PARRY
PINUS FLEXILIS JAMES (LIMITED TO 9,900-10,500 FT ELEVATION)

ROSACEAE

POTENTILLA HIPPIANA LEHM.
PRUNUS VIRGINIANA L.
RUBUS PARVIFLORUS NUTT.

SCROPHULARIACEAE

CASTILLEJA CONFUSA GREENE
PEDICULARIS GRAYI A. NELS.

UMBELLIFERAE

OSMORHIZA OBTUSA (COULT. & ROSE) FERN.

SOUTH SLOPE, OPEN MEADOW (ELEVATION 10,700-11,200 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ACHILLEA LANULOSA NUTT.
AGOSERIS AURANTIACA (HOOK.) GREENE
ERIGERON SUBTRINERVIS RYDB.
HELENIUM HOOPESII GRAY
SENECIO UINTAHENSIS A. NELS.

GERANIACEAE

GERANIUM CAESPITOSUM JAMES

GRAMINEAE

AGROPYRON SUBSECUNDUM (LINK.) MALTE
BLEPHARONEURON TRICHOLEPIS (NASH.) TORR.
DANTHONIA INTERMEDIA VASEY
ELYMUS VIRGINICUS L.
FESTUCA THURBERI VASEY
KOELERIA CRISTATA (L.) PERS.
SITANION HYSTRIX (NUTT.) J.G. SMITH

LILIACEAE

ALLIUM CERNUUM ROTH. VAR. OBTUSUM COCKERELL
CALOCHORTUS GUNNISONII WATS.

POLYPODIACEAE

PTERIDIUM AQUILINIUM (L.) KAHN.

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

C. SOUTHWEST SLOPE (ELEVATION 9,500-11,000 FT;

LAT. 35°65'N LONG. 106°35'W)

THE SOUTHWEST SLOPE IS FORESTED TO THE SUMMIT WITH THE EXCEPTION OF A FEW SMALL OPENINGS RESULTING FROM FALLEN TREES AND ROCKSLIDES. THIS TRANSECT IS ENTIRELY WITHIN THE CANADIAN AND SUBALPINE ZONES.

Species Check List

(1) Canadian Zone (Elevation 9,500-9,800 ft)

Creek and Surrounding Area (Elevation 9,500-9,800 ft)

Aceraceae

Acer glabrum Torr.

Betulaceae

Alnus tenifolia Nutt.

Boraginaceae

Mertensia franciscana Heller

Cruciferae

Cardamine cordifolia Gray

Cyperaceae

Carex festivella Mackenz.

Gramineae

Phleum alpinum L.

Labiatae

Mentha arvensis L.
Prunella vulgaris L.

Liliaceae

Veratrum californicum Durand

Malvaceae

Sidalcea candida Gray

Onagraceae

Epilobium californicum Hausskn.

Polypodiaceae

Dryopteris filix-mas (L.) Schott.

(1) CARACIAN ZONE (ELEVATION [illegible]

CREEK AND SURROUNDING SIDE (ELEVATION [illegible]

ACERACEAE

ACER CIABRUM Torr.

BETULACEAE

ALNUS TENUIFOLIA Nutt.

BORAGINACEAE

MERTENSIA FRANCISCANA Heller

CRUCIFERAE

CARDAMINE CORDIFOLIA Gray

CYPERACEAE

CAREX FESTIVELLA Mackenz.

GRAMINEAE

PHLEUM ALPINUM L.

LABIATAE

MENTHA ARVENSIS L.
PRUNELLA VULGARIS L.

LILIACEAE

VERATRUM CALIFORNICUM Durand

MALVACEAE

SIDALCEA MALVIFLORA Gray

ONAGRACEAE

EPILOBIUM CALIFORNICUM Hausk.

POLYPODIACEAE

CRYPTOGRAMMA [illegible]

ROSACEAE

ROSA NEOMEXICANA COCKERELL
RUBUS PARVIFLORUS NUTT.
RUBUS STRIGOSUS MICHX.

RUBIACEAE

GALIUM APARINE L.

SCROPHULARIACEAE

MIMULUS GUTTATUS DC.
VERONICA AMERICANA (RAF.) SCHWEIN.

UMBELLIFERAE

HERACLEUM LANATUM MICHX.
LIGUSTICUM PORTERI COULT. & ROSE

FORESTED AREA (ELEVATION 9,500-9,800 FT)

ACERACEAE

ACER GLABRUM TORR.

BERBERIDACEAE

BERBERIS REPENS LINDL.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

CELASTRACEAE

PACHYSTIMA MYRSINITES (PURSH.) RAF.

COMPOSITAE

ACHILLEA LANULOSA NUTT.
HELENIUM HOOPESII GRAY

GERANIACEAE

GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

KOELERIA CRISTATA (L.) PERS.
POA INTERIOR RYDB.

ROSACEAE

Rosa sp.
Rubus parviflorus Nutt.
Rubus sp.

RUBIACEAE

Galium aparine L.

SCROPHULARIACEAE

Mimulus guttatus DC.
Veronica americana (Raf.) Schwein.

UMBELLIFERAE

Heracleum lanatum Michx.
Lomatium dorreii Coult. & Nutt.

[illegible] AREA (ELEVATION [illegible])

ACERACEAE

Acer glabrum Torr.

BERBERIDACEAE

Berberis repens Lindl.

CAMPANULACEAE

Campanula rotundifolia L.

CELASTRACEAE

Pachystima myrsinites (Pursh.) Raf.

Composite

Achillea lanulosa Nutt.
Hieracium scouleri Hook.

GERANIACEAE

Geranium richardsonii Fisch. & [illegible]

GRAMINEAE

Bouteloua gracilis (L.) [illegible]
Poa interior Rydb.

LEGUMINOSAE

VICIA AMERICANA MUHL.

ORCHIDACEAE

CORALLORHIZA MACULATA RAF.

PINACEAE

ABIES CONCOLOR (GORDON) HOOPES
PICEA PUNGENS ENGELM.
PINUS PONDEROSA LAWSON
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

ROSACEAE

POTENTILLA PULCHERRIMA LEHM.

SALICACEAE

POPULUS TREMULOIDES MICHX.

(2) SUBALPINE ZONE (ELEVATION 9,800-11,000 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ACHILLEA LANULOSA NUTT.
ANTENNARIA APRICA GREENE
CIRSIUM PARRYI (GRAY) PETRAK.
ERIGERON CANUS GRAY
HELENIUM HOOPESII GRAY
SOLIDAGO DECUMBENS GREENE

GERANIACEAE

GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

KOELERIA CRISTATA (L.) PERS.
POA INTERIOR RYDB.

LEGUMINOSAE

VICIA AMERICANA MUHL.

LEGUMINOSAE

Vicia americana Muhl.

ONAGRACEAE

Oenothera hookeri Torr.

PINACEAE

Abies concolor (Gordon) Hildebr.
Picea pungens Engelm.
Pinus ponderosa Laws.
Pseudotsuga taxifolia (Poir.) Britton

ROSACEAE

Potentilla pulcherrima Lehm.

SALICACEAE

Populus tremuloides Michx.

(2) Subalpine zone (elevation 9,500-11,500 ft)

CAMPANULACEAE

Campanula rotundifolia L.

COMPOSITAE

Achillea lanulosa Nutt.
Antennaria aprica Greene
Chrysothamnus viscidiflorus (Hook.) Nutt.
Erigeron peregrinus (Pursh) Greene
Haplopappo carthamoides Torr. & Gray
Senecio fremontii Torr. & Gray
Solidago decumbens Greene

GERANIACEAE

Geranium richardsonii Fisch. & Trautv.

GRAMINEAE

Koeleria cristata (L.) Pers.
Poa interior Rydb.

LEGUMINOSAE

Vicia americana Muhl.

PINACEAE

ABIES LASIOCARPA NUTT. VAR. *ARIZONICA* (MERRIAM) LEMMON
PICEA ENGELMANNII PARRY
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

RANUNCULACEAE

THALICTRUM FENDLERI ENGELM.

ROSACEAE

FRAGARIA BRACTEATA HELLER
POTENTILLA HIPPIANA LEHM.

SCROPHULARIACEAE

CASTILLEJA CONFUSA GREENE

D. THE WEST SLOPE (ELEVATION 9,300-11,000 FT; LAT. 35°65'N LONG. 106°36'W)

WITH THE EXCEPTION OF A FEW OPEN WINDFALL AREAS, THE WEST SLOPE IS DENSELY FORESTED AT ELEVATIONS BETWEEN 9,000 AND 11,000 FT. A ROCKY, SPRUCE-DOTTED MEADOW AND EXTENSION OF A LARGE ROCKSLIDE EXIST ABOVE THE 11,000-FT LEVEL. A SMALLER MEADOW IS LOCATED BETWEEN 10,500 AND 10,700 FT ON THIS SLOPE. BECAUSE OF THE INACCESSABLE APPROACH, THIS SLOPE WAS NOT COLLECTED BELOW THE 9,300-FT LEVEL.

SPECIES CHECK LIST

(1) CANADIAN ZONE (ELEVATION 9,300-9,800 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

HELENIUM HOOPESII GRAY

ERICACEAE

Pterospora andromedea Nutt.

PINACEAE

Abies concolor (Gordon) Hoopes
Picea pungens Engelm.
Pseudotsuga taxifolia (Poir.) Britton

(2) Subalpine Zone (Elevation 9,800-11,000 ft)

CAMPANULACEAE

Campanula rotundifolia L.

COMPOSITAE

Achillea lanulosa Nutt.
Senecio atratus Greene
Viguiera multiflora (Nutt.) Blake

CUPRESSACEAE

Juniperus communis L.

GRAMINEAE

Blepharoneuron tricholepis (Nash.) Torr.
Muhlenbergia montana (Nutt.) Hitchc.

PINACEAE

Abies lasiocarpa Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry
Pseudotsuga taxifolia (Poir.) Britton

POLEMONIACEAE

Gilia aggregata (Pursh.) Spreng.

POLYPODIACEAE

Pteridium aquilinum (L.) Kuhn.

RANUNCULACEAE

Thalictrum fendleri Engelm.

SCROPHULARIACEAE

Penstemon whippleanus Gray

ERICACEAE

PTEROSPORA ANDROMEDEA HUT .

PINACEAE

ABIES CONCOLOR (GORDON) HOPKIN
PICEA RUBENS SARGENT.
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

(2) SUBALPINE ZONE (ELEVATION 5,000-11,000 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ACHILLEA LANULOSA NUTT.
SENECIO ATRATUS GRAYIS
VIGUIERA MULTIFLORA (NUTT.) BLAKE

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

GRAMINEAE

DESCHAMPSIA TRICHOPHYLLA (HACK.) VASH.
MUHLENBERGIA MONTANA (NUTT.) HITCH.

PINACEAE

ABIES LASIOCARPA (HOOK.) NUTT. VAR. ARIZONICA (MERR.) LEMM.
PICEA ENGELMANNII A.
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

POLEMONIACEAE

GILIA AGGREGATA (PURSH.) SPRENG.

POLYPODIACEAE

PTERIDIUM AQUILINUM (L.) KUHN.

RANUNCULACEAE

THALICTRUM FENDLERI GRAY.

SCROPHULARIACEAE

PENSTEMON MONTANUS GRAY

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

E. THE SOUTHEAST SLOPE (ELEVATION 8,800-10,900 FT; LAT. 35°64'N. LONG 106°31W)

THIS SLOPE IS EASILY APPROACHED ONLY THROUGH A RAVINE THAT BISECTS A SERIES OF STEEP RIDGES AND SMALL PEAKS ATTAINING AN ALTITUDE OF 10,000 FT, ALL OF WHICH FLANK REDONDO PEAK PROPER.

THE MOST EXTENSIVE EXPANSES OF MEADOW AND ROCKSLIDE ARE LOCATED ON THE SOUTHEAST SLOPE. THESE AREAS COVER MUCH OF THE SOUTHEAST SLOPE AND PART OF THE EAST SLOPE FROM 10,000 TO 11,200 FT ELEVATION. THE SLOPE IS DENSELY FORESTED FROM THE BASE OF THE PEAK TO THE BEGINNING OF THE MEADOW AT THE 10,000-FT LEVEL. JUST SOUTH OF THE MEADOW IS ANOTHER AREA OF DENSE FOREST FROM 10,000 TO 11,000 FT ELEVATION.

THIS TRANSECT BEGINS IN THE EXTREME UPPER EXTENSION OF THE TRANSITION ZONE AND CUTS THROUGH THE CANADIAN AND SUBALPINE ZONES, FOLLOWING A SMALL CREEK AND SURROUNDING SEEPS AT ELEVATIONS BETWEEN 9,600 AND 10,000 FT.

THE SPECIES CHECK LIST INCLUDES ONLY THOSE SPECIES FOUND IN THE MEADOW AND ROCKSLIDE AREA UP TO 10,600 FT. THE SPECIES FROM THE HIGHER ELEVATIONS OF THIS AREA ARE LISTED WITH THE EAST SLOPE TRANSECT BECAUSE BOTH TRANSECTS INTERSECT AT THE 11,600-FT LEVEL.

Species Check List

(1) Transition Zone (Elevation 8,800-8,950 ft)

Boraginaceae

Lithospermum multiflorum Torr.

Campanulaceae

Campanula rotundifolia L.

Compositae

Helenium hoopesii Gray
Rudbeckia hirta L.

Geraniaceae

Geranium caespitosum James

Gramineae

Festuca arizonica Vasey
Koeleria cristata (L.) Pers.

Guttiferae

Hypericum formosum H.B.K.

Leguminosae

Vicia americana Muhl.

Liliaceae

Allium cernuum Roth.

Pinaceae

Pinus ponderosa Lawson
Pseudotsuga taxifolia (Poir.) Britton

Polemoniaceae

Gilia aggregata (Pursh) Spreng.

Rosaceae

Potentilla fruticosa L.

(1) Trabajo [illegible]

SCROPHULARIACEAE

PENSTEMON BARBATUS (CAV.) ROTH.

(2) CANADIAN ZONE (ELEVATION 8,950-9,600 FT)

ACERACEAE

ACER GLABRUM TORR.

BERBERIDACEAE

BERBERIS REPENS LINDL.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ANTENNARIA MARGINATAM GREENE
HELENIUM HOOPESII GRAY
RUDBECKIA HIRTA L.

GERANIACEAE

GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

FESTUCA ARIZONICA VASEY
KOELERIA CRISTATA (L.) PERS.
POA INTERIOR RYDB.

IRIDACEAE

SISYRINCHIUM DEMISSUM GREENE

LEGUMINOSAE

LUPINUS AMMOPHILUS GREENE
VICIA AMERICANA MUHL.

LILIACEAE

ALLIUM CERNUUM ROTH.
CALOCHORTUS GUNNISONII WATS.

PINACEAE

ABIES CONCOLOR (GORDON) HOOPES

SCROPHULARIACEAE

PENSTEMON BARBATUS (CAV.) ROTH.

(2) CANADIAN ZONE (ELEVATION 8,000-9,000 FT.)

ACERACEAE

ACER GLABRUM TORR.

BERBERIDACEAE

BERBERIS REPENS LINDL.

CARYOPHYLLACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ANTENNARIA MARGINATA GREENE
HELENIUM HOOPESII GRAY
HIERACIUM ALBIFLORUM HOOK.
HIERACIUM GRACILE HOOK.
HIERACIUM SCABRUM MICHX.
HIERACIUM SUBCAERULEUM GRAY
HYMENOPAPPUS NEWBERRYI GRAY
HYMENOXYS GRANDIFLORA (TORR. & GRAY) PARKER
LACTUCA LEUCOPHAEA PURSH
LACTUCA PULCHELLA (PURSH) DC.
LACTUCA SCARIOLA L.
LEUCELENE ERICOIDES (HOOK.) GREENE
MACHAERANTHERA CANESCENS (PURSH) GRAY
MACHAERANTHERA GRINDELIOIDES (NUTT.) GREENE
SENECIO CRASSULUS GRAY
SENECIO FREMONTII TORR. & GRAY
SENECIO INTEGERRIMUS NUTT.
SENECIO SERRA HOOK.
SENECIO TRIANGULARIS HOOK.
SOLIDAGO MISSOURIENSIS NUTT.
SOLIDAGO MULTIRADIATA (AIT.) GRAY
SYMPHYOTRICHUM FOLIACEUM (LINDL.) NESOM
SYMPHYOTRICHUM FOLIOSUM (A. GRAY) NESOM
SYMPHYOTRICHUM SPATHULATUM (LINDL.) NESOM
TARAXACUM OFFICINALE WEBER
TETRADYMIA CANESCENS DC.
TRAGOPOGON DUBIUS SCOP.

CRUCIFERAE

ARABIS DRUMMONDII GRAY
ARABIS HOLBOELLII HORNEM.
ARABIS PERENNANS S. WATS.
ARABIS PULCHRA (GRAY) S. WATS.
ARABIS RETROFRACTA GRAY
ARABIS SPARSIFLORA NUTT.
ARABIS VISCIDULA PURSH
CAMELINA MICROCARPA ANDRZ.
DESCURAINIA PINNATA (WALT.) BRITT.
DESCURAINIA RICHARDSONII (SWEET) O. E. SCHULZ
ERYSIMUM ASPERUM (NUTT.) DC.
LEPIDIUM DENSIFLORUM SCHRAD.
LESQUERELLA ALPINA (NUTT.) WATS.
LESQUERELLA MONTANA (RYDB.) REHD.
LESQUERELLA RECURVATA (HOOK.) A. GRAY
PHYSARIA LINDHEIMERI (A. GRAY) O. E. SCHULZ
SISYMBRIUM ALTISSIMUM L.
THELYPODIUM INTEGRIFOLIUM (HOOK.) ENDL.
THLASPI ARVENSE L.

CUCURBITACEAE

CUCURBITA FOETIDISSIMA H.B.K.

CUPRESSACEAE

JUNIPERUS COMMUNIS L.
JUNIPERUS SCOPULORUM SARG.

CYPERACEAE

CAREX ATHERODES SPRENG.
CAREX BEBBII L. H. BAILEY
CAREX CAPITATA L.
CAREX CRAWFORDII FERN.
CAREX DOUGLASII BOOTT
CAREX ELYNOIDES HOLM
CAREX FILIFOLIA NUTT.
CAREX GEYERI BOOTT
CAREX HOOKERIANA DEWEY
CAREX HYSTERICINA MUHL.
CAREX INOPERTA BAILEY
CAREX LANUGINOSA MICHX.
CAREX MICROPTERA MACK.
CAREX NEBRASCENSIS DEWEY
CAREX PELLITA MUHL.
CAREX PRAEGRACILIS W. BOOTT
CAREX PRAIREA DEWEY
CAREX RICHARDSONII R. BR.
CAREX ROSTRATA STOKES
CAREX SCOPULORUM HOLM
CAREX SIMULATA MACK.
CAREX STIPATA MUHL.
CAREX SYCHNOCEPHALA CAREY
CAREX TENERA BOOTT
CAREX VESICARIA L.
CAREX WOODII DEWEY
ELEOCHARIS PALUSTRIS (L.) R. & S.
SCIRPUS ACUTUS MUHL.
SCIRPUS AMERICANUS PERS.
SCIRPUS MICROCARPUS PRESL

EQUISETACEAE

EQUISETUM ARVENSE L.
EQUISETUM HYEMALE L.
EQUISETUM LAEVIGATUM A. BR.

EUPHORBIACEAE

EUPHORBIA ESULA L.

GENTIANACEAE

GENTIANA AMARELLA L.
GENTIANA ANDREWSII GRISEB.
GENTIANA PARRYI ENGELM.
GENTIANELLA ACUTA (MICHX.) J. GILLETT
GENTIANELLA AMARELLOIDES (R. BR.) HOOK.
GENTIANELLA ANGUSTIFOLIA (VAHL) J. GILLETT
GENTIANELLA ROSEA (GRISEB.) J. GILLETT
GENTIANELLA THERMALIS (KUNTH) J. GILLETT

GERANIACEAE

GERANIUM CAESPITOSUM JAMES
GERANIUM RICHARDSONII FISCH. & TRAUTV.

GRAMINEAE

AGROPYRON CRISTATUM (L.) GAERTN.
AGROPYRON DASYSTACHYUM (HOOK.) SCRIBN.
AGROPYRON INTERMEDIUM (HOST) BEAUV.
AGROPYRON SMITHII RYDB.
AGROPYRON TRACHYCAULUM (LINK) MALTE
AGROSTIS ALBA L.
AGROSTIS EXARATA TRIN.
AGROSTIS HYEMALIS (WALT.) BRITT.
ALOPECURUS PRATENSIS L.
ANTHOXANTHUM ODORATUM L.
ARRHENATHERUM ELATIUS (L.) BEAUV. EX J. & C. PRESL
BECKMANNIA SYZIGACHNE (STEUD.) FERNALD
BOUTELOUA CURTIPENDULA (MICHX.) TORR.
BOUTELOUA GRACILIS (H.B.K.) LAG. EX GRIFFITHS & HITCH.
BROMUS ANOMALUS RUPR. EX FOURN.
BROMUS CARINATUS HOOK. & ARN.
BROMUS CILIATUS L.
BROMUS INERMIS LEYSS.
BROMUS MARGINATUS NEES EX STEUD.
BROMUS TECTORUM L.
CALAMAGROSTIS CANADENSIS (MICHX.) BEAUV.
CALAMAGROSTIS MONTANENSIS SCRIBN.
CALAMAGROSTIS PURPURASCENS R. BR.
CALAMAGROSTIS STRICTA (TIMM) KOELER
DANTHONIA INTERMEDIA VASEY
DANTHONIA PARRYI SCRIBN.
DANTHONIA SPICATA (L.) BEAUV. EX ROEM. & SCHULT.
DESCHAMPSIA CAESPITOSA (L.) BEAUV.
ELYMUS CANADENSIS L.
ELYMUS GLAUCUS BUCKL.
ELYMUS HISPIDUS (OPIZ) MELDERIS
ELYMUS INTERMEDIUS SCRIBN. & SMITH
ELYMUS LANCEOLATUS (SCRIBN. & SMITH) GP. & BARK.
ELYMUS MACROURUS (TURCZ.) TZVEL.
ELYMUS SALINUS SCRIBN. & TWEEDY
ELYMUS TRACHYCAULUS (LINK) GP. & BARK.
ELYMUS VIRGINICUS L.
ELYMUS WILLDENOWIANUS SCRIBN. & SMITH
FESTUCA ARIZONICA VASEY
FESTUCA IDAHOENSIS ELMER
FESTUCA OCCIDENTALIS HOOK.
FESTUCA OVINA L.
FESTUCA PRATENSIS HUDS.
FESTUCA RUBRA L.
HELICTOTRICHON HOOKERI (SCRIBN.) HENR.
HESPEROSTIPA COMATA (TRIN. & RUPR.) BARKW.
HESPEROSTIPA NEOMEXICANA (THURB.) BARKW.
HESPEROSTIPA SPARTEA (TRIN.) BARKW.
HORDEUM BRACHYANTHERUM NEVSKI
HORDEUM JUBATUM L.
KOELERIA CRISTATA (L.) PERS.
LEPTOCHLOA FILIFORMIS (LAM.) BECK.
MELICA BULBOSA GEYER EX PORTER & COULT.
MELICA SPECTABILIS SCRIBN.
MUHLENBERGIA CUSPIDATA (TORR.) RYDB.
MUHLENBERGIA FILIFORMIS (THURB.) RYDB.
MUHLENBERGIA GLOMERATA (WILLD.) TRIN.
MUHLENBERGIA MONTANA (NUTT.) HITCH.
MUHLENBERGIA RACEMOSA (MICHX.) BSP.
MUHLENBERGIA RICHARDSONIS (TRIN.) RYDB.
MUHLENBERGIA SYLVATICA TORR. EX A. GRAY
MUHLENBERGIA TORREYI (KUNTH) HITCH. EX CHASE
PANICUM CAPILLARE L.
PANICUM VIRGATUM L.
PHALARIS ARUNDINACEA L.
PHLEUM ALPINUM L.
PHLEUM PRATENSE L.
POA ALPINA L.
POA ARIDA VASEY
POA COMPRESSA L.
POA FENDLERIANA (STEUD.) VASEY
POA LANGUIDA SCRIBN.
POA NEMORALIS L.
POA PALUSTRIS L.
POA PRATENSIS L.
POA SECUNDA PRESL
POA WHEELERI VASEY
SCHEDONNARDUS PANICULATUS (NUTT.) TRELEASE
SCHIZACHNE PURPURASCENS (TORR.) SWALLEN
SPARTINA GRACILIS TRIN.
SPARTINA PECTINATA LINK
SPOROBOLUS AIROIDES (TORR.) TORR.
SPOROBOLUS CRYPTANDRUS (TORR.) A. GRAY
SPOROBOLUS HETEROLEPIS (A. GRAY) A. GRAY
STIPA COMATA TRIN. & RUPR.
STIPA NEOMEXICANA (THURB.) SCRIBN.
STIPA SPARTEA TRIN.
STIPA VIRIDULA TRIN.
TRISETUM MONTANUM VASEY
TRISETUM PENSYLVANICUM (L.) BEAUV.
TRISETUM SPICATUM (L.) RICHT.
TRISETUM WOLFII VASEY

HYDROPHYLLACEAE

ELLISIA NYCTELEA L.
HYDROPHYLLUS CAPITATUS DOUGL. EX BENTH.
HYDROPHYLLUS FENDLERI TORR. & GRAY
HYDROPHYLLUS INTERMEDIUS TORR. & GRAY
PHACELIA HASTATA DOUGL. EX BENTH.
PHACELIA HETEROPHYLLA PURSH
PHACELIA LINEARIS (PURSH) HOLZ.
PHACELIA SERICEA (GRAHAM) GRAY

IRIDACEAE

SISYRINCHIUM MONTANUM GREENE

JUNCACEAE

JUNCUS BALTICUS WILLD.
JUNCUS CONFUSUS COVILLE
JUNCUS DUDLEYI WIEG.
JUNCUS ENSIFOLIUS WIKSTR.
JUNCUS INTERIOR WIEG.
JUNCUS MERTENSIANUS BONG. EX LAHARPE
JUNCUS TENUIS WILLD.

LABIATAE

AGASTACHE URTICIFOLIA (BENTH.) KUNTZE
MENTHA ARVENSIS L.
MONARDA FISTULOSA L.
MONARDA MENTHAEFOLIA GRAH.
NEPETA CATARIA L.
PRUNELLA VULGARIS L.
SALVIA DORRII (KELLOGG) ABRAMS
SCUTELLARIA ANGUSTIFOLIA PURSH
STACHYS PALUSTRIS L.
STACHYS PILOSA NUTT.

LEGUMINOSAE

ASTRAGALUS ADSURGENS PALL. EX WILLD.
ASTRAGALUS AGRESTIS DOUGL. EX G. DON
ASTRAGALUS ALPINUS L.
ASTRAGALUS CANADENSIS L.
ASTRAGALUS CICER L.
ASTRAGALUS COLLINUS DOUGL. EX HOOK.
ASTRAGALUS CONVALLARIUS A. NELSON & KENNEDY
ASTRAGALUS CRASSICARPUS NUTT.
ASTRAGALUS DRUMMONDII DOUGL. EX HOOK.
ASTRAGALUS GILVIFLORUS SHELDON
ASTRAGALUS GOODRICHII HOLM
ASTRAGALUS LENTIGINOSUS DOUGL. EX HOOK.
ASTRAGALUS MISSOURIENSIS NUTT.
ASTRAGALUS PARRYI A. GRAY
ASTRAGALUS PECTINATUS DOUGL. EX G. DON
ASTRAGALUS PLATTENSIS NUTT.
ASTRAGALUS ROBBINSII (OAKES) A. GRAY
ASTRAGALUS SPATULATUS SHELDON
ASTRAGALUS TENELLUS PURSH
ASTRAGALUS VEXILLIFLEXUS A. NELSON
ASTRAGALUS WOOTONII SHELDON
ASTRAGALUS YOUNGII A. NELSON
ASTRAGALUS ZIONIS A. NELSON
ASTRAGALUS ZOTHECINUS BARNEBY
LATHYRUS ARIZONICUS VASEY
LATHYRUS LANSZWERTII KELLOGG
LATHYRUS LEUCANTHUS DUCHESNE
LATHYRUS PAUCIFLORUS NUTT.
LUPINUS ARGENTEUS PURSH
LUPINUS KINGII S. WATS.
LUPINUS PARVIFLORUS NUTT.
LUPINUS SERICEUS PURSH
MEDICAGO LUPULINA L.
MELILOTUS ALBUS MEDIK.
MELILOTUS OFFICINALIS (L.) LAM.
OXYTROPIS LAMBERTII PURSH
OXYTROPIS SERICEA NUTT. EX TORR. & GRAY
PEDICULARIS CENTRANTHERA GRAY
PEDICULARIS GROENLANDICA RETZ.
PEDICULARIS PARRYI A. GRAY
PEDICULARIS RACEMOSA DOUGL. EX BENTH.
PEDICULARIS SUDETICA WILLD.
PETALOSTEMUM CANDIDUM (WILLD.) MICHX.
PETALOSTEMUM PURPUREUM (VENT.) RYDB.
PETALOSTEMUM VILLOSUM NUTT.
PSORALEA ARGOPHYLLA PURSH
PSORALEA ESCULENTA PURSH
PSORALEA LANCEOLATA PURSH
PSORALEA TENUIFLORA PURSH
TRIFOLIUM DUBIUM SIBTH.
TRIFOLIUM HYBRIDUM L.
TRIFOLIUM PRATENSE L.
TRIFOLIUM REPENS L.
VICIA AMERICANA MUHL.

LILIACEAE

ALLIUM CERNUUM ROTH.
CALOCHORTUS NUTTALLII GRAY

PINACEAE

ABIES CONCOLOR (GORDON) HILDEB.

Picea pungens Engelm.
Pinus flexilis James
Pinus ponderosa Lawson
Pseudotsuga taxifolia (Poir.) Britton

Ranunculaceae

Actaea arguta Nutt.

Salicaceae

Populus tremuloides Michx.

(3) Subalpine Zone (Elevation 9,600-11,000 ft)

Creek and Immediate Area (Elevation 9,600-10,000 ft)

Aceracea

Acer glabrum Torr.

Compositae

Helenium hoopesii Gray
Rudbeckia laciniata L.

Gramineae

Bromus ciliatus L.
Hierochloe odorata (L.) Beauv.
Phleum alpinum L.
Sphenopholis intermedia (Rydb.) Rydb.

Juncaceae

Luzula parviflora (Ehrh.) Desv.

Labiatae

Prunella vulgaris L.

Leguminosae

Trifolium lacerum Greene

Liliaceae

Veratrum californicum Durand

RANUNCULACEAE

ACTAEA ARGUTA NUTT.

SALICACEAE

POPULUS TREMULOIDES MICHX.

CHECK AND IMMEDIATE

ACERACEA

ACER GLABRUM TORR.

COMPOSITAE

HELENIUM MOERHEIM GRAY
HYMENOXYS LACINIATA L.

GRAMINEAE

BROMUS CILIATUS L.
HIEROCHLOE ODORATA (L.) BEAUV.
MELICA ALTISSIMA L.
PANICOPHOLIS INTERMEDIA (POIR.) A.CHEV.

JUNCACEAE

LUZULA PARVIFLORA (EHRH.) DESV.

LABIATAE

PRUNELLA VULGARIS L.

LEGUMINOSAE

TRIFOLIUM LACINUM CHEEK

LILIACEAE

VERATRUM CALIFORNICUM DURAND

ONAGRACEAE

Epilobium adenocaulon Haussk.

PINACEAE

Abies concolor (Gordon) Hoopes (only near 9,700 ft)

RANUNCULACEAE

Aconitum columbianum Nutt.
Aceaea arguta Nutt.

RUBIACEAE

Galium aparine L.

SCROPHULARIACEAE

Mimulus guttatus DC.
Penstemon barbatus (Cav.) Roth.
Veronica americana (Raf.) Schwein.

Forested Area (Elevation 9,600-10,900 ft)

ACERACEAE

Acer glabrum Torr.

GERANIACEAE

Geranium richardsonii Fisch. & Traut.

LEGUMINOSAE

Vicia americana Muhl.

ORCHIDACEAE

Goodyera oblongifolia Raf.

PINACEAE

Abies concolor (Gordon) Hoopes (only between 9,600 and 9,800 ft)
Abies lasiocarpa Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry
Pinus flexilis James
Pseudotsuga taxifolia (Poir.) Britton

ONAGRACEAE

Epilobium adenocaulon Hausskn.

PINACEAE

Abies concolor (Gordon) Hoopes [syn.: *Pinus*

RANUNCULACEAE

Aconitum columbianum Nutt.
Actaea arguta Nutt.

RUBIACEAE

Galium aparine L.

SCROPHULARIACEAE

Mimulus guttatus DC.
Penstemon barbatus [Cav. ... Trel.
Veronica americana [Raf.] Schwein.

FORESTED AREA (CLEVELAND & SCOTTSDALE)

ACERACEAE

Acer glabrum Torr.

GERANIACEAE

Geranium richardsonii [Fisch. & Trautv.

LEGUMINOSAE

Vicia americana Muhl.

ORCHIDACEAE

Goodyera oblongifolia Raf.

PINACEAE

Abies concolor (Gordon) Hoopes [syn. *Pinus*
Abies lasiocarpa Nutt. var. *arizonica* (Merr.)
Picea engelmannii Parry
Pinus flexilis James
Pseudotsuga taxifolia (Poir.)

RANUNCULACEAE

ACTAEA ARGUTA NUTT.

ROSACEAE

FRAGARIA BRACTEATA HELLER

RUBIACEAE

GALIUM BOREALE L.

SALICACEAE

POPULUS TREMULOIDES MICHX.

MEADOW (ELEVATION 10,000-10,600 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ERIGERON SUPERBUS GREENE
HELENIUM HOOPESII GRAY
RUDBECKIA HIRTA L.
SENECIO UINTAHENSIS A. NELS.
SOLIDAGO DECUMBENS GREENE

GRAMINEAE

DANTHANIA SPICATA (L.) BEAUV.
ELYMUS VIRGINICUS L.
FESTUCA ARIZONICA VASEY
KOELERIA CRISTATA (L.) PERS.
POA INTERIOR RYDB.
POA LONGILIGULA SCRIBN. & WILL.
SITANION HYSTRIX (NUTT.) J.G. SMITH

HYDROPHYLLACEAE

PHACELIA MAGELLANICA (LAM.) COV.

IRIDACEAE

IRIS MISSOURIENSIS NUTT.

LEGUMINOSAE

ROBINIA NEOMEXICANA GRAY

RANUNCULACEAE

ACTAEA ARGUTA Nutt.

ROSACEAE

FRAGARIA BRACTEATA Heller

RUBIACEAE

GALIUM BOREALE L.

SALICACEAE

POPULUS TREMULOIDES Michx.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

ERIGERON SUPERBUS Steele
HELENIUM AUTUMNALE (L.)
LIGOCECIA HIRTA L.
SENECIO LUGHANENSIS A. Nels.
SOLIDAGO OCCIDENTALIS Gurke

GRAMINEAE

DANTHONIA SPICATA (L.) Beauv.
ELYMUS VIRGINICUS L.
FESTUCA ARIZONICA Vasey
KOELERIA CRISTATA (L.)
POA LETTERMANI Hitchc.
POA SECUNDA Scribn.
STIPA VIRIDULA Trin.

HYDROPHYLLACEAE

PHACELIA HASTATA Lam.

IRIDACEAE

IRIS MISSOURIENSIS Nutt.

LEGUMINOSAE

ASTRAGALUS ADSURGENS Pall.

POLEMONIACEAE

GILIA AGGREGATA (PURSH.) SPRENG.

POLYPODIACEAE

PTERIDIUM AQUILINUM (L.) KUHN.

SCROPHULARIACEAE

CASTILLEJA CONFUSA GREENE

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

(F) THE EAST SLOPE (ELEVATION 9,200-11,000 FT; LAT 35°65'N LONG 106°31'W)

A LARGER NUMBER OF TAXA WERE FOUND ON THIS SLOPE THAN IN ANY OTHER STUDY AREA, APPARENTLY BECAUSE OF THE WIDE RANGE OF HABITATS HERE, IE., MANY SMALL CLEARINGS WITHIN THE FOREST, NUMEROUS SEEPS, TWO CREEKS, SEVERAL SMALL MEADOWS AT ELEVATIONS OF 9,700-10,275 FT, AND AN EXTENSIVE GRASSLAND AT 10,600-11,000 FT ELEVATION. THE EAST AND NORTH SLOPES SUPPORT EXTREMELY DENSE FORESTS AND ARE NEARLY IMPENETRABLE IN SOME AREAS.

THIS TRANSECT TRAVERSES THE CANADIAN AND SUBALPINE ZONES AND FOLLOWS LA JARA CREEK, ONE OF THE MAJOR PERMANENT STREAMS OF THE PEAK, FROM 9,200 FT TO ITS SOURCE AT 10,050 FT. THE SPECIES ALONG THIS STREAM ARE LISTED SEPARATELY IN THE CHECK LIST. ANOTHER SMALLER CREEK AND SURROUNDING SEEPS (ELEVATION 9,500-10,200 FT) WERE STUDIED DURING A SECOND TRIP UP THIS SLOPE. THIS AREA IS ALSO TREATED SEPARATELY.

Species Check List

(1) La Jara Creek (Elevation 9,200-10,050 ft)

Betulaceae

Alnus tenuifolia Nutt.

Boraginaceae

Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Caryophyllaceae

Cerastium arvense L.

Compositae

Helenium hoopesii Gray
Rudbeckia laciniata L.
Senecio crassulus Gray

Crassulaceae

Sedum cockerellii Britton

Cruciferae

Cardamine cordifolia Gray
Draba aurea Vahl.
Thlaspi fendleri Gray

Cyperaceae

Scirpus californicus (C. Meyer) Stead.

Fumariaceae

Corydalis aurea Willd.

Geraniaceae

Geranium richardsonii Fisch. & Traut.

Gramineae

Poa fendleriana (Stead.) Vasey

BETULACEAE

ALNUS TENUIFOLIA Nutt.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

CARYOPHYLLACEAE

CERASTIUM ARVENSE L.

COMPOSITAE

HIERACIUM PROFUSUM Gray
RUDBECKIA LACINIATA L.
SENECIO CHAMISSONIS Gray

CRASSULACEAE

SEDUM COCKERELLI Britt.

CRUCIFERAE

CARDAMINE CORDIFOLIA Gray
DRABA ADUNCA Vahl.
THLASPI FENDLERI Gray

CYPERACEAE

SCIRPUS CALIFORNICUS (C. Meyer) Steud.

FUMARIACEAE

CORYDALIS AUREA Willd.

GERANIACEAE

GERANIUM RICHARDSONII Fisch. & Trautv.

GRAMINEAE

POA FENDLERIANA (Steud.) Vasey

LABIATAE

Prunella vulgaris L.

LEGUMINOSAE

Lathyrus arizonicus Britton
Thermopsis pinetorum Greene

LILIACEAE

Veratrum californicum Durand

MALVACEAE

Sidalcea candida Gray

ORCHIDACEAE

Calypso bulbosa (L.) Oakes

PINACEAE

Abies concolor (Gordon) Hoopes
Picea engelmannii Parry
Pinus flexilis James

POLEMONIACEAE

Polemonium foliosissimum Gray

POLYGONACEAE

Rumex acetosella L.

POLYPODIACEAE

Asplenium trichomones L.
Dryopteris filix-mas (L.) Schott.

PRIMULACEAE

Androsace septentrionalis L.
Dodecatheon radicatum Greene

RANUNCULACEAE

Aconitum columbianum Nutt.
Actaea arguta Nutt.
Aquilegia elegantula Greene
Clematis pseudoalpina (Kuntze) A. Nels.

LABIATAE

Prunella vulgaris L.

LEGUMINOSAE

Lathyrus japonicus Willd.
Trifolium pilulierum Gerstn.

LILIACEAE

Veratrum californicum Durand

MALVACEAE

Sidalcea campbia Gray

ORCHIDACEAE

Calypso bulbosa (L.) Oakes

PINACEAE

Abies concolor (Gordon) Lindley
Picea sargentiana Rehder
Pinus flexilis James

POLEMONIACEAE

Polemonium foliosissimum Gray

POLYGONACEAE

Rumex acetosella L.

POLYPODIACEAE

Asplenium trichomanes L.
Dryopteris filix-mas (L.) Schott

PRIMULACEAE

Dodecatheon hendersonii A. Gray
Dodecatheon radicatum Greene

RANUNCULACEAE

Aconitum columbianum Nutt.
Actaea arguta Nutt.
Anemone flaccida Fischer
Clematis pseudoalpina (Maximowicz) Finet

Ranunculus aquatilis L.
Ranunculus cardiophyllus Hook.

Rosaceae

Amelanchier oreophila A. Nels
Fragaria bracteata Heller
Fragaria ovalis (Lehm.) Rydb.
Geum rivale L.
Prunus virginiana L.
Rosa fendleri Crepin.
Rubus parviflorus Nutt.

Rubiaceae

Galium aparine L.

Scrophulariaceae

Mimulus guttatus DC.
Veronica americana (Raf.) Schwein.
Veronica wormskjoldii Roem. & Schult.

Umbelliferae

Heracleum lanatum Michx.

Violaceae

Viola adunca T.E. Smith
Viola canadensis L.

(2) Canadian Zone (Elevation 9,100-9,600 ft)

Forest Area and Small Open Areas

Aceraceae

Acer glabrum Torr.

Berberidaceae

Berberis repens Lindl.

Campanulaceae

Campanula rotundifolia L.

Compositae

Senecio integerrimus Nutt.

RANUNCULUS AQUATILIS L.
RANUNCULUS CANDICANS [DC.]

ROSACEAE

ANELANCHIER OREOPHILA A.
FRAGARIA BRACTEATA [HELLER]
[FRAGARIA OVALIS (LEHM.) ROHR.]
GEUM TRIFLORUM L.
[RUBUS VITICINIANUS L.
ROSA ECKLONII CREPIN.
[LUCENS PARVIFOLIUS HUTT.

RUBIACEAE

GALIUM ASPERUM L.

SCROPHULARIACEAE

MIMULUS GUTTATUS DC.
VERONICA AMERICANA (RAF.) SCHWEIN.
VERONICA WORMSKJOLDII ROEM. & SCHULT.

UMBELLIFERAE

[HERACLEUM LANATUM MICHX.

VIOLACEAE

VIOLA ADUNCA E.E. SMITH
VIOLA CANADENSIS L.

(3) CANADIAN ZONE (ELEVATION 5,100-11,500 FEET)

FOREST AREA AND SMALL OPEN AREAS

ACERACEAE

ACER GLABRUM TORR.

BERBERIDACEAE

BERBERIS REPENS LINDL.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

CRUCIFERAE

DESCURAINIA INCISA [NUTT.] BRITT.

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

FUMARIACEAE

CORYDALIS AUREA WILLD.

GERANIACEAE

GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

BROMUS CILIATUS L.

IRIDACEAE

IRIS MISSOURIENSIS NUTT.

LEGUMINOSAE

LAYTHRUS ARIZONICUS BRITTON
VICIA AMERICANA MUHL.

LILIACEAE

SMILACINA RACEMOSA (L.) DEAF.

ORCHIDACEAE

CORALLORHIZA MACULATA RAF.

PINACEAE

ABIES CONCOLOR (GORDON) HOOPES
PICEA PUNGENS ENGELM.
PINUS FLEXILIS JAMES
PINUS PONDEROSA LAWSON
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

RANUNULACEAE

ACTAEA ARGUTA NUTT.
THALICTRUM FENDLERI ENGELN.

ROSACEAE

FRAGARIA BRACTEATA HELLER
RUBUS PARVIFLORUS NUTT.

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

PINACEAE

CORYDALIS AUREA Willd.

GERANIACEAE

GERANIUM RICHARDSONII Fisch. & Trautv.

GRAMINEAE

BROMUS CILIATUS L.

IRIDACEAE

IRIS MISSOURIENSIS Nutt.

LEGUMINOSAE

LATHYRUS ANIZOPHYLLUS Elliott
VICIA AMERICANA Muhl.

LILIACEAE

SMILACINA RACEMOSA (L.) Desf.

ORCHIDACEAE

CORALLORHIZA MACULATA Raf.

PINACEAE

ABIES CONCOLOR (Gord.) Hildebr.
PICEA PUNGENS Engelm.
PINUS FLEXILIS James
PINUS PONDEROSA Laws.
PSEUDOTSUGA TAXIFOLIA (Poir.) Britton

RANUNCULACEAE

ACTAEA ARGUTA Nutt.
THALICTRUM FENDLERI Engelm.

ROSACEAE

FRAGARIA BRACTEATA Heller
RUBUS PARVIFLORUS Nutt.

RUBIACEAE

GALIUM APARINE L.

SALICACEAE

POPULUS TREMULOIDES MICHX.

SCROPHULARIACEAE

CASTILLEJA CONFUSA GREENE

VIOLACEAE

VIOLA ADUNCA J.E. SMITH
VIOLA CANADENSIS L.

(3) SUBALPINE ZONE (ELEVATION 9,500-10,900 FT)

FOREST AREA

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

COMPOSITAE

SENECIO MUTABILIS GREENE

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

CYPERACEAE

CAREX XERANTICA BAILEY

ERICACEAE

VACCINIUM OREOPHILUM RYDB.

GRAMINEAE

BROMUS CILIATUS L.

IRIDACEAE

IRIS MISSOURIENSIS NUTT.

RUBIACEAE

Galium aparine L.

SALICACEAE

Populus tremuloides Michx.

SCROPHULARIACEAE

Castilleja confusa Greene

VIOLACEAE

Viola adunca J.E. Smith
Viola canadensis L.

(3) Subalpine Zone (Elevation 2,450-3,200 m)

Pinus Zone

CAMPANULACEAE

Campanula rotundifolia L.

COMPOSITAE

Senecio pyramidalis Greene

CUPRESSACEAE

Juniperus communis L.

CYPERACEAE

Carex xerantica Bailey

ERICACEAE

Vaccinium oreophilum Prov.

GRAMINEAE

Bromus ciliatus L.

IRIDACEAE

Iris missouriensis Nutt.

LILIACEAE

Smilacina racemosa (L.) Deaf.

ORCHIDACEAE

Calypso bulbosa (L.) Oakes
Corallorhiza maculata Raf.

PINACEAE

Abies lasiocarpa Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry
Pinus flexilis James
Pseudotsuga taxifolia (Poir.) Britton

POLYPODIACEAE

Woodsia oregana D.C. Eaton

RANUNCULACEAE

Actaea arguta Nutt.
Aquilegia elegantula Greene
Clematis pseudoalpina (Kuntze) A. Nels.
Thalictrum fendleri Engelm.

ROSACEAE

Fragaria bracteata Heller

RUBIACEAE

Galium aparine L.

SALICACEAE

Populus tremuloides Michx.

SCROPHULARIACEAE

Castilleja confusa Greene

UMBELLIFERAE

Osmorhiza obtusa (Coult. & Rose) Fern.

VIOLACEAE

Viola canadensis L.

SMALL CREEK AND SURROUNDING SEEPS (ELEVATION 9,500-10,200 FT)

BETULACEAE

ALNUS TENUIFOLIA NUTT.

COMPOSITAE

RUDBECKIA LACINIATA L.

CYPERACEAE

CAREX BELLA BAILEY
CAREX STIPATA MUHL.
CAREX XERANTICA BAILEY
SCIRPUS CALIFORNICUS (C. MEYER) STEAD.

HYDROPHYLLIACEAE

HYDROPHYLLUM FENDLERI (GRAY) HELLER

JUNCACEAE

LUZULA PARVIFLORA (EHRH.) DESV.

LEGUMINOSAE

TRIFOLIUM LACERUM GREENE

LILIACEAE

VERATRUM CALIFORNICUM DURAND

POLYPODIACEAE

CYSTOPTERUS FRAGILIS (L.) BERNH.
DRYOPTERIS FILIX-MAS (L.) SCHOTT.
WOODSIA OREGANA D.C. EATON

PRIMULACEAE

DODECATHEON RADICATUM GREENE

RANUNCULACEAE

ACONITUM COLUMBIANUM NUTT.
AQUILEGIA CAERULEA JAMES
RANUNCULUS MACOUNII BUTTON

ROSACEAE

GEUM RIVALE L.

BETULACEAE

Alnus tenuifolia Nutt.

COMPOSITAE

Endocronia lacinata L.

CYPERACEAE

Carex bella Bailey
Carex stipata Muhl.
Carex scabrata Dietr.
Scirpus californicus (C. A. Mey.) Steud.

HYDROPHYLLACEAE

Hydrophyllum fendleri (Gray) Heller

JUNCACEAE

Luzula parviflora (Ehrh.) Desv.

LEGUMINOSAE

Thermopsis lanceolata Greene

LILIACEAE

Veratrum californicum Durand

POLYPODIACEAE

Cystopteris fragilis (L.) Bernh.
Dryopteris filix-mas (L.) Schott
Woodsia oregana D. C. Eaton

PRIMULACEAE

Dodecatheon radicatum Greene

RANUNCULACEAE

Aconitum columbianum Nutt.
Aquilegia elegantula Greene
Ranunculus macounii Britt.

ROSACEAE

Geum rivale L.

Prunus virginiana L.

Rubiaceae

Galium boreale L.

Umbelliferae

Heracleum lanatum Michx.
Ligusticum porteri Coult. & Rose

Urticaceae

Urtica gracilis Ait.

Meadow and Forest Edge (Elevation 9,700-10,275 ft)

Boraginaceae

Hackelia floribunda (Lehm.) Johnst.
Lithospermum multiflorum Torr.
Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Caprifoliaceae

Sambucus racemosa L.

Caryophyllaceae

Arenaria fendleri var. *brevifolia* (Maguire) Maguire
Cerastium brachypodum (Engelm.) Robins.

Compositae

Achillea lanulosa Nutt.
Agoseris aurantiaca (Hook.) Greene
Antennaria marginata Greene
Erigeron canus Gray
Helenium hoopesii Gray
Rudbeckia hirta L.
Senecio neomexicanus Gray

Cruciferae

Erysimum capitatum (Dougl.) Greene
Sisymbrium elegans (Jones) Payson
Thlaspi fendleri Gray

CYPERACEAE

CAREX FESTIVELLA MACKENZ.

FAGACEAE

QUERCUS GAMBELII NUTT.

GERANIACEAE

GERANIUM CAESPITOSUM JAMES
GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

FESTUCA THURBERI VASEY
KOELERIA CRISTATA (L.) PERS.
POA FENDLERIANA (STEUD.) VASEY
POA INTERIOR RYDB.
POA LONGILIGULA SCRIBN. & WILL.

HYDROPHYLLACEAE

PHACELIA MAGELLANICA (LAM.) COV.

IRIDACEAE

IRIS MISSOURIENSIS NUTT.
SISYRINCHIUM DEMISSUM GREENE

LEGUMINOSAE

THERMOPSIS PINETORUM GREENE

LILIACEAE

SMILACINA RACEMOSA (L.) DEAF.

PINACEAE

PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

POLEMONIACEAE

GILIA AGGREGATA (PURSH) SPRENG.

ROSACEAE

POTENTILLA PULCHERRIMA LEHM.
RUBUS STRIGOSUS MICHX.

CYPERACEAE

CAREX FESTIVELLA MACKENZ.

FAGACEAE

QUERCUS GAMBELII NUTT.

GERANIACEAE

GERANIUM CAESPITOSUM JAMES
GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

FESTUCA THURBERI VASEY
KOELERIA CRISTATA (L.) PERS.
POA FENDLERIANA (STEUD.) VASEY
POA INTERIOR RYDB.
POA LONGILIGULA Scribn. & Williams

HYDROPHYLLACEAE

PHACELIA HASTATA (Lam.) Torr.

IRIDACEAE

IRIS MISSOURIENSIS NUTT.
SISYRINCHIUM DEMISSUM Greene

LEGUMINOSAE

THERMOPSIS RHOMBIFOLIA Greene

LILIACEAE

ZIGADENUS PACHYRHIZA (L.) Dur. -

PINACEAE

PSEUDOTSUGA TAXIFOLIA (Poir.) Britton

POLEMONIACEAE

GILIA ARISTATA (Nuttall) Spreng.

ROSACEAE

POTENTILLA PULCHERRIMA Lehm.
RUBUS STRIGOSUS Michx.

SALICACEAE

POPULUS TREMULOIDES MICHX.
SALIX BEBBIANA SARG.

SCROPHULARIACEAE

CASTILLEJA CONFUSA GREENE

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

MEADOW (ELEVATION 10,600-10,900 FT)

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L.

CAPRIFOLIACEAE

SAMBUCUS MELANOCARPA GRAY

COMPOSITAE

ERIGERON CANUS GRAY
HELENIUM HOOPESII GRAY
SENECIO NEOMEXICANUS GRAY

CRUCIFERAE

ERYSIMUM CAPITATUM (DOUGL.) GREENE
THLASPI FENDLERI GRAY

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

CYPERACEAE

CAREX BELLA BAILEY
CAREX NEBRASKENSIS DEWEY

ERICACEAE

VACCINIUM OREOPHILUM RYDB.

GRAMINEAE

DANTHONIA INTERMEDIA VASEY

SALICACEAE

Populus tremuloides Michx.
Salix bebbiana Sarg.

SCROPHULARIACEAE

Castilleja coloma Dietr.

UMBELLIFERAE

Pseudocymopterus montanus (Gray) Coult. & Rose

MOSSES (Determination by [illegible])

CAMPANULACEAE

Campanula rotundifolia L.

CAPRIFOLIACEAE

Sambucus mexicana Gray

Compositae

Erigeron canus Gray
Hulsenia hookeri Gray
Senecio integerrimus Gray

Cruciferae

Erysimus capitatum (Doug.) Greene
Thlaspi fendleri Gray

Cupressaceae

Juniperus communis L.

Cyperaceae

Carex nelsonii Bailey
Carex scirpoidea Michx.

Ericaceae

Vaccinium oreophilum Rydb.

Gramineae

Calamagrostis inexpansa A. Gray

Festuca ovina L.
Festuca thurberi Vasey
Poa fendleriana (Steud.) Vasey
Poa interior Rydb.
Poa longiligula Scribn. & Will.

Iridaceae

Iris missouriensis Nutt.

Leguminosae

Thermopsis pinetorum Greene

Liliaceae

Allium cernuum Roth.

Pinaceae

Picea engelmannii Parry (scattered)
Pinus flexilis James (rare)

Polypodiaceae

Pteridium aquilinum (L.) Kuhn.

Rosaceae

Potentilla concinna Lehm.

Salicaceae

Salix bebbiana Sarg.

Saxifragaceae

Ribes cereum Dougl.
Ribes montegenum Mc Clatchie

Scrophulariaceae

Castilleja confusa Greene

Umbelliferae

Pseudocymopterus montanus (Gray) Coult. & Rose

(G) The Northeast Slope

(Elevation 9,000-11,000 ft; lat 35°66'N long 106°30'W)

This slope is densely forested from 9,000 ft to 11,000 ft elevation, except for a few open areas and seeps.

Species Check List

(1) Canadian Zone (Elevation 9,000-9,600 ft)

Aceraceae

Acer glabrum Torr.

Berberidaceae

Berberis repens Lindl.

Boraginaceae

Hackellia floribunda (Lehm.) Johnst.
Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Caryophyllaceae

Arenaria fendleri Gray var. *brevifolia* (Maguire) Maguire

Compositae

Haplopappus parryi Gray
Helenium hoopesii Gray
Taraxicum officinale Weber.

Cruciferae

Draba rectifructa C.L. Hitchc.

Cyperaceae

Carex canescens L.

Fagaceae

Quercus gambelii Nutt.

(1) Canadian Zone (Elevation 0-[illegible] ft.

Aceraceae

Acer glabrum Torr.

Betulaceae

Betula occidentalis Hook.

Boraginaceae

Hackelia floribunda (Lehm.) Johnst.
Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Caryophyllaceae

Arenaria fendleri Gray var. [illegible]

Compositae

Haplopappus [illegible]
Helenium hoopesii Gray
Tarazacum officinale Weber.

Cruciferae

Draba [illegible]

Cyperaceae

Carex [illegible]

Fagaceae

Quercus [illegible]

GERANIACEAE

GERANIUM RICHARDSONII FISCH. & TRAUT.

GRAMINEAE

AGROPYRON SUBSECUNDUM (LINK.) HITCHC.
AGROPYRON TRACHYCAULUM (LINK.) MALTE.
BLEPHARONEURON TRICHOLEPIS (NASH.) TORR.
LYCURUS PHLEOIDES H.B.K.
POA INTERIOR RYDB.
STIPA LETTERMANII VASEY

LEGUMINOSAE

LATHRYUS ARIZONICUS BRITTON
LUPINUS AMMOPHILUS GREENE
THERMOPSIS PINETORUM GREENE

LILIACEAE

ALLIUM CERNUUM ROTH.
LILIUM UMBELLATUM PURSH
SMILACENA STELLATA (L.) DEAF.

PINACEAE

ABIES CONCOLOR (GORDON) HOOPES
PICEA PUNGENS ENGELM.
PINUS FLEXILIS JAMES
PINUS PONDEROSA LAWSON (9,300 FT, ONLY)
PSEUDOTSUGA TAXIFOLIA (POIR.) BRITTON

POLYPODIACEAE

PTERIDIUM AQUILINUM (L.) KUHN.

PRIMULACEAE

DODECATHEON RADICATUM GREENE

RANUNCULACEAE

ACTAEA AUREA NUTT.
AQUILEGIA CAERULEA JAMES
AQUILEGIA ELEGANTULA GREENE
THALICTRUM FENDLERI ENGELM.

RUBIACEAE

GALIUM APARINE L.

GERANIACEAE

GERANIUM RICHARDSONII Fisch. & Trau.

GRAMINEAE

ABROPYRON SUBSECUNDUM (Link.) Hitchc.
ABROPYRON TRACHYCAULUM (Link.) Tzvel.
ELYTRIGIA INTERMEDIA (Host.) Nevski.
LYCOPUS RUBELLUS M.E.Jones.
POA INTERIOR Rydb.
STIPA LETTERMANII Vasey

LEGUMINOSAE

LATHYRUS ARIZONICUS Britton
LUPINUS ARBOREUS Sims
THERMOPSIS RHOMBIFOLIA Richards.

LILIACEAE

ALLIUM CERNUUM Roth.
LILIUM PHILADELPHICUM Linn.
SMILACINA STELLATA (L.) Desf.

PINACEAE

ABIES CONCOLOR (Gord. & Glend.) Lindl.
PICEA PUNGENS Engelm.
PINUS FLEXILIS James
PINUS PONDEROSA Lawson (*P. scopulorum*, only)
PSEUDOTSUGA TAXIFOLIA (Poir.) Britton

POLYPODIACEAE

PTERIDIUM AQUILINUM (L.) Kuhn.

PRIMULACEAE

DODECATHEON RADICATUM Greene

RANUNCULACEAE

ACTAEA ARGUTA Nutt.
AQUILEGIA CAERULEA James
AQUILEGIA ELEGANTULA Greene
THALICTRUM FENDLERI Engelm.

RUBIACEAE

GALIUM APARINE L.

SALICACEAE

Populus tremuloides Michx.

SCROPHULARIACEAE

Castilleja confusa Greene

UMBELLIFERAE

Pseudocymopterus montanus (Gray) Coult. & Rose

VIOLACEAE

Viola canadensis L.

(2) Subalpine Zone (Elevation 9,600-11,000 ft)

BORAGINACEAE

Mertensia franciscana Heller

CAMPANULACEAE

Campanula rotundifolia L.

CARYOPHYLLACEAE

Arenaria fendleri Gray var. *brevifolia* (Maguire) Maguire

COMPOSITAE

Rudbeckia hirta L.
Senecio crassulus Gray
Solidago decumbens Greene

CRUCIFERAE

Draba rectifructa C.L. Hitchc.

ERICACEAE

Vaccinium oreophilum Rydb.

GRAMINEAE

Festuca thurberi Vasey
Poa interior Rydb.

IRIDACEAE

Iris missouriensis Nutt.

LEGUMINOSAE

LATHYRUS ARIZONICUS BRITTON
VICIA AMERICANA MUHL.

MALVACEAE

SIDALCEA CANDIDA GRAY

OXALIDACEAE

OXALIS METCALFEI (SMALL) KNUTH.

PINACEAE

ABIES LASIOCARPA NUTT. VAR. *ARIZONICA* (MERRIAM) LEMMON
PICEA ENGELMANNII PARRY
PICEA PUNGENS X *ENGELMANNII*
PINUS FLEXILIS JAMES

RANUNCULACEAE

AQUILEGIA ELEGANTULA GREENE

RUBIACEAE

GALIUM ASPERRIMUM GRAY

SALICACEAE

POPULUS TREMULOIDES MICHX.

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

VIOLACEAE

VIOLA CANDENSIS L.

SMALL ROCKSLIDE AREA (ELEVATION 10,400 FT)

CAPRIFOLIACEAE

SAMBUCUS RACEMOSA L.

LEGUMINOSAE

LATHYRUS ARIZONICUS BRITTON
VICIA AMERICANA MUHL.

LEGUMINOSAE

LATHYRUS ARIZONICUS BRITTON
VICIA AMERICANA MUHL.

MALVACEAE

SIDALCEA CAMPICOLA GRAY

OXALIDACEAE

OXALIS METTAUERI (SMALL) SOUTH.

PINACEAE

ABIES LASIOCARPA HUTT. VAR. *ARIZONICA* (MERR.) LEMMON
PICEA ENGELMANNII PARRY
PICEA PUNGENS X *ENGELMANNII*
PINUS FLEXILIS JAMES

RANUNCULACEAE

AQUILEGIA ELEGANTULA GREENE

ROSACEAE

GALIUM ARIZONICUM GRAY

SALICACEAE

POPULUS TREMULOIDES MICHX.

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

VIOLACEAE

VIOLA CANADENSIS L.

SMALL ROCKSLIDE AREA (ELEVATION 10,450 FT.)

CARYOPHYLLACEAE

SAXIFRAGE RADIPHORA L.

LEGUMINOSAE

LATHYRUS ARIZONICUS BRITTON
VICIA AMERICANA MUHL.

POLYPODIACEAE

CYSTOPTERUS FRAGILIS (L.) BERNH.

ROSACEAE

HOLODISCUS DUMOSUS (NUTT.) HELLER

SAXIFRAGACEAE

JAMESIA AMERICANA T. & G.

(H) THE NORTH SLOPE

(ELEVATION 9,500-11,200 FT; LAT 35°66'N LONG 106°32'W)

THE NORTH SLOPE IS THE MOST DENSELY FORESTED SLOPE OF REDONDO PEAK WITH FOREST EXTENDING FROM 9,500 FT TO 10,800 FT ELEVATION. THERE ARE SEVERAL SMALL OPEN AREAS IN THE CANADIAN ZONE AT 9,500-9,600 FT. AN EXTENSIVE ROCKSLIDE COVERS THIS SLOPE FROM 10,800-FT TO THE 11,200-FT LEVEL.

THIS SLOPE IS APPROACHED EASILY FROM THE NORTHEAST SLOPE UP TO THE 9,500-FT LEVEL (WHERE SAMPLING OF THE NORTH SLOPE WAS THEN BEGUN).

SPECIES CHECK LIST

(1) CANADIAN ZONE (ELEVATION 9,500-9,650 FT)

ACERACEAE

ACER GLABRUM TORR.

CAPRIFOLIACEAE

SAMBUCUS RACEMOSA L.

CELASTRACEAE

PACHYSTIMA MYRSINITES (PURSH) RAF.

COMPOSITAE

ACHILLEA LANULOSA NUTT.

Helenium hoopesii Gray
Rudbeckia hirta L.
Senecio macdougalii Heller
Solidago decumbens Greene

Cupressaceae

Juniperus communis L.

Cyperaceae

Carex stenoptila Hermann.

Geraniaceae

Geranium richardsonii Fisch. & Traut.

Gramineae

Agrostis scabra Willd.
Blepharoneuron tricholepis (Nash.) Torrs
Bromus ciliatus L.
Danthonia intermedia Vasey
Festuca ovina L.
Phleum pratense L.
Poa nevadensis Vasey
Sitanion hystrix (Nutt.) J.G. Smith

Liliaceae

Allium geyeri Wats.

Pinaceae

Abies concolor (Gordon) Hoopes
Picea pungens Engelm.
Pinus flexilis James
Pseudotsuga taxifolia (Poir.) Britton

Polygonaceae

Rumex crispus L.

Ranunculaceae

Actaea arguta Nutt.
Thalictrum fendleri Engelm.

Rosaceae

Fragaria bracteata Heller

Holodiscus dumosus (Nutt.) Heller
Rubus parviflorus Nutt.

Rubiaceae

Galium aparine L.

Scrophulariaceae

Orthocarpus luteus Nutt.
Pedicularis grayi A. Nels.
Penstemon rydbergii A. Nels (rare in New Mexico)
Verbascum thapsus L.

(2) Subalpine Zone (Elevation 9,650-11,200 ft)

Campanulaceae

Campanula rotundifolia L.

Caryophyllaceae

Arenaria fendleri Gray var. *brevifolia* (Maguire) Maguire

Compositae

Achillea lanulosa Nutt.
Artemesia franserioides Greene
Aster laevis L.
Brickellia grandiflora (Hook.) Nutt. (only in rockslide area)
Erigeron elatior (Gray) Greene
Erigeron superbus Greene
Helenium hoopesii Gray
Viguiera multiflora (Nutt.) Blake

Cruciferae

Thlaspi fendleri Gray

Cyperaceae

Carex stipata Muhl. (only at 9,800 ft)

Ericaceae

Monotropa latiquama (Rydb.) Hulten
Pyrola secunda L.
Vaccinium oreophilum Rydb.

Holocarpus sundbergii (Nutt.) Nesom
Rudbeckia paniculata Nutt.

RUBIACEAE

Galium aparine L.

SCROPHULARIACEAE

Castilleja wightii Nutt.
Penstemon gracilis A. Nels.
Penstemon procerus A. Nels. (rare in New Mexico)
Verbascum thapsus L.

(2) Upper Sonoran Zone (Elevation 5,550-11,200 ft)

CAMPANULACEAE

Campanula rotundifolia L.

CARYOPHYLLACEAE

Arenaria fendleri Gray var. *benthamii* (Maguire) Maguire

COMPOSITAE

Achillea lanulosa Nutt.
Artemisia frigida Willd.
Aster laevis L.
Brickellia grandiflora (Hook.) Nutt. (only in rock slide area)
Erigeron glaucus (Gray) Greene
Erigeron superbus Greene
Hulsea nana Gray
Ximenesia multiflora (Nutt.) Blake

CRUCIFERAE

Thlaspi fendleri Gray

CYPERACEAE

Carex stipata Muhl. (only at 9,300 ft)

ERICACEAE

Monotropa lathropiana (Hyde.) Hulten
Pyrola secunda L.
Vaccinium oreophilum Hyde.

GENTIANACEAE

Gentiana affinis Griseb.
Gentiana strictiflora (Rydb.) A. Nels.

GERANIACEAE

Geranium richardsonii Fisch. & Traut.

GRAMINEAE

Bromus ciliatus L.
Phleum pratense L.

IRIDACEAE

Iris missouriensis Nutt.

LABIATAE

Marrubium vulgare L.

LILIACEAE

Smilacina racemosa (L.) Deaf.

ONOGRACEAE

Epilobium californicum Hausskn. (only at 9,800 ft)

ORCHIDACEAE

Corallorhiza maculata Raf.
Goodyera oblongifolia Raf.

PINACEAE

Abies lasiocarpa Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry

POLYPODIACEAE

Cystopteris fragilis (L.) Bernh.

RANUNCULACEAE

Thalictrum fendleri Engelm.

ROSACEAE

Rosa arizonica Rydb. (only at 9,800 ft)

RUBIACEAE

Galium aparine L.

SALICACEAE

Populus tremuloides Michx.

SAXIFRAGACEAE

Ribes leptanthum Gray

SCROPHULARIACEAE

Castilleja confusa Greene

UMBELLIFERAE

Pseudocymopterus montanus (Gray) Coult. & Rose

Rockslide Area (Elevation 10,800-11,200 ft)

CAPRIFOLIACEAE

Lonicera involucrata (Richards.) Banks

COMPOSITAE

Helenium hoopesii Gray

POLYPODIACEAE

Cystopteris fragilis (L.) Bernh.

PRIMULACEAE

Androsace septentrionalis L.

RANUNCULACEAE

Aquilegia caerulea James
Aquilegia chrysantha Gray

SAXIFRAGACEAE

Saxifraga bronchialis L.

RUBIACEAE

GALIUM APARINE L.

SALICACEAE

POPULUS TREMULOIDES MICHX.

SAXIFRAGACEAE

RIBES LEPTANTHUM GRAY

SCROPHULARIACEAE

CASTILLEJA CONPUSA GREENE

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

ROCKSLIDE AREA (ELEVATE[illegible]

CAPRIFOLIACEAE

LONICERA INVOLUCRATA (RICHARDS.) BA[illegible]

COMPOSITAE

HIERACIUM ROBERTII GRAY

POLYPODIACEAE

CYSTOPTERIS FRAGILIS (L.) BERNH.

PRIMULACEAE

ANDROSACE SEPTENTRIONALIS L.

RANUNCULACEAE

AQUILEGIA CAERULEA JAMES
AQUILEGIA CHRYSANTHA GRAY

SAXIFRAGACEAE

SAXIFRAGA BRONCHIALIS L.

(1) Summit of Redondo Peak

(Elevation 11,000-11,254 ft; lat 35°65'N long 106°33'W)

The thin, rocky-soil at the summit supports an open, mature stand of *Picea engelmannii* and an occasional *Abies lasiocarpa*. There is a sparse cover of herbs, including species of *Poa*, *Danthonia*, *Muhlenbergia*, and *Pseudocymopterus*. On the southeast slope and part of the east slope just below the summit between the 10,000-ft to the 11,000-ft levels, is the largest meadow on the peak. An extensive rockslide covers the north slope from 10,800 ft to 11,200 ft elevation.

The presence of subalpine climax species and herbaceous species characteristic of the Subalpine and Canadian zones definitely substantiates that the summit is well within the Subalpine Zone.

Species Check List

Boraginaceae

Mertensia franciscana Heller

Campanulaceae

Campanula rotundifolia L.

Caprifoliaceae

Lonicera involucrata (Richards.) Banks

Caryophyllaceae

Stellaria longipes Goldie.

Compositae

Achillea lanulosa Nutt.
Anaphalis margaritacea (L.) Gray
Erigeron formosissimus Greene
Helenium hoopesii Gray
Senecio atratus Greene
Solidago decumbens Greene

CRUCIFERAE

Erysimum capitatum (Dougl.) Greene

CUPRESSACEAE

Juniperus communis L.

CYPERACEAE

Carex bella Bailey
Carex siccata Dewey

ERICACEAE

Vaccinium oreophilum Rydb.

GRAMINEAE

Agrostis scabra Willd.
Blepharoneuron tricholepis (Nash.) Torr.
Danthonia intermedia Vasey
Festuca arizonica Vasey
Koeleria cristata (L.) Pers.
Muhlenbergia montana (Nutt.) Hitchc.
Poa longiligula Scribn. & Will.
Sitanion hystrix (Nutt.) J.G. Smith
Trisetum montanum Vasey

IRIDACEAE

Iris missouriensis Nutt.

LEGUMINOSAE

Lathyrus arizonicus Britton

PINACEAE

Abies lasiocarpa Nutt. var. *arizonica* (Merriam) Lemmon
Picea engelmannii Parry

PRIMULACEAE

Androsace septentrionalis L.

RANUNCULACEAE

Aquilegia chrysantha Gray

ROSACEAE

Potentilla arguta Pursh

CRUCIFERAE

DRABA INCERTA (Greene) PAYSON

CUPRESSACEAE

JUNIPERUS COMMUNIS L.

CYPERACEAE

CAREX BELLA BAILEY
CAREX SICCATA DEWEY

ERICACEAE

VACCINIUM OREOPHILUM Tyson

GRAMINEAE

AGROSTIS SCABRA Willd.
CALAMAGROSTIS CANADENSIS (Michx.) Beauv.
DANTHONIA INTERMEDIA Vasey
FESTUCA ARIZONICA Vasey
KOELERIA CRISTATA (L.) Pers.
MUHLENBERGIA MONTANA (Nutt.) Hitchc.
POA LONGILIGULA Scribn. & Vasey
SITANION HYSTRIX (Nutt.) J.G. Smith
TRISETUM MONTANUM Vasey

IRIDACEAE

IRIS MISSOURIENSIS Nutt.

LEGUMINOSAE

LATHYRUS ARIZONICUS Britton

PINACEAE

ABIES LASIOCARPA Nutt. var. ARIZONICA (Merriam) Lemmon
PICEA ENGELMANNII Parry

PLUMBAGINACEAE

ARMERIA SETACEA (Thrift.) Wherry

RANUNCULACEAE

AQUILEGIA CHRYSANTHA Gray

ROSACEAE

POTENTILLA ARGUTA Pursh

SAXIFRAGACEAE

RIBES CEREUM DOUGL.
RIBES INERME RYDB.
SAXIFRAGA BRONCHIALIS L.

UMBELLIFERAE

PSEUDOCYMOPTERUS MONTANUS (GRAY) COULT. & ROSE

VIOLACEAE

VIOLA NEPHROPHYLLA GREENE

KEY TO THE FLORA OF REDONDO PEAK AND MOUNT TAYLOR

THE FOLLOWING CODE FACILITATES THE READING OF THE KEY:
R- SPECIES FOUND ON REDONDO PEAK
T- SPECIES FOUND ON MOUNT TAYLOR
R, T- SPECIES FOUND ON BOTH PEAKS

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1. PLANTS PRODUCING SPORES ..... PTERIDOPHYTA 2

1. PLANTS PRODUCING SEEDS ..... SPERMATOPHYTA 4

2. SPORANGIA BORNE ADAXIALLY AT BASE OF SPOROPHYLL; STROBILUS CONE-SHAPED; LEAVES NOT MORE THAN 4 MM LONG 3

2. SPORANGIA BORNE ON LEAF BLADES; STROBILUS NONE; LEAVES MUCH LONGER THAN 4 MM ..... POLYPODIACEAE

3. LEAVES WHORLED, ENCLOSING THE STEM IN A SHEATH; STEMS JOINTED ..... EQUISETACEAE

3. LEAVES NEITHER WHORLED NOR FORMING A SHEATH; STEMS NOT JOINTED ..... SELAGINELLACEAE

4. PLANTS WITH FLOWERS; SEEDS ENCLOSED IN AN OVARY ..... ANGIOSPERMAE 6

4. PLANTS WITHOUT FLOWERS; SEEDS NOT ENCLOSED IN AN OVARY ..... GYMNOSPERMAE 5

5. LEAVES SCALELIKE OR AWL-SHAPED, OPPOSITE OR ARRANGED IN WHORLS OF 4; CONES FLESHY AT MATURITY ..... CUPRESSACEAE

5. LEAVES NEEDLELIKE, ARRANGED SPIRALLY, SINGLY, OR IN FASCICLES; CONES DRY AND OFTEN WOODY AT MATURITY ..... PINACEAE

6. LEAVES WITH PARALLEL VENATION; FLOWERS 3-MEROUS; VASCULAR BUNDLES SCATTERED IN THE STEM ..... MONOCOTYLEDONEAE

6. LEAVES WITH PINNATE OR PALMATE VENATION; FLOWERS 2-, 4-, OR 5-MEROUS; VASCULAR BUNDLES ARRANGED IN A CYLINDER ..... DICOTYLEDONEAE

EQUISETACEAE

EQUISETUM ARVENSE L. T

SELAGINELLACEAE

SELAGINELLA DENSA RYDB. T

POLYPODIACEAE

1. RHIZOMES HAIRY, NOT SCALY; SORI LINEAR AND MARGINALLY ARRANGED ON PINNULES ..... 1. *PTERIDIUM*
1. RHIZOMES GLABROUS, SCALY; SORI OVATE, OBLONG, OR LINEAR, AND DORSALLY ARRANGED ON LATERAL VEINS 2
2. SORI OBLONG TO LINEAR ..... 2. *ASPLENIUM*
2. SORI ROUND OR NEARLY SO 3
3. INDUSIA RENIFORM ..... 3. *DRYOPTERIS*
3. INDUSIA NOT RENIFORM 4
4. INDUSIUM ATTACHED UNDER THE SORI, BREAKING UP INTO FIMBRIATE PROJECTIONS ..... 4. *WOODSIA*
4. INDUSIUM ATTACHED AT A SINGLE POINT TO SORI, FIMBRIATE PROJECTIONS ABSENT ..... 5. *CYSTOPTERIS*

1. PTERIDIUM

PTERIDIUM AQUILINUM (L.) KUHN. R, T

2. ASPLENIUM

ASPLENIUM TRICHOMONES L. R

3. DRYOPTERIS

DRYOPTERIS FILIX-MAS (L.) SCHOTT. R

4. WOODSIA

WOODSIA OREGANA D. C. EATON R, T

5. CYSTOPTERIS

CYSTOPTERIS FRAGILIS (L.) BERNH. R, T

CUPRESSACEAE

1. JUNIPERUS

1. LEAVES AWLLIKE, NOT IMBRICATE, GLAUCOSE ..... J. COMMUNIS L. R, T

1. LEAVES SCALELIKE, IMBRICATE, NOT GLAUCOSE 2

2. FOLIAGE LACY; BRANCHES SLENDER AND OFTEN DROOPING; LEAVES ENTIRE; FRUIT USUALLY 2-SEEDED ..... J. SCOPULORUM SARG. T

2. FOLIAGE COARSE; BRANCHES ERECT AND STOUT; LEAVES FINELY TOOTHED; FRUIT USUALLY 1-SEEDED ..... J. MONOSPERMA (ENGELM.) SARG. T

PINACEAE

1. NEEDLES IN FASCICLES; CONE SCALES THICK, WOODY ..... 1. PINUS

1. NEEDLES NOT IN FASCICLES; CONE SCALES THIN, NOT WOODY 2

2. CONES ERECT; NEEDLES SESSILE ..... 2. ABIES

2. CONES DROOPING; NEEDLES PETIOLATE OR IF NOT, THEN YOUNG BRANCHES WITH RAISED LEAF SCARS 3

3. LEAVES 4-SIDED, DECIDUOUS UPON DRYING; LEAF SCARS RAISED .. 3. PICEA

3. LEAVES FLAT, TAPERING INTO A SLENDER PETIOLE, NOT FALLING UPON DRYING; LEAF SCARS NOT RAISED ..... 4. PSEUDOSTUGA

1. PINUS

1. NEEDLES IN FASCICLES OF 2, 5 CM LONG OR LESS, INCURVED .... P. EDULIS ENGELM. T

1. NEEDLES IN FASCICLES OF 3 OR 5, MORE THAN 5 CM LONG, STRAIGHT 2

2. NEEDLES IN FASCICLES OF 3, 10 CM LONG OR MORE .... P. PONDEROSA LAWSON R, T

2. Needles in fascicles of 5, less than 10 cm long .....
..... P. flexilis James R

2. Abies

1. Current season's twigs glabrous; cones yellow or grayish-green; needles acute or acuminate ..... A. concolor (Gordon) Hoopes R

1. Current season's twigs pubescent; cones dark purplish-brown; needles blunt ... A. lasiocarpa Nutt. var. arizonica (Merriam) Lemmon R, T

3. Picea

1. Young twigs glabrous; needles rigid and abruptly acute .....
..... P. pungens Engelm. R, T

1. Young twigs pubescent; needles less rigid, obtuse .....
..... P. engelmannii Parry R, T

4. Pseudotsuga

Pseudotsuga taxifolia (Poir.) Britton R, T

Monocotyledoneae

1. Perianth present 2

1. Perianth absent 5

2. Ovary superior 3

2. Ovary interior 4

3. Perianth petaloid (in ours); stamens 6 ..... Liliaceae

3. Perianth scalelike, scarious or slightly herbaceous; stamens 3 or 6 .
..... Juncaceae

4. Perianth regular or slightly irregular; flowers subtended by bracts; stamens 3, not adnate to the style ..... Iridaceae

4. Perianth very irregular; flowers not subtended by bracts; stamens 1-2, adnate to the style ..... Orchidaceae

5. Plants semiaquatic; flowers in thick spikes, all unisexual .... Typhaceae

5. Plants terrestrial; flowers not in thick spikes, often perfect ... 6

6. Stems jointed at the nodes, usually hollow and terete; each spikelet subtended by 2 glumes ..... Gramineae

6. Stems usually not jointed at the nodes, solid and triangular; spikelets not subtended by glumes ..... Cyperaceae

Liliaceae

1. Plants with a woody caudex; leaves many, narrow, rigid, spine tipped, arranged in rosettes at the top of the caudex ..... 1. Yucca

1. Plants completely herbaceous; leaves not as above 2

2. Styles 3; flowers in racemes or panicles; perianth white or greenish-white 3

2. Style 1; flowers not as above 4

3. Leaves linear or nearly so ..... 2. Zigadenus

3. Leaves broadly elliptic or ovate ..... 3. Veratrum

4. Perianth segments unlike, the 3 outer ones narrow, sepallike, the 3 inner ones broad, petallike, bearing a large gland near the base .. .. 4. Calochortus

4. Perianth segments alike, petal glands absent 5

5. Flowers in terminal racemes or panicles, white; fruit berrylike; stem from a horizontal rhizome; leaves broadly lanceolate to ovate .. .. 5. Smilacina

5. Flowers in terminal umbels or racemes, orange or pink; fruit a capsule; stem from a bulb or corm; leaves narrowly linear 6

6. Plants scapose; leaves basal; flowers pink, 1 cm long or less, in umbels subtended by membranaceous bracts ..... 6. Allium

6. Plants with leafy stems; leaves in whorls; flowers orange, 6-9 cm long, in racemes, bracts absent ..... 7. Lilium

1. Yucca

Yucca elata Engelm. T

2. Zigadenus

Zigadenus elegans Pursh R, T

3. Veratrum

Veratrum californicum Durand R, T

4. Calochortus

Calochortus gunnisonii Wats. R

5. Smilacina

1. Inflorescence a panicle of numerous flowers; perianth 2-4 mm long; leaves usually ovate ..... S. racemosa (L.) Deaf. R, T

1. Inflorescence a raceme of few flowers; perianth 3-7 mm long; leaves usually lanceolate ..... S. stellata (L.) Deaf. R, T

6. Allium

1. Outer bulb coat of coarse, interwoven fibers; umbel upright .....
..... A. geyeri Wats. R

1. Outer bulb coat thin, without fibers; umbel nodding .....
..... A. cernuum Roth. R, T

a. Inner bulb scales white or cream .....
..... Var. neomexicanum (Rydb.) Macbr. T

b. Inner bulb scales pink or purplish-red .....
..... Var. obtusum Cockerell R, T

7. LILIUM

LILIUM UMBELLATUM PURSH

JUNCACEAE

1. PLANTS GLABROUS; LEAF SHEATHS OPEN; SEEDS MANY; FLOWERS NOT IN DROOPING PANICLE ..... 1. JUNCUS

1. PLANTS PILOSE; LEAF SHEATH CLOSED; SEEDS 3; FLOWERS IN A LOOSE, DROOPING PANICLE ..... 2. LUZULA

1. JUNCUS

1. FLOWERS IN HEADS, NOT BRACTEOLATE ..... J. MARGINATUS ROSTK. R, T

1. FLOWERS IN COMPACT PANICLES, BRACTEOLATE ... J. CONFUSUS CONVILLE R

2. LUZULA

LUZULA PARVIFLORA (EHRH.) DESV. R, T

IRIDACEAE

1. SEPALS RECURVED; PETALS ERECT; STYLE BRANCHES PETALOID, FILAMENTS DISTINCT ..... 1. IRIS

1. SEPALS AND PETALS SPREADING; STYLE BRANCHES NOT PETALOID; FILAMENTS UNITED ..... 2. SISYRINCHIUM

1. IRIS

IRIS MISSOURIENSIS NUTT. R, T

2. SISYRINCHIUN

SISYRINCHIUM DEMISSUM GREENE R, T

ORCHIDACEAE

1. PLANTS PURPLISH-BROWN; LEAVES SCALELIKE; FLOWERS IN A RACEME; COROLLA BROWNISH, LIP NOT SACCATE ..... 1. CORALLORHIZA

1. PLANTS GREEN; LEAVES WELL DEVELOPED; FLOWERS SOLITARY OR IN A SPIRAL RACEME; COROLLA PINK, ROSE-PINK, OR GREENISH-WHITE, LIP SACCATE .. 2

2. Leaf solitary; flower solitary; corolla pink or rose-pink, lip deeply saccate ..... 2. Calypso

2. Leaves several; flowers in a spiral raceme; corolla greenish-white, lip slightly saccate ..... 3. Goodyera

1. Corallorhiza

Corallorhiza maculata Raf. R, T

2. Calypso

Calypso bulbosa (L.) Oakes R, T

3. Goodyera

Goodyera oblongifolia Raf. R

Typhaceae

Typha latifolia L. R

Gramineae

1. Inflorescence a panicle or spikelike panicle 2

1. Inflorescence a spike (a spikelike raceme in Bouteloua) 20

2. Spikelets 1 flowered 3

2. Spikelets 2 to several-flowered or 1 flowered with additional rudimentary florets 10

3. Floret rounded, awned 4

3. Floret thin or firm, not rounded, unawned 5

4. Lemmas tapering into an awn column, this terminating as a 3 parted awn ..... 1. Aristida

4. Lemmas terminating in an unbranched, twisted awn ..... 2. Stipa

5. Glumes equal, longer than the florets 6

5. Glumes usually unequal, as long as or shorter than the florets ... 7

6. Spikelets 1 flowered; glumes acute or awn-tipped; lemmas obtuse, awnless or awn-tipped ..... 3. Agrostis

6. Spikelets 2 flowered; glumes acute, never awn-tipped; lemmas truncate, 2 to 4 toothed at tip, awned from below the middle .... 4. Deschampsia

7. Panicle open (in these species) 8

7. Panicle contracted 9

8. Caryopsis remaining attached to the lemma and palea at maturity; nerves of lemma glabrous or pilose at the base .... 5. Muhlenbergia

8. Caryopsis falling from the lemma and palea at maturity; lemma nerves silky or villous ..... 6. Blepharoneuron

9. First glume 2 to 3 awned, second glume 2 awned; lemmas herbaceous throughout, pubescent on the margins, slender-awned ..... 7. Lycurus

9. First and secind glumes 1 awned; lemmas hyaline, margins glabrous, awns absent ..... 8. Phleum

10. First glume usually as long as or longer than the first floret...11

10. First glume usually shorter than the first floret 14

11. Rachilla extending beyond the terminal floret; glumes less than 4 mm long 12

11. Rachilla not extending beyond the terminal floret; glumes 8 mm long or longer 13

12. Rachilla villous; the first glume shorter than the second; lemmas bifid, the awn arising from the back below the bifid apex .... 9. Trisetum

12. Rachilla glabrous; the first glume longer than the second; lemmas entire at the apex, awnless ..... 10. Sphenopholis

13. Spikelets with one perfect terminal floret and two staminate florets below; lemmas awnless ..... 11. Hierochloe

13. Spikelets with two or more perfect florets; lemma awned from the bifid apex ..... 12. Danthonia

14. Spikelets 3 to 7 flowered; leaf blades with conspicuous scalariform secondary venation ..... 13. Poa

14. Spikelets 2 to many flowered; leaf blades not as above 15

15. Lemmas awned 16

15. Lemmas awnless 17

16. Spikelets 2.5 cm long or longer, often nodding; awns of lemmas 2 mm long or more; blades flat and broad ..... 14. Bromus

16. Spikelets less than 2.5 cm long, seldom nodding; awns of lemmas 2 mm long or less; blades involute and narrow ..... 15. Festuca

17. Lemmas lanceolate, acuminate, herbaceous at the apex .... 15. Festuca

17. Lemmas ovate-lanceolate to obovate, acute, hyaline toward the apex 18

18. Panicle contracted, spikelike; rachilla ending in a bristle beyond the last floret; glumes equal, one-half to three-fourths the length of the floret; lemmas 5-nerved ..... 16. Koeleria

18. Panicle open; rachilla not ending in a bristle beyond the last floret; glumes unequal, less than one-half the length of the floret; lemmas 5 to 9 nerved 19

12. RACHILLA GLABROUS THE FIRST FLORET 12
13. SPIKELETS 13
14. SPIKELETS 14
15. LEMMAS AWNED 15
16. SPIKELETS 2.5 16
17. LEMMAS LANCEOLATE, ... 17
18. PANICLE CONTRACTED, ... 18
19. PANICLE OVERALL 19

19. Panicle branches drooping with the spikelets clustered at the ends; glumes obtuse, 1 nerved; lemmas obtuse, prominently 5 to 9 nerved .. .. 17. Glyceria

19. Panicle branches upright or slightly spreading with the spikelets not clustered at the ends; glumes acute, 3 to 5 nerved; lemmas acute, obscurely 7 nerved ..... 18. Melica

20. Spikelets 1 at a node 21

20. Spikelets 2 or more at a node 22

21. Spikelets flattened, 2 ranked; glumes equal, several nerved .... 19. Agropyron

21. Spikelets not flattened, arranged in 2 rows along 1 side of the rachis; glumes unequal, 1 nerved ..... 20. Bouteloua

22. Spikelets 3 at a node ..... 21. Hordeum

22. Spikelets 2 at a node 23

23. Rachis continous; glumes equal ..... 22. Elymus

23. Rachis disarticulating at each joint at maturity; glumes usually unequal ..... 23. Sitanion

1. Aristida

Aristida longiseta Steud. T

2. Stipa

Stipa lettermanii Vasey R

3. Agrostis

1. Palea present; rhizomes present ..... A. alba L. T

1. Palea absent; rhizomes absent 2

2. PANICLE CONTRACTED, THE BRANCHES DENSELY FLOWERED .....
..... A. EXARATA TRIN. R, T

2. PANICLE OPEN, THE BRANCHES NOT DENSELY FLOWERED 3

3. PANICLE NOT DIFFUSE, SECONDARY BRANCHING PRESENT .....
..... A. IDAHOENSIS NASH. T

3. PANICLE DIFFUSE, SECONDARY BRANCHING ABSENT ... A. SCABRA WILLD. R

4. DESCHAMPSIA

DESCHAMPSIA CAESPITOSA (L.) BEAUV. R

5. MUHLENBERGIA

1. PANICLE OPEN; CULMS IN A BROAD TUFT, OFTEN DYING IN THE CENTER;
SECOND GLUME TAPERING INTO A SINGLE AWN .....
..... M. TORREYI (NUTT.) HITCHC. T

1. PANICLE CONTRACTED; CULMS NOT IN A BASAL TUFT; SECOND GLUME
3 TOOTHED ..... M. MONTANA (NUTT.) HITCHC. R, T

6. BLEPHARONEURON

BLEPHARONEURON TRICHOLEPIS (NASH) TORR. R, T

7. LYCURUS

LYCURUS PHLEOIDES H.B.K. R

8. PHLEUM

1. PANICLE OVOID OR OBLONG, NOT MORE THAN TWICE AS LONG AS WIDE .....
..... P. ALPINUM L. R

1. PANICLE CYLINDRIC, AT LEAST 2.5 TIMES AS LONG AS WIDE .....
..... P. PRATENSE L. R

9. TRISETUM

TRISETUM MONTANUM VASEY R, T

10. SPHENOPHOLIS

SPHENOPHOLIS INTERMEDIA (RYDB.) RYDB. R

11. HIEROCHLOE

HIEROCHLOE ODERATA (L.) BEAUV. R

12. DANTHONIA

1. LEMMAS GLABROUS ON THE BACK 2

1. LEMMAS PUBESCENT ON THE BACK ..... D. SPICATA (L.) BEAUV. R

2. PANICLE BRANCHES SPREADING ..... D. CALIFORNICA BOLANDER T

2. PANICLE BRANCHES ERECT ..... D. INTERMEDIA VASEY R, T

13. POA

1. PLANTS ANNUAL 2

1. PLANTS PERENNIAL 3

2. PANICLE NARROW, BRANCHES APPRESSED OR ASCENDING; LEMMAS WEBBED AT THE BASE ..... P. BIGELOVII VASEY AND SCHRIBN. T

2. PANICLE TRIANGULAR, BRANCHES SPREADING; LEMMAS NOT WEBBED AT THE BASE ..... P. ANNUA L. T

3. SPIKELETS NOT COMPRESSED ..... P. NEVADENSIS VASEY R, T

3. SPIKELETS COMPRESSED 4

4. RHIZOMES PRESENT 5

4. RHIZOMES ABSENT 6

5. CULMS FLATTENED ..... P. COMPRESSA L. T

5. CULMS NOT FLATTENED ..... P. PRATENSIS L. T

6. LEMMAS WEBBED AT THE BASE ..... P. INTERIOR RYDB. R, T

6. LEMMAS NOT WEBBED AT THE BASE 7

7. Blades involute; panicle open 8

7. Blades flat; panicle contracted ..... P. rupicola Nash T

8. Ligule less than 1 mm long ..... P. fendleriana (Steud.) Vasey R, T

8. Ligule 5-7 mm long ..... P. longiligula Scribn. and Will. R, T

14. Bromus

1. Spikelets flattened 2

1. Spikelets not flattened 3

2. Sheaths pilose; blades pubescent; lemmas pubescent .....
..... B. marginatus Nees. T

2. Sheaths glabrous; blades hispidulous; lemmas glabrous .....
..... B. polyanthus Scribn. T

3. Plants annual ..... B. tectorum L. R

3. Plants perennial 4

4. Lemmas pubescent only along the margin and sometimes dorsally below
..... B. ciliatus L. R, T

4. Lemmas evenly pubescent 5

5. Panicle 6-9 cm long, open and drooping; sheaths pilose to scabrous ..
..... B. anomalus Rupr. T

5. Panicle 9-20 cm long, erect, sometimes drooping; sheaths glabrous ..
..... B. frondosus (Shear.) Woot. and Standl. T

15. Festuca

1. Ligule 2-4 mm long; lemmas awnless ..... F. thurberi Vasey R, T

1. Ligule less than 1 mm long; lemmas awned 2

2. Blades seldom more than one-half the length of the culms; panicle
spikelike; awn 2-4 mm long ..... F. ovina L. R, T

2. Blades nearly as long as the culms; panicle not spikelike; awn usually less than 1.5 mm long ..... F. arizonica Vasey R, T

16. Koeleria

Koeleria cristata (L.) Pers. R, T

17. Glyceria

Glyceria striata (Lam.) Hitchc. T

18. Melica

Melica porteri Scribn. T

19. Agropyron

1. Plants with rhizomes 2

1. Plants without rhizomes 3

2. Blades stiff, involute in drying; glumes rigid, tapering to a short awn; lemmas glabrous ..... A. smithii Rydb. T

2. Blades lax, flat in drying; glumes not rigid, acute or abruptly awn-tipped; lemmas scaberulous or hispid .....
..... A. pseudorepens Scribn. and Smith R

3. Spikelets crowded and compressed on the rachis .....
..... A. desertorum (Fisch.) Schult. T

3. Spikelets neither crowded nor compressed on the rachis 4

4. Spikelets awnless or with awns less than 1 mm long .....
..... A. trachycaulum (Link.) Malte. R, T

4. Spikelets with awns more than 3 mm long 5

5. Awns straight ..... A. subsecundum (Link.) Hitchc. R, T

5. Awns divergent ..... A. bakeri E. Nels. T

20. BOUTELOUA

BOUTELOUA GRACILIS (H.B.K.) LAG. T

21. HORDEUM

1. SPIKE AS LONG AS BROAD; AWNS 2-5 CM LONG ..... H. JUBATUM L. T

1. SPIKE MUCH LONGER THAN BROAD; AWNS 1 CM LONG OR LESS .....
..... H. BRACHYANTHERUM NEVSKI R, T

22. ELYMUS

1. GLUMES THIN, ACUMINATE OR AWN-TIPPED ..... E. GLAUCUS BUCHL. T

1. GLUMES FIRM, LONG AWNED 2

2. AWNS DIVERGENT; LEMMAS PUBESCENT ..... E. CANADENSIS L. T

2. AWNS STRAIGHT; LEMMAS GLABROUS ..... E. VIRGINICUS L. R

23. SITANION

SITANION HYSTRIX (NUTT.) J. G. SMITH R, T

CYPERACEAE

1. ACHENE ENCLOSED IN A PERIGYNIUM; FLOWERS UNISEXUAL, STAMINATE AND PISTILLATE FLOWERS FOUND ON DIFFERENT SPIKES OR ARRANGED ON OPPOSITE ENDS OF THE SAME SPIKE ..... 1. CAREX

1. ACHENE NOT ENCLOSED IN A PERIGYNIUM; FLOWERS PERFECT ..... 2. SCIRPUS

1. CAREX

1. STIGMAS 3; SPIKES BLACKISH 2

1. STIGMAS 2; SPIKES BROWNISH 3

2. LOWER SPIKES DROOPING ON LONG PEDUNCLES; SCALES BLACK THROUGHOUT .....
..... C. BELLA BAILEY R, T

2. LOWER SPIKES ERECT; SCALES BLACK WITH WHITE HYALINE MARGINS .....
..... C. ALBO-NIGRA MACKENZ. T

3. LATERAL SPIKES PEDUNCLED ..... C. NEBRASKENSIS DEWEY R

3. Lateral spikes sessile 4

4. Culms from creeping rhizomes 5

4. Culms not from creeping rhizomes 6

5. Perignia flattened, wing-margined ..... C. siccata Dewey R, T

5. Perigynia neither flattened nor wing-margined .....
..... C. simulata Mackenz. T

6. Scales obtuse, concealong the perigynia ..... C. xerantica Bailey R

6. Scales acute, shorter than the perigynia 7

7. Perigynia wing-margined 8

7. Perigynia not winged, merely thin-edged 11

8. Spikes either entirely pistillate, or staminate flowers above the
pistillate flowers ..... C. stipata Muhl. R

8. Spikes with staminate flowers below the pistillate flowers 9

9. Perigynia lanceolate, usually 3 times longer than wide 10

9. Perigynia ovate, less than 3 times longer than wide .....
..... C. festivella Mackenz. R, T

10. Perigynia brown; scales dark brown with lighter brown center .....
..... C. stenoptila Hermann. R

10. Perigynia yellow-green; scales light brown with green center .....
..... C. scoparia Schkukr. R

11. Perigynia pale yellow or tan throughout .....
..... C. wootoni Mackenz. T

11. Perigynia tan, with small white dots .....
..... C. canescens L. R

2. SCIRPUS

SCIRPUS CALIFORNICUS (C. MEYER) STEUD. R

DICOTYLEDONEAE

1. OVARY SUPERIOR 2

1. OVARY INFERIOR 40

2. COROLLA PRESENT 3

2. COROLLA ABSENT 30

3. PETALS FREE 4

3. PETALS UNITED, AT LEAST AT THE BASE 19

4. FLOWERS REGULAR 5

4. FLOWERS IRREGULAR 17

5. STAMENS 15 OR MORE 6

5. STAMENS LESS THAN 15 9

6. STAMENS FREE 7

6. STAMENS UNITED, AT LEAST AT THE BASE 8

7. LEAVES STIPULATE; STAMENS NOT ATTACHED ON THE RECEPTACLE; PISTILS 1 TO NUMEROUS ..... ROSACEAE

7. LEAVES NOT STIPULATE; STAMENS SPIRALLY ATTACHED ON THE RECEPTACLE; PISTILS SEVERAL TO NUMEROUS ..... RANUNCULACEAE

8. LEAVES ALTERNATE, NOT GLANDULAR-PUNCTATE, USUALLY WITH STELLATE PUBESCENCE; FILAMENTS UNITED TO FORM A TUBE ..... MALVACEAE

8. LEAVES OPPOSITE, GLANDULAR-PUNCTATE, GLABROUS; STAMENS IN 3 TO 5 CLUSTERS; FILAMENTS UNITED ONLY AT THE BASE ..... GUTTIFERAE

9. SEPALS AND PETALS 5 (PETALS 4 IN SOME GENERA OF ERICACEAE AND SEDUM OF CRASSULACEAE) 10

9. Sepals and petals 4 or 6 15

10. Leaves opposite or basal 11

10. Leaves alternate, caulescent or acaulescent, never basal 12

11. Leaves palmately lobed or parted, stipulate; petals early deciduous; stamens 10, 5 longer than the other 5; style 5 parted, exerted .... Geraniaceae

11. Leaves entire, non-stipulate; petals persistent; stamens 10, all the same length; styles 3, not exerted ..... Caryophyllaceae

12. Leaves simple, caulescent or acaulescent 13

12. Leaves compound and acaulescent; leaflets 3 or more, wedge-shaped ..... Oxalidaceae

13. Leaves sessile 14

13. Leaves petioled ..... Ericaceae

14. Leaves succulent; petals persistant; stamens 10 ..... Crassulaceae

14. Leaves not succulent; petals early deciduous; stamens 5 .. Linaceae

15. Sepals and petals 4; leaves not hollylike 16

15. Sepals and petals 6: leaves hollylike or nearly entire and spine-tipped ..... Berberidaceae

16. Plant a low, creeping shrub; mature leaves of a thick, leathery texture; fruit a drupe or berry ..... Celastraceae

16. Plants herbaceous; mature leaves thin; fruit a silicle or silique .. .. Cruciferae

17. Leaves simple (obovate or kidney-shaped)..... Violaceae

17. Leaves compound 18

18. Petals 5, not spurred; stamens usually 10; filaments often partially united; fruit a legume .....Leguminosae

18. Petals 4; outer petals spurred; stamens 6; filaments not united; fruit a capsule ..... Fumariaceae

19. Perianth 4-merous; corolla scarious or scarious-margined; stamens 2 or 4 ..... Plantaginaceae

19. Perianth usually 5-merous, occasionally 4-merous; corolla not scarious or scarious-margined; stamens 4-12 20

20. Corolla regular 21

20. Corolla irregular 28

21. Stamens 8-12; style 1 or 5 22

21. Stamens 4-5; style 1-2 23

22. Leaves not succulent; style 1 ..... Ericaceae

22. Leaves succulent; styles 5 ..... Crassulaceae

23. Leaves alternate or basal, petiolate; stamens alternate or opposite the corolla lobes 24

23. Leaves opposite, sessile; stamens alternate with the corolla lobes ..... Gentianaceae

24. Plants acaulescent; leaves in a basal rosette; stamens opposite the corolla lobes ..... Primulaceae

24. Plants caulescent; leaves basal and cauline; stamens alternate with the corolla lobes 25

25. Style 1; flowers never in scorpoid cymes 26

25. Styles 2; flowers often in scorpoid cymes ..... Hydrophyllaceae

26. Bracts subtending the flowers; fruit a cluster of 4 nutlets ..... Boraginaceae

26. Bracts not as above or absent; fruit otherwise 27

27. Leaves simple, entire; calyx and corolla subtended by a pair of bracts; stamens inserted equally on the corolla; style 2-cleft ..... Convolvulaceae

27. Leaves compound, or if simple, then deeply pinnately dissected; bracts absent; stamens inserted unequally on the corolla; style 3-parted ..... Polemoniaceae

28. Stamens 2 or 4; stamen filaments separate; fruit not a legume ... 29

28. Stamens 10; stamen filaments at least partially united; fruit a legume ..... Leguminosae

29. Stems usually square; leaves opposite, simple; stamens 2 or 4; style 2-parted ..... Labiatae

29. Stems round; leaves alternate or whorled, simple or compound; stamens 4; style 1, entire (corolla regular and stamens 5 in Verbascum) ..... Schophulariaceae

30. Small trees or shrubs 31

30. Herbs 34

31. Inflorescence a catkin 32

31. Inflorescence not as above 33

32. Plants dioecious, producing pendulous male or female catkins ..... Salicaceae

32. Plants monoecious, producing pendulous male catkins and conelike female catkins ..... Betulaceae

33. Fruit a double samara; stamens arranged on a disc ..... Aceraceae

33. Fruit not a samara; stamens not arranged on a disc; pistil long exerted and plumose on the mature fruit (Cercocarpus) ..... Rosaceae

34. Perianth petaloid, usually highly colored 35

34. Perianth calyxlike 37

35. Perianth united; stems without swollen nodes 36

35. Perianth free; stems with swollen nodes (except Eriogonum) .....
..... Polygonaceae

36. Perianth funnelform or salverform, pink or purple; (ovary appears to be inferior); stamens 3-5; style not plumose ..... Nyctaginaceae

36. Perianth free, usually white or purple; stamens numerous; style plumose (Clematis) ..... Ranunculaceae

37. Ovary 3-loculed; plants with milky sap ..... Euphorbiaceae

37. Ovary 1- or many-loculed; plants without milky sap 38

38. Plants pubescent; leaves simple; stamens shorter than the sepals ...
..... 39

38. Plants glabrous; leaves ternately compound; stamens much longer than the sepals (Thalictrum) ..... Ranunculaceae

39. Pubescence of stinging hairs; panicle 4-5 cm long ..... Urticaceae

39. Pubescence not of stinging hairs, often scurfy; panicle 1-3 cm long
..... Chenopodiaceae

40. Corolla absent; staminate flowers in catkins; pistillate flowers solitary, enclosed with scalelike bracts (ovary sometimes appears superior; small trees or shrubs; leaves deciduous) ..... Fagaceae

40. Corolla present; flowers perfect or staminate, not in catkins; pistillate flowers not enclosed in scalelike bracts 41

41. Petals free 42

41. Petals united 45

42. Sepals and petals 4 43

42. Sepals and petals 5 44

43. Plants herbaceous; flowers axillary or in terminal racemes; stigmas 4-lobed ..... Onagraceae

43. Plants shrubby; flowers in corymbs; stigmas entire ..... Cornaceae

44. Stems hollow; flowers in umbels; stamens 5, inserted on a disc; styles 2 ..... Umbelliferae

44. Stems solid; flowers not in umbels; stamens 10 or more, not always inserted on a disc; style 1 (ovary partially inferior) .... Saxifragaceae

45. Plants parasitic upon trees, dioecious; stems jointed; perianth calyxlike ..... Loranthaceae

45. Plants not parasitic; monoecious; stems not jointed; perianth differentiated 46

46. Stamens 5 47

46. Stamens 3-4 49

47. Stamens distinct; flowers not in heads 48

47. Stamens united by the anthers; flowers in heads surrounded by involucres of phyllaries ..... Compositae

48. Leaves alternate, simple; corolla campanulate; stamens adnate to the corolla and opposite the lobes; stigmas 3 ..... Campanulaceae

48. Leaves opposite, simple or compound; corolla rotate, funnelform, or nearly so; stamens adnate to the corolla and alternate with the lobes; stigmas 1-5, seldom 3 ..... Caprifoliaceae

49. Leaves opposite; stipules absent; corolla 4 to 5 lobed; stigma 1 .. .. Valerianaceae

49. Leaves whorled; stipules present, leaflike; corolla 3- to 4-parted; stigmas 1-4 ..... Rubiaceae

Rosaceae

1. Fruit a 1-seeded drupe ..... 1. Prunus
1. Fruit not as above 2
2. Plants spiny 3
2. Plants unarmed 4
3. Fruit pomelike ..... 2. Rosa
3. Fruit a compound drupe ..... 3. Rubus
4. Plants shrubby 5
4. Plants herbaceous 8
5. Corolla present; styles usually not exerted at maturity 6
5. Corolla absent; styles exerted at maturity ..... 4. Cercocarpus
6. Flowers in racemes; fruit a compound drupe or a pome 7
6. Flowers in panicles; fruit of 5 achenes ..... 5. Holodiscus
7. Plant a low shrub; fruit a compound drupe ..... 3. Rubus
7. Plant a small tree; fruit a pome ..... 6. Amelanchier
8. Leaves trifoliate; fruit of many achenes imbedded on a fleshy receptacle ..... 7. Fragaria
8. Leaves digitately or pinnately compound; achenes not imbedded on a fleshy receptacle 9
9. Style persistent on the mature achene ..... 8. Geum
9. Style deciduous from the mature achene ..... 9. Potentilla

1. Prunus

1. Leaf base rounded .....
..... P. virginiana L. var. melanocarpa (A. Nels.) Sarg. R, T

1. Leaf base acute ..... P. virens (Woot. & Standl.) Shreve. T

2. Rosa

1. Stem prickles straight, slender ..... R. fendleri Crepin. R, T

1. Stem prickles curved, stout 2

2. Fruit globose ..... R. arizonica Rydb. R, T

2. Fruit ellipsoid ..... R. neomexicana Cockerell R, T

3. Rubus

1. Plants with stiff bristles; leaves 3 to 5 foliate .....

..... R. strigosus Michx. R, T

1. Plants unarmed; leaves simple ..... R. parviflorus Nutt. R, T

4. Cercocarpus

Cercocarpus montanas Raf. T

5. Holodiscus

Holodiscus dumosa (Nutt.) Heller R, T

6. Amelanchier

Amelanchier oreophila A. Nels. R

7. Fragaria

1. Leaves toothed only at the apex ..... F. ovalis (Lehm.) Rydb. R, T

1. Leaves toothed to below the middle ..... F. bracteata Heller R, T

8. Geum

1. Petals flesh-colored, purple veined ..... G. rivale L. R

1. Petals yellow, yellow veined ..... G. macrophyllum Willd. R, T

9. Potentilla

1. Plants woody shrubs ..... P. fruticosa L. R

1. Plants herbaceous 2

2. Styles lateral ..... P. arguta Pursh R, T

2. Styles terminal 3

3. Inflorescence leafy; petals not longer than sepals .....
..... P. norvegica L. R

3. Inflorescence scapose; petals much longer than sepals 4

4. Basal leaves pinnate; leaves sericeous beneath .....
..... P. hippiana Lehm. R, T

4. Basal leaves digitate (P. pulcherrima occasionally obscurely pinnate); leaves white-tomentose beneath 5

5. Plants caulescent; leaflets more than 5, toothed to below the middle; flowering stems erect ..... P. pulcherrima Lehm. R, T

5. Plants acaulescent or nearly so; leaflets 5, toothed only above the middle; flowering stems spreading ..... P. concinna Richards. R

Ranunculaceae

1. Fruit a berry ..... 1. Actaea

1. Fruit a follicle or achene 2

2. Fruit a follicle 3

2. Fruit an achene 4

3. Flowers irregular; petals not spurred ..... 2. Aconitum

3. Flowers regular; petals long spurred ..... 3. Aquilegia

4. Petals present ..... 4. Ranunculus

4. Petals absent 5

5. Sepals lavender or purple, longer than the stamens; achenes present (with plumose tails) ..... 5. Clematis

5. Sepals green, shorter than the stamens; achenes absent .....
..... 6. Thalictrum

1. ACTAEA

ACTAEA ARGUTA NUTT. R, T

2. ACONITUM

ACONITUM COLUMBIANUM NUTT. R

3. AQUILEGIA

1. FLOWERS NODDING; SPURS RED; SEPALS RED WITH GREEN OR YELLOW TIPS ... . A. ELEGANTULA GREENE R, T

1. FLOWERS ERECT; SPURS AND SEPALS NOT AS ABOVE 2

2. SPURS, SEPALS, AND PETALS YELLOW ..... A. CHRYSANTHA GRAY R

2. SPURS AND SEPALS BLUE; PETALS WHITE ..... A. CAERULEA JAMES R

4. RANUNCULUS

1. PLANTS AQUATIC; PETALS WHITE ..... R. AQUATILIS L. R

1. PLANTS PALUSTRINE OR TERRESTRIAL; PETALS YELLOW 2

2. BASAL LEAVES ROTUND ..... R. INAMOENUS GREENE R

2. BASAL LEAVES OTHER THAN ROTUND 3

3. PLANTS OFTEN PALUSTRINE; BASAL LEAVES CORDATE OR RENIFORM; STEM LEAVES, IF PRESENT, DEEPLY 3-PARTED 4

3. PLANTS TERRESTRIAL; BASAL LEAVES DIGITATELY TRI-FOLIATE; STEM LEAVES USUALLY CRENATE ..... R. MACOUNII BUTTON R, T

4. STEM LEAVES ABSENT ..... R. CYMBALARIA PURSH T

4. STEM LEAVES PRESENT (LINEAR) ..... R. CARDIOPHYLLUS HOOK. R, T

5. CLEMATIS

1. SEPALS THIN; SPREADING, GLABROUS .... C. PSEUDOALPINA (KUNTZ) A. NELS. R

1. SEPALS THICK, ERECT, PUBESCENT 2

2. Tails of the achenes 2.5-3 cm long, glabrous .....

..... C. bigelovii Torr. T

2. Tails of the achenes 4-5 cm long, plumose ..... C. palmeri Rose T

6. Thalictrum

Thalictrum fendleri Engelm. R, T

Malvaceae

1. Plants without stellate pubescence; style branches filiform, longitudinally stigmatic; petals white or cream ..... 1. Sidalcea

1. Plants with stellate pubescence; style branches terminating in a capitate stigma; petals brick-red or orange ..... 2. Sphaeralcea

1. Sidalcea

Sidalcea candida Gray R, T

2. Sphaeralcea

Sphaeralcea digitata (Greene) Rydb. T

Guttiferae

1. Hypericum

Hypericum formosum H.B.K. R, T

Geraniaceae

1. Geranium

1. Petals white 2

1. Petals purple, rose-purple, or lavender 4

2. Petals 7-9 mm long; pedicels glandular-villous without purple glands

..... 3

2. Petals 12-20 mm long; pedicels glandular-villous with purple glands

..... G. richardsonii Fisch. & Traut. R, T

3. Stems and petioles glandular-villous; style column 20-24 mm long, glandular pubescent ..... G. lentum Woot. & Standl. T

3. Stems and petioles slightly pilose; style column 15-18 mm long, pilose ..... G. wislizenii Wats. T

4. Petals lavender ..... G. fremontii Torr. R, T

4. Petals rose-purple 5

5. Pedicels short-pubescent ..... G. caespitosum James R, T

5. Pedicels glandular-pubescent ..... G. eremophilum Woot. & Standl. R, T

Caryophyllaceae

1. Sepals united; petals clawed, red ..... 1. Silene

1. Sepals distinct; petals without claws, white 2

2. Petals deeply cleft 3

2. Petals entire ..... 2. Arenaria

3. Capsule elongate; styles 5 ..... 3. Cerastium

3. Capsule ovoid or oblong; styles 3 ..... 4. Stellaria

1. Silene

Silene laciniata Cav. T

2. Arenaria

Arenaria fendleri Gray var. brevifolia (Maguire) Maguire R

3. Cerastium

1. Plants annual; calyx slightly longer than the sepals ..... C. brachypodum (Engelm.) Robins. R

1. Plants perennial; calyx twice as long as the sepals ..... C. arvense L. R

4. STELLARIA

STELLARIA LONGIPES GOLDIE R, T

OXALIDACEAE

1. OXALIS

1. PETALS YELLOW; BULBS ABSENT ..... O. STRICTA L. T

1. PETALS PINK; BULBS PRESENT 2

2. OUTER BULB SCALES USUALLY 3-NERVED; LEAFLETS 1-3 CM WIDE, LOBES OVATE ..... O. METCALFEI (SMALL) KNUTH. R

2. OUTER BULB SCALES USUALLY MORE THAN 3-NERVED; LEAFLETS 2-5 CM WIDE, LOBES OBLONG-OVATE ..... O. AMPLIFOLIA (TREL.) KNUTH. T

ERICACEAE

1. PLANTS SAPROPHYTIC; CHLOROPHYLL ABSENT 2

1. PLANTS NOT SAPROPHYTIC; CHLOROPHYLL PRESENT 3

2. PETALS DISTINCT; ANTHERS AWNLESS ..... 1. MONOTROPA

2. PETALS UNITED BELOW; ANTHERS AWNED ..... 2. PTEROSPORA

3. PLANTS SMALL, SHRUBBY, LEAFY THROUGHOUT; PETALS UNITED .... 3. VACCINIUM

3. PLANTS HERBACEOUS; LEAVES BASAL; PETALS DISTINCT 4

4. FLOWERS IN RACEMES ..... 4. PYROLA

4. FLOWERS SOLITARY ..... 5. MONESES

1. MONOTROPA

MONOTROPA LATISQUAMA (RYDB.) HULTEN R

2. PTEROSPORA

PTEROSPORA ANDROMEDIA NUTT. R, T

3. VACCINIUM

VACCINIUM OREOPHILUM RYDB. R, T

4. PYROLA

1. RACEME SECUND; STYLE STRAIGHT ..... P. SECUNDA L. R, T

1. RACEME NOT SECUND; STYLE REFLEXED ..... P. ELLIPTICA NUTT. T

5. MONESES

MONESES UNIFLORA (L.) GRAY T

CRASSULACEAE

1. SEDUM

SEDUM COCKERELLII BRITTON R

LINACEAE

1. LINUM

LINUM LEWISII PURSH T

BERBERIDACEAE

1. BERBERIS

1. STEMS SPINY; LEAVES SIMPLE ..... B. FENDLERI GRAY T

1. STEMS UNARMED; LEAVES COMPOUND; LEAFLETS HOLLYLIKE .....

..... B. REPENS LINDL. R, T

CELASTRACEAE

PACHYSTIMA MYRSINITES (PURSH) RAF. R, T

CRUCIFERAE

1. FRUIT COMPRESSED PERPENDICULAR TO THE NARROW PARTITION 2

1. FRUIT COMPRESSED PARALLEL TO THE NARROW PARTITION 3

2. PLANTS HIRSUTE; LEAVES BASAL, PINNATIFID; STEM LEAVES AURICULATE, NOT CLASPING ..... 1. CAPSELLA

2. PLANTS GLABROUS; LEAVES CAULINE, ENTIRE TO LOBED; STEM LEAVES NOT AURICULATE, CLASPING ..... 2. THLASPI

3. Fruit more than twice as long as wide 4

3. Fruit less than twice as long as wide ..... 3. Draba

4. Petals purple 5

4. Petals white, yellow, or orange 6

5. Herbage glaucose ..... 4. Sisymbrium

5. Herbage pubescent with stellate or forked hairs ..... 5. Arabis

6. Herbage pubescence of simple hairs or glabrous 7

6. Herbage pubescence of stellate or forked hairs ..... 3. Draba

7. Herbage usually glabrous; leaves cordate; petals white; capsules globose, ascending ..... 6. Cardamine

7. Herbage pubescence of simple, appressed hairs; leaves not cordate; petals yellow or orange; capsule 4-sided, erect ..... 7. Erysimum

1. Capsella

Capsella bursa-pastoris (L.) Medic. R, T

2. Thlaspi

Thlaspi fendleri Gray R, T

3. Draba

1. Plants perennial, tall and leafy 2

1. Plants annual, short and scapose 3

2. Fruit erect; style 0.5-1.5 mm long ..... D. aurea Vahl. R, T

2. Fruit spreading; style 2-3.5 mm long ..... D. helleriana Greene T

3. Flowers yellow ..... D. rectifructa C. L. Hitchc. R, T

3. Flowers white ..... D. brachycarpa Nutt. T

4. Sisymbrium

1. Stem leaves entire and auriculate-clasping .....

..... S. elegans (Jones) Payson R

1. Stem leaves not auriculate-clasping 2

2. Stem leaves entire or toothed; petals purple or purple-pink .....

..... S. linearifolium (Gray) Payson T

2. Stem leaves pinnatifid; petals yellow or cream .....

..... S. altissimum L. R

5. Arabis

Arabis fendleri (Wats.) Greene T

6. Cardamine

Cardamine cordifolia Gray R

7. Erysimum

Erysimum capitatum (Dougl.) Greene R

Violaceae

1. Petals white ..... V. canadensis L. R, T

1. Petals purple 2

2. Plants acaulescent; spur much less than one-half as long as the petal

..... V. nephrophylla Greene R, T

2. Plants caulescent; spur more than one-half as long as the petal .....

..... V. adunca J. E. Smith R, T

Leguminosae

1. Plants woody shrubs or small trees, spiny ..... 1. Robinia

1. Plants herbaceous 2

2. Leaves palmately divided 3

2. Leaves pinnately compound 5

3. Leaves with 3 leaflets; anther size uniform 4

3. Leaves with 4-15 leaflets; anther size varying greatly ....2. Lupinus

4. Petals yellow; filaments distinct to the base ..... 3. *Thermopsis*

4. Petals rose, purple to white; filaments united above the base .....
..... 4. *Trifolium*

5. Leaves with tendrils 6

5. Leaves without tendrils 7

6. Style round, apically tufted, pubescent on all surfaces ... 5. *Vicia*

6. Style flat; not apically tufted, pubescent only on inner surface ...
..... 6. *Lathyrus*

7. Leaves appearing digitate; stem leaves often reduced; stamens flattened ..... 7. *Lotus*

7. Leaves never appearing digitate; stem leaves not reduced; stamens rounded ..... 8. *Astragulus*

1. Robinia

Robinia neomexicana Gray R

2. Lupinus

1. Plants annual or biennial 2

1. Plants perennial 3

2. Leaflets pubescent on the upper surface .....
..... *L. concinnus* Agardh. var. *orcuttii* (Wats.) C.P. Smith T

2. Leaflets glabrous on the upper surface .....
..... *L. kingii* Wats. var. *kingii* T

3. Petals purple 4

3. Petals white ..... *L. parishii* (Eastw.) Williams T

4. Leaflets glabrous on the upper surface 5

4. Leaflets pubescent on the upper surface 7

5. Stem pubescence spreading or ascending ..... *L. ammophilus* Greene R

5. Stem pubescence appressed 6

6. Keel and banner glabrous ..... L. ingratus Greene T

6. Keel and banner pubescent ..... L. argenteus Pursh var. argenteus T

7. Stem pubescence appressed; flowers orbicular in lateral view .....
..... L. alpestris A. Nels. T

7. Stem pubescence spreading; flowers narrow in lateral view .....
..... L. palmeri Wats. T

3. Thermopsis

Thermopsis pinetorum Greene R

4. Trifolium

Trifolium lacerum Greene R

5. Vicia

1. Flowers 20-25 mm long, purple ..... V. americana Muhl. R, T

1. Flowers 12 mm long or less, cream ..... V. pulchella H.B.K. T

6. Lathyrus

1. Tendrils rudimentary, not prehensile ... L. arizonicus Britton R, T

1. Tendrils well developed, prehensile ..... L. laetivirens Greene T

7. Lotus

Lotus wrightii (Gray) Greene T

8. Astragulus

Astragulus tephrodes Gray T

Fumariaceae

1. Corydalis

Corydalis aurea Willd. R, T

6. Keel and banner glands 7
6. Keel and banner pubescent 7
7. Stem pubescence appressed, flowers subsessile in axillary clusters .....
..... 7
7. Stem pubescence of erect hairs, flowers in axillary 7
..... 7

PLANTAGINACEAE

1. PLANTAGO

PLANTAGO MAJOR L. R, T

GENTIANACEAE

1. GENTIANA

1. COROLLA SINUSES FOLDED ..... G. AFFINIS GRISEB. R, T

1. COROLLA SINUSES NOT FOLDED 2

2. FLOWERS NUMEROUS AND CROWDED; INFLORESCENCE DENSE AND SPIKELIKE ....
..... G. STRICTIFLORA (RYDB.) A. NELS. R

2. FLOWERS NOT NUMEROUS OR CROWDED; INFLORESCENCE OTHERWISE .....
..... G. PLEBEIA CHAM. R

PRIMULACEAE

1. PLANTS PERENNIAL; COROLLA SHOWY, 12-20 MM LONG, PINK, DRYING PURPLE; FILAMENTS UNITED AT THE BASE ..... 1. DODECATHEON

1. PLANTS ANNUAL; COROLLA INCONSPICUOUS, 2 MM LONG OR LESS, WHITISH-GREEN; FILAMENTS DISTINCT ..... 2. ANDROSACE

1. DODECATHEON

DODECATHEON RADICATUM GREENE R

2. ANDROSACE

ANDROSACE SEPTENTRIONALIS L. R, T

HYDROPHYLLACEAE

1. LEAVES PINNATIFID, VEINS NOT PROMINENT; FLOWERS IN CAPTIATE CLUSTERS; PETALS PERSISTENT ..... 1. HYDROPHYLLUM

1. LEAVES ENTIRE, VEINS PROMINENT; FLOWERS IN SCORPIOID CYMES; PETALS EARLY DECIDUOUS ..... 2. PHACELIA

1. HYDROPHYLLUM

HYDROPHYLLUM FENDLERI (GRAY) HELLER R

2. PHACELIA

PHACELIA MAGELLANICA (LAM.) COV. R, T

BORAGINACEAE

1. COROLLA BLUE 2

1. COROLLA YELLOW 3

2. INFLORESCENCE A SLIGHTLY SCORPIOID CYME; COROLLA SALVERFORM; NUTLETS WITH BARBED PRICKLES ..... 1. HACKELIA

2. INFLORESCENCE NEVER SCORPIOID; COROLLA FUNNELFORM; NUTLETS WITH NO BARBED PRICKLES ..... 2. MERTENSIA

3. PLANTS PUBERULENT ONLY; STIGMA BIFID; NUTLETS ATTACHED BY THEIR BASE TO THE RECEPTACLE ..... 3. LITHOSPERMUM

3. PLANTS PUBERULENT WITH SCATTERED LONG HAIRS; STIGMA ENTIRE, NUTLETS ATTACHED LATERALLY TO THE RECEPTACLE ..... 4. CRYPTANTHA-

1. HACKELIA

HACKELIA FLORIBUNDA (LEHM.) JOHNST. R

2. MERTENSIA

MERTENSIA FRANCISCANA HELLER R, T

3. LITHOSPERMUM

1. ROOT WITH A PURPLE DYE; COROLLA DEEP YELLOW OR YELLOW-ORANGE .....
..... L. MULTIFLORUM TORR. R

1. ROOTLLACKING A PURPLE DYE; COROLLA LIGHT YELLOW .....
..... L. CORBRENSE GREENE T

4. Cryptantha

1. Plants coarse, perennial; nutlets smooth ..... C. jamesii (Torr.) Payson T
1. Plants slender, annual; nutlets rough ..... C. micrantha (Torr.) Johnst. T

Convolvulaceae

1. Convolvulus

Convolvulus incana Vahl. T

Polemoniaceae

1. Leaves pinnately compound; corolla purple ..... 1. Polemonium
1. Leaves simple, entire or pinnately dissected; corolla red or white..2
2. Leaves entire, opposite; corolla white, pink, or rose ..... 2. Phlox
2. Leaves pinnately dissected, basal or stem leaves alternate or both alternate; corolla red ..... 3. Gilia

1. Polemonium

Polemonium foliosissimum Gray R, T

2. Phlox

1. Plants in matted clumps; shoots short; petals white 2
1. Plants not in matted clumps; shoots elongated; petals pink or rose .. .. P. stansburyi (Torr.) Heller R
2. Inflorescence, stem, and calyx glandular .... P. caespitosa Nutt. T
2. Inflorescence, stem, and calyx glabrous ... P. austromontana Cov. T

3. Gilia

Gilia aggregata (Pursh) Spreng. R, T

LABIATAE

1. Stems densely white-woolly; calyx teeth 10; flowers in dense sub-globose axil clusters ..... 1. *Marrubium*

1. Stems not densely white-woolly; calyx teeth 5; flower arrangement not as above 2

2. Floral bracts absent; corolla regular ..... 2. *Mentha*

2. Floral bracts present; corolla bilateral 3

3. Floral bracts herbaceous, margins ciliate ..... 3. *Agastache*

3. Floral bracts often scarious, margins not ciliate 4

4. Floral bracts spine-toothed, hollylike, not clasping, glabrous; corolla barely exceeding the calyx ..... 4. *Moldavica*

4. Floral bracts entire, membranous, clasping, ciliate; corolla greatly exceeding the calyx ..... 5. *Prunella*

1. Marrubium

Marrubium vulgare L. R

2. Mentha

Mentha arvensis L. R

3. Agastache

1. Calyx 7mm long or less; corolla tube 6 mm long or less, purple .... *A. wrightii* (Greene) Woot. & Standl. T

1. Calyx 8 mm long or longer; corolla tube 10-16 mm long, rose-purple .. *A. pallidiflora* (Heller) Rydb. var. *neomexicana* (Briq.) Lint & Epling T.

4. Moldavica

Moldavica parviflora (Nutt.) Britton R, T

5. PRUNELLA

PRUNELLA VULGARIS L. R, T

SCROPHULARIACEAE

1. COROLLA REGULAR; FERTILE STAMENS 5 ..... 1. VERBASCUM

1. COROLLA IRREGULAR, SOMETIMES APPEARING REGULAR; FERTILE STAMENS 2 OR 4 2

2. STAMENS 2; COROLLA REGULAR OR NEARLY SO ..... 2. VERONICA

2. STAMENS 4; COROLLA DEFINITELY BILATERAL 3

3. LEAVES ALTERNATE 4

3. LEAVES OPPOSITE 6

4. CALYX BRIGHT ORANGE, RED, OR TINGED WITH ORANGE; FLOWERS IN DENSELY LEAFY SPIKES ..... 3. CASTILLEJA

4. CALYX GREEN; FLOWERS NOT AS ABOVE 5

5. ANTHER CELLS EQUAL; LEAVES PETIOLED ..... 4. PEDICULARIS

5. ANTHER CELLS UNEQUAL; LEAVES SESSILE ..... 5. ORTHOCARPUS

6. COROLLA YELLOW; STIGMA 2-LOBED; STAMENS 4, ALL FERTILE ... 6. MIMULUS

6. COROLLA NOT YELLOW; STIGMA ENTIRE; STAMENS 5, 1 STERILE..7. PENSTEMON

1. VERBASCUM

VERBASCUM THAPSUS L. R, T

2. VERONICA

1. PLANTS TERRESTRIAL; RACEMES TERMINAL; LEAVES SESSILE, FLORAL LEAVES ALTERNATE ..... V. WORMSKJOLDII ROEM. & SCHULT. R

1. PLANTS AQUATIC AND SEMIAQUATIC; RACEMES AXILLARY; LEAVES SHORT PETIOLED, FLORAL LEAVES OPPOSITE ..... V. AMERICANA (RAF.) SCHWEIN. R, T

3. Castilleja

1. Bracts entire or nearly so 2
1. Bracts deeply incised ..... C. confusa Greene R, T
2. Plants gray-tomentose; corolla 3-4 cm long ..... C. integra Gray T
2. Plants with sparse, spreading hairs; herbage green; corolla 2.5-3 cm long ..... C. austromontana Standl. & Blumer T

4. Pedicularis

1. Plants subacaulescent; herbage glabrous; inflorescence slightly villous, few flowered, not surpassing the leaves ..... P. centranthera Gray T
1. Plants caulescent; herbage pubescent; inflorescence villous, many flowered, surpassing the leaves ..... P. grayi A. Nels. R

5. Orthocarpus

1. Inflorescence many flowered; corolla yellow ..... O. luteus Nutt. R
1. Inflorescence few flowered; corolla purple and white ..... O. purpureo-albus Gray T

6. Mimulus

Mimulus guttatus DC. R, T

7. Penstemon

1. Corolla red ..... P. barbatus (Cav.) Roth. R, T
1. Corolla some shade of blue or purple 2
2. Leaves linear, 30 mm long or less ..... P. linarioides Gray T
2. Leaves not linear, longer than 30 mm 3
3. Inflorescence glandular, not secund; corolla blue, conspicuous purple lines absent 4

3. Inflorescence not glandular, secund; corolla violet-blue or lavender with conspicuous deep purple lines ..... P. virgatus Gray T

4. Throat of corolla ventrally 2 ridged within, these ridges hairy ..... P. rydbergii A. Nels. R

4. Throat of corolla ventrally rounded, glabrous 5

5. Basal leaves not purple-tinged; stem leaves oblanceolate; corolla rose-purple to brown-purple ..... P. whippleanus Gray R, T

5. Basal leaves purple-tinged; stem leaves linear-lanceolate; corolla mostly blue with the upper portion purple ..... P. oliganthus Woot. & Standl. T

Salicaceae

1. Trees; dormant bud scales several; stamens 15 or more .....1. Populus

1. Shrubs; dormant bud scale 1; stamens 10 or less ..... 2. Salix

1. Populus

Populus tremuloides Michx. R, T

2. Salix

Salix bebbiana Sarg. R, T

Betulaceae

1. Alnus

1. Leaves ovate or oblong-ovate, rounded or subcordate at the base ..... A. tenuifolia Nutt. R

1. Leaves elliptic or ovate-oblong, acutish at the base ..... A. oblongifolia Torr. R

Aceraceae

1. Acer

Acer glabrum Torr. R, T

POLYGONACEAE

1. STEMS WITH SWOLLEN JOINTS 2
1. STEMS WITHOUT SWOLLEN JOINTS ..... 1. *ERIOGONUM*
2. PERIANTH 6-PARTED, THE 3 INNER SEGMENTS BECOMING ENLARGED WITH THE MATURE FRUIT; STYLES 3 ..... 2. *RUMEX*
2. PERIANTH 5 PARTED, OFTEN ENCLOSING THE FRUIT BUT THE INNER SEGMENTS NOT ENLARGED; STYLE 1 ..... 3. *POLYGONUM*

1. ERIOGONUM

1. PERIANTH YELLOW; ACHENES WINGED ..... *E. ALATUM* TORR. T
1. PERIANTH PINK OR CREAM; ACHENES NOT WINGED ... *E. RACEMOSUM* NUTT. T

2. RUMEX

1. PLANTS DIOECIOUS; LEAVES HASTATE ..... *R. ACETOSELLA* L. R
1. PLANTS MONOECIOUS; LEAVES NOT HASTATE 2
2. STEM WITH AXILLARY BRANCHES..*R. TRIANGULIVALVIS* (DANSER) RECH. R, T
2. STEM SIMPLE 3
3. LEAF MARGINS CRISPED; LEAF BASE NARROW; VALVES OF FRUIT WITH CALLOSITIES ..... *R. CRISPUS* L. R
3. LEAF MARGINS FLAT; LEAF BASE CORDATE; VALVES OF FRUIT WITHOUT CALLOSITIES ..... *R. OCCIDENTALIS* WATS. R, T

3. POLYGONUM

POLYGONUM SAWATCHENSE SMALL T

NYCTAGINACEAE

1. OXYBAPHUS

1. LEAVES DELTOID-OVATE; STEM PILOSE OR VILLOUS, NOT GLANDULAR .... *O. PUMILUS* (STANDL.) STANDL. T

1. Leaves linear; stem villous-glandular.....
..... O. linearis (Pursh) Robins. T

Euphorbiaceae

1. Euphorbia

Euphorbia serpyllifolia Pers. T

Urticaceae

1. Urtica

Urtica gracilis Ait. R, T

Chenopodiaceae

1. Leaves narrow, pilose or villous; upper leaves of the inflorescence not reduced .....1. Kochia
1. Leaves deltoid, scurfy; upper leaves of the inflorescence reduced ...
..... 2. Chenopodium

1. Kochia

Kochia scoparia (L.) Schrad. T

2. Chenopodium

1. Seeds vertical; perianth fleshy and red .....
..... C. capitatum (L.) Asch. R
1. Seeds horizontal; perianth never fleshy or red 2
2. Leaves as wide as long ..... C. fremontii Wats. T
2. Leaves longer than wide ..... C. albescens Small R

Fagaceae

1. Quercus

Quercus gambelii Nutt. R, T

ONAGRACEAE

1. COROLLA 3-6 MM LONG, PURPLE ..... 1. EPILOBIUM

1. COROLLA 15-40 MM LONG, WHITE OR YELLOW ..... 2. OENOTHERA

1. EPILOBIUM

1. INFLORESCENCE GLANDULAR ..... E. ANENOCAULON HAUSSKN. R, T

1. INFLORESCENCE PUBERULENT, NEVER GLANDULAR .....

..... E. CALIFORNICUM HAUSSKN. R, T

2. OENOTHERA

OENOTHERA ALBICAULIS PURSH T

CORNACEAE

CORNUS STOLONIFERA MICHX. T

UMBELLIFERAE

1. FRUIT LINEAR-OBLONG, AT LEAST 4 TIMES AS LONG AS WIDE, THE APEX SHARP-POINTED ..... 1. OSMORHIZA

1. FRUIT OBLONG TO ORBICULAR, 2 TIMES AS LONG AS WIDE OR LESS, THE APEX NEVER SHARP-POINTED 2

2. COROLLA WHITE; FRUIT TERETE OR FLATTENED 3

2. COROLLA PURPLE, ORANGE, OR YELLOW; FRUIT FLATTENED .....

..... 2. PSEUDOCYMOPTERUS

3. LEAF PETIOLES WITH LARGE DIALATED SHEATHS; FRUIT FLATTENED .....

..... 3. HERACLEUM

3. LEAF PETIOLES WITHOUT LARGE DILATED SHEATHS; FRUIT TERETE .....

..... 4. LIGUSTICUM

1. OSMORHIZA

OSMORHIZA OBTUSA (COULT. & ROSE) FERN. R, T

2. Pseudocymopterus

Pseudocymopterus montanus (Gray) Coult. & Rose R, T

3. Heracleum

Heracleum lanatum Michx. R

4. Ligusticum

Ligusticum porteri Coult. & Rose R, T

Saxifragaceae

1. Plants shrubby; fruit a berry or capsule 2

1. Plants herbaceous; fruit a follicle 3

2. Leaves alternate; fruit a berry ..... 1. Ribes

2. Leaves opposite; fruit a capsule ..... 2. Jamesia

3. Plants scapose; leaves simple, shallowly palmately lobed; flowers pink, in racemes ..... 3. Heuchera

3. Plants caulescent; leaves simple, linear; flowers white, in panicles ..... 4. Saxifraga

1. Ribes

1. Stems without spines and bristles 2

1. Stems with bristles on internodes and/or spines at nodes 3

2. Petiole much widened at base; leaves not noticeably lighter below; fruit red, glabrous ..... R. cereum Dougl. R, T
(R. inebrians Lindl.)

2. Petioles not widened at base; leaves lighter below; fruit black, glandular-bristly ..... R. wolfii Rothr. R

3. Spines few, slender and mostly inconspicuous; leaves velutinous .... R. inerme Rydb. R

3. Spines many, 1-3 per node, stout and conspicuous; leaves hirsute .. 4

4. Leaves darker above; stems canescent; flowers campanulate; fruit spiny or glandular-bristly 5

4. Leaves not darker above; stems with glandular hairs; flowers funnelform; fruit glabrous ..... R. leptanthum Gray R, T

5. Stems without bristles; leaves usually reniform; petioles not widened at base; spines usually curved; fruit spiny .....
..... R. pinetorum Greene R, T

5. Stems with bristles; leaves orbiculate; petioles much widened at base; fruit glandular-bristly ..... R. montigenum McClatchie R, T

2. Jamesia

Jamesia americana T. & G. R

3. Heuchera

Heuchera versicolor Greene T

4. Saxifraga

Saxifraga bronchialis L. R, T

Loranthaceae

1. Arceuthobium

Arceuthobium vaginatum (Willd.) Presl. R

Compositae

1. Flowers all hermaphroditic; corolla straplike, 5 toothed 2

1. Flowers not all hermaphroditic; hermaphroditic flowers, when present, tubelike and regular; ray flowers, if present, 2 or 3 toothed, pistillate or neutral 6

2. Pappus of plumose bristles; leaves grasslike ..... 1. Tragopogon

2. Pappus of capillary bristles; leaves broader 3

3. Achenes beaked 4

3. Achenes not beaked 5

4. Phyllaries in 2 unequal series; achenes 4 to 5 ridged ... 2. Taraxacum

4. Phyllaries in several graduated series; achenes 10 to 15 ridged .....
..... 3. Agoseris

5. Leaves often in basal rosettes; phyllaries thickened; pappus white ...
..... 4. Crepis

5. Leaves not in basal rosettes; phyllaries not thickened; pappus
brownish ..... 5. Hieracium

6. Ray flowers present 7

6. Ray flowers absent or vestigial 20

7. Pappus of capillary bristles 8

7. Pappus otherwise 12

8. Rays white, pink, or purple 9

8. Rays yellow or orange 10

9. Phyllaries graduated; rays usually more than 2 mm wide ..... 6. Aster

9. Phyllaries equal; rays usually less than 2 mm wide ..... 7. Erigeron

10. Phyllaries in 1 equal series, often subtended by bractlets; style
tips truncate ..... 8. Senecio

10. Phyllaries in several graduated series, not subtended by bractlets;
style tips not truncate 11

11. Heads 2-5 mm long, numerous, in panicles or cymes ..... 9. Solidago

11. Heads 7-18 mm long, few, not in panicles or cymes ....10. Haplopappus

12. Pappus of awns, scales or paleae 13

12. Pappus absent 19

3. Achenes beaked 4

3. Achenes not beaked 5

4. Phyllaries in 2 unequal lists; annuals ..... Lygodesmia

4. Phyllaries in several to many equal to subequal lists; perennials 6

5. Leaves often in basal rosettes, pinnatifid, the lobes rounded; annuals ..... Crepis

5. Leaves not in basal rosettes, entire or toothed; perennials 7

6. Ray flowers pistillate ..... Pyrrhopappus

6. Ray flowers absent or vestigial 8

7. Pappus of capillary bristles ..... Microseris

7. Pappus otherwise 9

8. Rays white, pink, or purple ..... Stylothemis

8. Rays yellow or orange 10

9. Phyllaries unequal; rays usually more than 2 mm wide ..... Prionopsis

9. Phyllaries equal; rays usually (1.5) 1.8 to 2 mm wide ..... Prenanthes

10. Phyllaries in 1 equal series, often subtended by bractlets; style tips truncate ..... Lactuca

10. Phyllaries in several graduated series, not subtended by bractlets; style tips not truncate 11

11. Heads 2–5 mm long, numerous, in panicles or cymes ..... Youngia

11. Heads 7–15 mm long, few, not in panicles or cymes 12

12. Pappus of awns, scales or rays 13

12. Pappus absent 14

13. Rays pistillate ..... 11. *Verbesina*

13. Rays neutral 14

14. Achenes thickened 15

14. Achenes compressed 17

15. Receptacle conical ..... 12. *Rudbeckia*

15. Receptacle flat or convex 16

16. Pappus of scarious, deciduous awns; disc flowers brown .....
..... 13. *Helianthus*

16. Pappus of 2 persistent awns and short squamellae; disc flowers yellow ..... 14. *Viguiera*

17. Phyllaries in graduated series ..... 15. *Helianthella*

17. Phyllaries equal or in 2 unequal series 18

18. Rays persistent and papery ..... 16. *Hymenoxys*

18. Rays not persistent and papery ..... 17. *Helenium*

19. Leaves opposite, finely dissected ..... 18. *Achillea*

19. Leaves alternate, broad, coarsely dissected .....19. *Bahia*

20. Pappus present 21

20. Pappus absent ..... 20. *Artemisia*

21. Pappus of capillary bristles 22

21. Pappus of awns or scales or both ..... 21. *Pericome*

22. Receptacle bristly; phyllaries spiny ..... 22. *Cirsium*

22. Receptacle naked; phyllaries not spiny 23

23. Plants dioecious or subdioecious, 35 cm tall or less, tomentose; phyllaries scarious 24

23. Plants monoecious, more than 35 cm tall, usually not tomentose; phyllaries herbaceous, at least in the center 25

24. Plants dioecious; basal leaves in a rosette; stem leaves much reduced; all leaves tomentose on both sides ..... 23. Antennaria

24. Plants subdioecious; basal leaves not in a rosette; stem leaves not reduced; all leaves glabrous above ..... 24. Anaphalis

25. Plants shrubby ..... 25. Chrysothamnus

25. Plants herbaceous 26

26. Pappus plumose ..... 26. Brickellia

26. Pappus not plumose ..... 27. Conyza

1. Tragopogon

Tragopogon pratensis L. T

2. Taraxacum

Taraxacum officinale Weber. R, T

3. Agoseris

1. Beak of achene stout, less than one-half the length of the body .... A. glauca (Pursh) D. Dietr. T

1. Beak of achene slender, more than one-half the length of the body .. .. A. aurantiaca (Hook.) Greene R, T

4. Crepis

1. Plants glabrous, glaucous, usually scapose .... C. glauca (Nutt.) Torr. & Gray T

1. Plants pubescent; stem leafy ..... C. occidentalis Nutt. T

5. Hieracium

Hieracium fendleri Schultz. Bip. T

6. Aster

1. Leaves grasslike; involucres and peduncles glandular .... A. pauciflorus Nutt. T

1. Leaves broader, not grasslike; involucres and peduncles not glandular 2

2. Stems pubescent; outer involucral bracts oblanceolate or obovate-oblong, rounded apex 3

2. Stems glabrous; outer involucral bracts linear or nearly so, acute apex ..... A. laevis L. R

3. Plants 40 cm high or less; stem leaves linear ..... A. adenolepis Blake R

3. Plants 60 cm high or more; stem leaves lanceolate or oblong-lanceolate ..... A. aquifolius (Greene) Blake R

7. Erigeron

1. Plants 30 cm tall or more; heads 1 cm wide or more 2

1. Plants less than 30 cm tall (occasionally over 30 cm tall); heads less than 1 cm wide 5

2. Inflorescence stem leafy 3

2. Inflorescence stem naked ..... E. formosissimus Greene R, T

3. Involucres woolly-villous ..... E. elatior (Gray) Greene R

3. Involucres not woolly-villous 4

4. Leaves glabrous; stem glabrous below, glandular above ..... E. superbus Greene R, T

4. Leaves pubescent; stems pubescent, never glandular ..... E. subtrinervis Rydb. R

5. Pubescence spreading 6

5. Pubescence appressed 7

6. Plants annual or biennual; ray flowers drying blue ..... E. divergens Torr. & Gray T

6. PLANTS PERENNIAL; RAY FLOWERS DRYING WHITE OR PINK ..... E. CONCINNUS (HOOK. & ARM.) TORR. & GRAY T

7. PLANTS WITH RUNNERS; INVOLUCRAL BRACTS EQUAL OR SUBEQUAL; ACHENES 2 NERVED ..... E. FLAGELLARIS GRAY T

7. PLANTS WITHOUT RUNNERS; INVOLUCRAL BRACTS IMBRICATED IN SEVERAL ROWS OF DIFFERENT LENGTHS; ACHENES 8 TO 14 NERVED ..... E. CANUS GRAY R

8. SENECIO

1. BASAL LEAVES DEEPLY PINNATIFID 2

1. BASAL LEAVES ENTIRE OR TOOTHED 3

2. STEM LEAF SIZE UNIFORM; LEAF LOBES ACUTE; PHYLLARIES BLACK-TIPPED; PLANTS NOT TOMENTOSE ..... S. MACDOUGALII HELLER R

2. UPPER STEM LEAVES REDUCED; LEAF LOBES BLUNT; PHYLLARIES NOT BLACK-TIPPED; PLANTS TOMENTOSE ..... S. UINTAHENSIS A. NELS. R, T

3. PLANTS GLABROUS AND/OR GLAUCOSE 4

3. PLANTS TOMENTOSE 7

4. STEM LEAVES PINNATIFID, THIN ..... S. MUTABILIS GREENE R

4. STEM LEAVES ENTIRE OR TOOTHED, THICK 5

5. ROOTSTOCK SHORT, NOT WOODY; ROOTS FASCICLED; LEAVES ALL ENTIRE OR ALL DENTICULATE, NOT CLASPING, NOT GLAUCOSE 6

5. ROOTSTOCK WELL DEVELOPED, WOODY; ROOTS NOT FASCICLED; LEAVES NOT AS ABOVE, CLASPING, GLAUCOSE ..... S. WOOTONII GREENE R, T

6. LEAVES ENTIRE OR SOMETIMES UNDULATE; STEMS HOLLOW, FLATTENING ON DRYING; INVOLUCRAL BRACTS NOT THICKENED ON BACK; TERMINAL HEAD OF INFLORESCENCE SESSILE OR CONSPICUOUSLY SHORTER THAN THE OTHERS ..... S. INTEGERRIMUS NUTT. R

6. Leaves denticulate; stems solid; involucral bracts thickened on back; terminal head of inflorescence long-peduncled .... S. crassulus Gray R

7. Involucre bracts 8 per head; achenes glabrous ..S. atratus Greene R

7. Involucre bracts 13-21 per head; achenes pubescent 8

8. Plants permanently tomentose; involucre bracts 21 per head .... S. neomexicana Gray R, T

8. Plants tomentose at first, soon glabrous; involucre bracts 13-20 per head ..... S. mutabilis Greene R

9. Solidago

1. Stems glabrous ..... S. decumbens Greene R, T

1. Stems pubescent ..... S. pallida (Porter) Rydb. T

10. Haplopappus

Haplopappus parryi Gray R, T

11. Verbesina

Verbesina encelioides (Cav.) Benth. & Hook. T

12. Rudbeckia

1. Plants pubescent; leaves entire; stems 30-70 cm tall .... R. hirta L. R

1. Plants glabrous; basal leaves pinnately divided; upper leaves entire or 3-parted; stems 100-200 cm tall ..... R. laciniata L. R

13. Helianthus

Helianthus annus L. T

14. Viguiera

1. Plants perennial ..... V. multiflora (Nutt.) Blake R, T

1. Plants annual ..... V. longifolia (Robins & Greene) Blake T

15. Helianthella

1. Plants usually 55-135 cm tall; leaves leathery, up to 47 cm long; heads 4-5 cm wide ..... H. quinquenervis (Hook.) Gray T

1. Plants 20-50 cm tall; leaves not leathery, 10 cm long or less; heads 1.5-2.3 cm wide ..... H. parryi Gray T

16. Hymenoxys

Hymenoxys richardsoni (Hook.) Cockerell R, T

17. Helenium

Helenium hoopesii Gray R, T

18. Achillea

Achillea lanulosa Nutt. R, T

19. Bahia

Bahia dissecta (Gray) Britton T

20. Artemisia

1. Leaves once pinnatifid; lower surface of leaf permanently tomentose .. .. A. carruthii Wood. R

1. Leaves twice pinnatifid; lower surface of leaf tomentose at first, often becoming glabrous later ..... A. franserioides Greene R, T

21. Pericome

Pericome caudata Gray T

22. Cirsium

1. Corolla greenish-yellow ..... C. parryi (Gray) Petrak. R, T

1. Corolla purple or pink ..... C. ochrocentrum Gray T

23. Antennaria

1. Leaves glabrous and green above ..... A. marginata Greene R

1. Leaves tomentose above ..... A. aprica Greene T

24. Anaphalis

Anaphalis margaritacea (L.) Gray R

25. Chrysothamnus

Chrysothamnus nauseosus (Pall.) Britton T

26. Brickellia

Brickellia grandiflora (Hook.) Nutt. R, T

27. Conyza

Conyza coulteri Gray T

Campanulaceae

1. Campanula

1. Flowers erect; corolla broadly funnelform; sepals 7-18 mm long, usually three-fourth as long as the corolla ..... C. parryi Gray R

1. Flowers often nodding; corolla campanulate; sepals 5-7 mm long, usually one-fourth to one-third as long as the corolla ..... C. rotundifolia L. R, T

Caprifoliaceae

1. Leaves simple; flowers in axillary pairs 2

1. Leaves pinnately compound; flowers in cymes .....1. Sambucus

2. Corolla regular, funnelform; berry white, not subtended by bracts .... 2. Symphoricarpos

2. Corolla irregular, not funnelform; berry black, subtended by conspicuous bracts ..... 3. Lonicera

1. Sambucus

1. Branchlets and leaves glabrous; leaflets 7; corolla yellowish; berries red ..... S. racemosa L. R, T

1. Leaves tomentose above ..... 2. Artemisia (page 1)

2. Anaphalis margaritacea (L.) Benth. & Hook.

2. Chrysothamnus

Chrysothamnus nauseosus (Pall.) Britton

3. Gutierrezia

Gutierrezia sarothrae (Pursh) Britton & Rusby

3. Grindelia

Grindelia squarrosa (Pursh) Dunal

4. Campanulaceae

1. Campanula

1. Flowers erect; corolla broadly funnelform, about 1 cm long.

Usually three-fourth as long as the corolla ..... 1. C. rotundifolia L. var.

1. Flowers often nodding; corolla campanulate, about 2 cm long.

Usually one-fourth to one-third as long as the corolla .....

..... 2. C. rotundifolia L. var.

Campanulaceae

1. Leaves simple; flowers in axillary pairs .....

1. Leaves pinnately compound; flowers in a cyme .....

2. Corolla regular, funnelform; stamens not united by anthers ....

.....

2. Corolla irregular, not funnelform; stamens united by anthers

conspicuous bracts ..... 1. Lobelia

1. Branchlets and leaves glandular; leaves 1 to 2 cm long

berries red .....

1. Branchlets and lower surface of leaves slightly scurfy and villous; leaflets 5; corolla whitish; berries black ... S. melanocarpa Gray R

2. Symphoricarpos

Symphoricarpos utahensis Rydb. T

3. Lonicera

Lonicera involucrata (Richards.) Banks R, T

Valerianaceae

1. Valeriana

Valeriana acutiloba Rydb. T

Rubiaceae

1. Galium

1. Plants annual; leaves 5 or more per whorl; retorsely hispid .... G. aparine L. R, T

1. Plants perennial; leaves 4 or less or 5 or more per whorl; not retorsely hispid 2

2. Leaves 4 or less per whorl, distinctly 3 nerved .... G. boreale L. R

2. Leaves 5 or more per whorl, not distinctly 3 nerved .... G. asperrimum Gray R

THE COMPARISON OF FLORAS

Although Redondo Peak and Mount Taylor are similar in respect to geological origin, elevation, and physiography, the floras of these peaks are very different.

A comparison of the flora compositon of both peaks reveals that somewhat more xeric conditions prevail on Mount Taylor than on Redondo Peak, although both peaks receive nearly daily precipatation during the growing season and heavy snows during the winter. Apparently, total precipitation is not responsible for the more xeric flora on Mount Taylor, rather a combination of factors seems to be operating. Chief among these are the porous nature of the substratum (Mount Taylor is essentially a porous cinder cone above the 8,000-ft level) and the high evaporation rate due to the relatively small mass of the mountain and consequent exposure to dry west and southwest winds. Redondo Peak, on the other hand, is surrounded by high ridges and is an integral part of the more extensive Jemez Mountains; thus it is not directly exposed to dry prevailing winds.

Although Redondo Peak is more mesic than Mount Taylor, the flora of the latter is much more diverse and richer in numbers of species than is the former. This diversity is apparently influenced by the wide range of habitats on Mount Taylor, as grasslands, dry, rocky slopes, protected ravines, creeks, seeps, and disjunct areas of dense forest at all elevations, as contrasted with the more uniform conditions on Redondo Peak. In addition, open grasslands are characteristic of both north and northwest slopes of Mount Taylor; however, with the exception of three relatively small grassland areas and a few very

DRY RIDGES, A UNIFORMLY DENSE FOREST COMPLETELY COVERS REDONDO PEAK. THE CHARACTERISTIC HOMOGENEITY OF COMPOSITION AND THE RELATIVELY SMALL NUMBER OF TAXA IN FLORAS EXISTING UNDER CONDITIONS OF UNIFORM HABITATS HAVE BEEN NOTED BY MANY BOTANISTS. FOR EXAMPLE, GLEASON AND CRONQUIST (1964) STATED THAT "IN THE DEEPER FOREST THE FLOWERS ARE FEW AND THESE FLOWERS INCLUDE A NUMBER OF MEMBERS OF THE HEATH AND ORCHID FAMILIES."

ALTHOUGH THIS LACK OF DIVERSITY OF TAXA IS APPARENT IN THE DENSE FOREST AREAS OF BOTH MOUNT TAYLOR AND REDONDO PEAK, THE CONDITION IS MORE PRONOUNCED ON REDONDO PEAK BECAUSE OF THE MORE UNIFORM DISTRIBUTION AND GREATER EXTENT OF THE FOREST. THE CHECK LISTS FOR VARIOUS STUDY AREAS OF REDONDO PEAK SUPPORT THIS CONCEPT BY SHOWING THE HERBACEOUS FOREST SPECIES AS MAINLY REPRESENTED BY ERICACEAE, ORCHIDACEAE, AND RANINCULACEAE. ALSO, A COMPARISON OF THE WOODED AREAS WITH OPEN AREAS INDICATES THAT A LARGER NUMBER OF FAMILIES AND SPECIES ARE REPRESENTED IN THE OPEN AREAS.

A SUMMARY OF THE COEFICIENT OF THE THREE MAJOR COMMUNITIES OF MOUNT TAYLOR AND REDONDO PEAK HAS BEEN COMPILED. THIS SUMMARY SHOWS THE NUMBER OF SPECIES COMMON TO THE RESPECTIVE COMMUNITIES OF BOTH PEAKS, EXPRESSED AS A PERCENTAGE OF THE TOTAL NUMBER OF SPECIES FOUND IN A LIFE ZONE ON MOUNT TAYLOR AND REDONDO PEAK (FIG. 1).

THE PRECEDING EXPLAINS IN PART WHY MOUNT TAYLOR IS BOTANICALLY MORE INTERESTING AND CHALLENGING. THIS IS ILLUSTRATED BY SEVERAL EXAMPLES. THE CANADIAN ZONE IS WELL DEFINED ON REDONDO PEAK BY A DISTINCT ZONE OF ABIES CONCOLOR, PICEA PUNGENS, AND PSEUDOTSUGA TAXIFOLIA. THIS ZONE IS VERY FRAGMENTED ON MOUNT TAYLOR. THESE REPRESENTATIVE DOMINANTS ARE FOUND ONLY IN COOL, MOIST RAVINES AND

FIG. 1. FLORISTIC COEFFICIENT OF COMMUNITIES.

Life Zone	Peak	Number of Species	Number of Species Common to Both Peaks	Coefficient of Community
Transition	Redondo	51	42	22%
Transition	Mount Taylor	144		
Canadian	Redondo	132	55	24%
Canadian	Mount Taylor	94		
Subalpine	Redondo	161	87	28%
Subalpine	Mount Taylor	145		

Fig. 1.

AROUND A FEW SEEPS ON MOUNT TAYLOR, AND ABIES CONCOLOR, ONE OF THE IMPORTANT CLIMAX SPECIES OF THIS ZONE IN THE MIDDLE AND SOUTHERN ROCKY MOUNTAINS, IS MISSING ENTIRELY FROM THIS PEAK. PINUS EDULIS IS FOUND ON MOUNT TAYLOR ON DRY, EXPOSED RIDGES AT ELEVATIONS AS HIGH AS 10,600 FT; THIS SPECIES IS COMPLETELY ABSENT ON REDONDO. QUERCUS GAMBELII, COMMON UP TO AN ELEVATION OF 10,700 FT ON THE EAST APPROACH TO MOUNT TAYLOR, IS LESS COMMON ON REDONDO PEAK. THE MAXIMUM ELEVATIONAL LIMIT OF Q. GAMBELII ON REDONDO PEAK IS APPROXIMATELY 9,900 FT ON A FEW EXPOSED, DRY RIDGES. PINUS FLEXILIS, COMMON IN THE UPPER CANADIAN AND SUBALPINE ZONES ON REDONDO PEAK, IS ABSENT ON MOUNT TAYLOR. PINUS PONDEROSA GROWS IN LARGE STANDS AT 9,800-10,000 FT ON THE HIGH MESAS AND SOUTHWEST, AND SOUTHWEST-FACING SLOPES ON MOUNT TAYLOR AND IS FOUND OCCASIONALLY AS HIGH AS 9,500 FT, RARELY HIGHER, ON A FEW SOUTH-SLOPING RIDGES.

WITH THE EXCEPTION OF LILIUM UMBELLATUM, SUCH SPECIES AS DODECATHEON RADICATUM, TRIFOLIUM LACERUM, PHLEUM PRATENSE, P. ALPINUM, ACONITUM COLUMBIANUM, GOODYERA REPENS, ALNUS TENUIFOLIA, AQUILEGIA CAERULEA, DRYOPTERIS FILIX-MAS GEUM RIVALE, CARDAMINE CORDIFOLIA, AND HERACLEUM LANATUM ARE COMMON TO MORE MESIC SITUATIONS OF THE CANADIAN AND SUBALPINE ZONES OF NORTHERN NEW MEXICO AND ARE COMMON ON REDONDO PEAK. NONE OF THESE TAXA ARE ON MOUNT TAYLOR.

CONVERSELY, SPECIES ADAPTED TO MORE XERIC SITUATIONS SUCH AS QUERCUS GAMBELII, HOLODISCUS DUMOSA, SELAGINELLA DENSA, SISYMBRIUM LINIFOLIUM, PENSTEMON LOIGANTHUS, AND GILIA AGGREGATA ARE COMMON ON MOUNT TAYLOR BUT ARE EITHER LESS COMMON OR ABSENT ON REDONDO PEAK. A COMPLETE LIST OF SPECIES FOUND ON ONE PEAK BUT NOT THE OTHER IS FOUND

AT THE END OF THIS SECTION.

ONE PHENOMENON APPARENT ON BOTH MOUNT TAYLOR AND REDONDO PEAK WAS THE NOTICEABLY DRIER CONDITIONS ON BOTH PEAKS FROM THE 10,700-FT LEVEL TO THE SUMMITS THAN ON THOSE AREAS IMMEDIATELY BELOW THIS LEVEL. THIS CHARACTERISTIC IS MORE PRONOUNCED ON MOUNT TAYLOR. DAUBENMIRE (1954) STATES THAT RAINFALL INCREASES WITH A RISE IN ELEVATION UP TO A CERTAIN LEVEL AND THEN DECREASES TOWARD THE SUMMIT BECAUSE THE MOISTURE-LADEN AIR MASSES CAN PASS THROUGH THE SADDLES AND CANYONS BETWEEN THE HIGHER PEAKS AND RELEASE THE MOISTURE IN THESE AREAS. ON SEVERAL OCCASIONS, I OBSERVED HEAVY RAIN FALLING IN THE SADDLE BETWEEN MOUNT TAYLOR AND LA MOSCA PEAK WHILE NO RAIN WAS FALLING ON THE SUMMITS OF THESE TWO PEAKS. CONDITIONS ARE APPARENTLY SIMILAR ON REDONDO PEAK AS FREQUENT SHOWERS WERE OBSERVED ON REDONDO PEAK AND THE SEVERAL ADJOINING PEAKS BUT WERE OBSERVED LESS OFTEN ON THE UPPER ELEVATIONS OF REDONDO PEAK PROPER.

ANALYSIS OF THE COMPOSITION OF THE FLORAS OF BOTH AREAS REVEALS A RELATIVELY SMALL NUMBER OF SPECIES FOUND ON MOUNT TAYLOR AND REDONDO PEAK AS COMPARED WITH THE SPECIES ACCOUNTS IN THE COLLECTIONS AND WRITTEN RECORDS OF WOOTON AND STANDLEY, CASTETTER, DITTMER, AND MARTIN MADE FROM VARIOUR AREAS OF THE SANGRE DE CRISTO MOUNTAINS IN NORTHERN NEW MEXICO. THIS MAY BE EXPLAINED BY THE FACT THAT THE HIGHER ELEVATIONS OF MOUNT TAYLOR AND REDONDO PEAK ARE REALLY FRAGMENTS OF THE CANADIAN AND SUBALPINE ZONES DISCONNECTED FROM MORE EXTENSIVE AREAS OF THESE ZONES FOUND ON THE MASSIVE SANGRE DE CRISTO MOUNTAINS. CAIN (1944) SUGGESTS THAT THE SMALLER THE DISCONNECTED AREA OF A GIVEN ZONE, THE FEWER THE FAUNA AND FLORA TYPES WHICH

PERSIST IN THAT ZONE.

WHILE NO NEW SPECIES WERE DISCOVERED ON EITHER PEAK, RARE FORMS OF CERTAIN ESTABLISHED SPECIES WERE LOCATED. FOR EXAMPLE, ALBINO FORMS OF THE NORMALLY BLUISH-PURPLE *CAMPANULA ROTUNDIFOLIA* AND THE DEEP ROSE-PURPLE *GERANIUM CAESPITOSUM* WERE FOUND. BOTH SPECIES WERE GROWING APPROXIMATELY 100 YDS APART ON THE EAST SLOPE OF REDONDO PEAK AT 9,100 FT.

AN UNEXPECTED RESULT OF THIS INVESTIGATION WAS THE DISCOVERY THAT A RELATIVELY LARGE NUMBER OF TAXA WERE NOT COMMON TO BOTH PEAKS. FOR EXAMPLE, 87 SPECIES WERE FOUND RESTRICTED TO THE REDONDO PEAK FLORA, AND 116 SPECIES WERE APPARENTLY PRESENT ONLY ON MOUNT TAYLOR. IN THE FOLLOWING LISTS ARE ENUMERATED THE TAXA NOT COMMON TO BOTH PEAKS.

A LIST OF TAXA FOUND ON REDONDO PEAK (8,500-11,254 FT ELEVATION), BUT APPARENTLY ABSENT ON MOUNT TAYLOR

BETULACEAE

ALNUS OBLONGIFOLIA TORR.
ALNUS TENUIFOLIA NUTT.

BORAGINACEAE

HACKELIA FLORIBUNDA (LEHM.) JOHNST.
LITHOSPERMUM MULTIFLORUM TORR.

CAMPANULACEAE

CAMPANULA PARRYI GRAY

CAPRIFOLIACEAE

SAMBUCUS MELANOCARPA GRAY

CARYOPHYLLACEAE

ARENARIA FENDLERI GRAY
CERASTIUM ARVENSE L.

PERMIST IN THAT ZONE.

While no new species [illegible] on Pinos Peak, many forms of certain restricted genera [illegible] forms of the normally [illegible] to the Deep Rose-purple Geranium [illegible], growing approximately 100 [illegible] at 9,100 ft.

An undescribed [illegible] was the [illegible] that a relatively large number of [illegible] for example, of species [illegible] flora, and 116 species were [illegible] only [illegible] In the following lists are [illegible] peaks.

A List of Taxa Found on Pinos Peak [illegible].

BETULACEAE

Alnus [illegible]
Alnus [illegible]

BORAGINACEAE

Nacrelia [illegible]
Lithospermum [illegible]

CAMPANULACEAE

Campanula [illegible]

CAPRIFOLIACEAE

[illegible]

CARYOPHYLLACEAE

Arenaria [illegible]
Cerastium [illegible]

Cerastium brachypodum (Engelm.) Robins.

Chenopodiaceae

Chenopodium albescens Small

Compositae

Anaphalis margaritacea (L.) Gray
Antennaria marginata Greene
Artemisia carruthii Wood.
Aster adenolepis Blake
Aster aquifolius (Greene) Blake
Aster laevis L.
Erigeron canus Gray
Erigeron elatior (Gray) Greene
Erigeron subtrinervis Rydb.
Rudbeckia hirta L.
Rudbeckia laciniata L.
Senecio atratus Greene
Senecio crassulus Gray
Senecio integerrimus Nutt.
Senecio macdougalii Heller
Senecio mutabilis Greene

Cruciferae

Cardamine cordifolia Gray
Erysimum capitatum (Dougl.) Greene
Sisymbrium altissimum L.
Sisymbrium elegans (Jones) Payson

Cyperaceae

Carex canescens L.
Carex nebraskensis Dewey
Carex scoparia Schkukr.
Carex stenoptila Hermann
Carex stipata Muhl.
Scirpus californicus (C. Meyer) Steud.

Ericaceae

Monotropa latisquama (Rydb.) Hulten

Gentianaceae

Gentiana plebeia Cham.
Gentiana strictiflora (Rydb.) A. Nels.

Cenantium brachypterum (Engelm.) Porter.

CHENOPODIACEAE

Chenopodium album L.

COMPOSITAE

Anaphalis margaritacea (L.) Gray
Antennaria margaritacea Greene
Artemisia caudata Michx.
Aster adenolepis Blake
Aster adnitorius (Gray) Blake
Aster laevis L.
Erigeron canus Gray
Erigeron elatior (Gray) Greene
Erigeron subtrinervis Rydb.
Eupatorium maritum L.
Eupatorium laciniatum L.
Senecio atratus Greene
Senecio crassulus Gray
Senecio integerrimus Nutt.
Senecio macounii Nelles
Senecio mutabilis Greene

CRUCIFERAE

Cardamine corymbulosa Gray
Erysimum capitatum (Dougl.) Greene
Sisymbrium altissimum L.
Sisymbrium officinale (Scop.) Hayek

CYPERACEAE

Carex canescens L.
Carex vesicaria L.
Carex scoparia Schkuhr.
Carex utriculata Boott
Carex stipata Muhl.
Scirpus californicus (C. Mey.) Steud.

ERICACEAE

Monotropa latiflora (Hook.) Hulten

GENTIANACEAE

Gentiana affinis Griseb.
Gentiana strictiflora (Rydb.) Holz.

GRAMINEAE

AGROPYRON PSEUDOREPENS SCRIBN. & SMITH
AGROSTIS SCABRA WILLD.
DANTHONIA SPICATA (L.) BEAUV.
DESCHAMPSIA CAESPITOSA (L.) BEAUV.
HIEROCHLOE ODORATA (L.) BEAUV.
LYCURUS PHLEOIDES H.B.K.
PHLEUM ALPINUM L.
PHLEUM PRATENSE L.
SPHENOPHOLIS INTERMEDIA (RYDB.) RYDB.
STIPA LETTERMANII VASEY

HYDROPHYLLACEAE

HYDROPHYLLUM FENDLERI (GRAY) HELLER

JUNCACEAE

JUNCUS CONFUSUS COVILLE

LABIATAE

MARRUBIUM VULGARE L.
MENTHA ARVENSIS L.

LEGUMINOSAE

LUPINUS AMMOPHILUS GREENE
ROBINIA NEOMEXICANA GRAY
THERMOPSIS PINETORUM GREENE
TRIFOLIUM LACERUM GREENE

LILIACEAE

ALLIUM GEYERI WATS.
CALOCHORTUS GUNNISONII WATS.
LILIUM UMBELLATUM PURSH

LORANTHACEAE

ARCEUTHOBIUM VAGINATUM (WILLD.) PRESL.

ORCHIDACEAE

GOODYERA OBLONGIFOLIA RAF.

OXALIDACEAE

OXALIS METCALFEI (SMALL) KNUTH.

GRAMINEAE

Agrostis tenuis Sibth.
Aira caryophyllea L.
Anthoxanthum odoratum L.
Arrhenatherum elatius (L.) J. & C. Presl
Avena fatua L.
Briza media L.
Bromus hordeaceus L.
Cynosurus cristatus L.
Dactylis glomerata L.
Festuca ovina L.
Festuca rubra L.
Holcus lanatus L.
Lolium perenne L.
Phleum pratense L.
Poa pratensis L.
Poa trivialis L.

HYDROPHYLLACEAE

Hydrophyllum virginianum L.

JUNCACEAE

Juncus effusus L.
Juncus tenuis Willd.

LABIATAE

Marrubium vulgare L.
Nepeta cataria L.

LEGUMINOSAE

Lupinus perennis L.
Robinia pseudoacacia L.
Trifolium pratense L.
Trifolium repens L.

LILIACEAE

Allium canadense L.
Allium vineale L.
Asparagus officinalis L.
Lilium philadelphicum L.
Lilium superbum L.

LORANTHACEAE

Arceuthobium pusillum Peck

ORCHIDACEAE

Cypripedium parviflorum Salisb.

OXALIDACEAE

Oxalis stricta L.

PINACEAE

Abies concolor (Gordon) Hoopes
Pinus flexilis James

POLEMONIACEAE

Phlox stansburyi (Torr.) Heller

POLYPODIACEAE

Asplenium trichomones L.
Dryopteris filix-mas (L.) Schott

PRIMULACEAE

Dodecatheon radicatum Greene

RANUNCULACEAE

Aconitum columbianum Nutt.
Aquilegia caerulea James
Aquilegia chrysantha Gray
Clematis pseudoalpina (Kuntze) A. Nels.

ROSACEAE

Amelanchier oreophila A. Nels.
Geum rivale L.
Potentilla concinna Richards.
Potentilla fruticosa L.

RUBIACEAE

Galium asperrimum Gray
Galium boreale L.

SAXIFRAGACEAE

Jamesia americana Torr. & Gray
Ribes inerme Rydb.
Ribes wolfii Rothr.

SCROPHULARIACEAE

Orthocarpus luteus Nutt.
Pedicularis grayi A. Nels.
Penstemon rydbergii A. Nels.
Veronica wormskjoldii Roem. & Schult.

PINACEAE

Abies concolor (Gordon) Hoopes
Pinus ponderosa Lawso

POLEMONIACEAE

Phlox stansburyi (Torr.) Heller

POLYPODIACEAE

Asplenium trichomanes L.
Cryptogramma acrostichoides (L.) Schlott

PRIMULACEAE

Dodecatheon radicatum Greene

RANUNCULACEAE

Aconitum columbianum Nutt.
Aquilegia caerulea James
Aquilegia chrysantha Gray
Clematis hexapetala (Watse) A. Heller

ROSACEAE

Amelanchier oregonica A. Nels.
Geum rivale L.
Potentilla concinna Richards.
Potentilla fruticosa L.

RUBIACEAE

Galium asperrimum Gray
Galium boreale L.

SAXIFRAGACEAE

Jamesia americana Torr. & Gray
Ribes inerme Ryd.
Ribes wolfii Rothr.

SCROPHULARIACEAE

Castilleja lutea Nutt.
Pedicularis cinaxi A. Nels.
Penstemon rydbergii A. Nels.
Veronica wormskjoldii Roem. & Schult.

TYPHACEAE

TYPHA LATIFOLIA L.

UMBELLIFERAE

HERACLEUM LANATUM MICHX.

A List of Taxa Found on Mount Taylor (8,500-11,389 ft elevation), but Apparently Absent on Redondo Peak

Berberidaceae

Berberis fendleri Gray

Boraginaceae

Cryptantha jamesii (Torr.) Payson
Cryptantha micrantha (Torr.) Johnst.
Lithospermum cobrense Greene

Caprifoliaceae

Symphoricarpos utahensis Rydb.

Caryophyllaceae

Silene laciniata Cav.

Chenopodiaceae

Chenopodium capitatum (L.) Asch.
Chenopodium fremontii Wats.
Kochia scoparia (L.) Schrad.

Compositae

Agoseris glauca (Pursh) D. Dietr.
Antennaria aprica Greene
Aster pauciflorus Nutt.
Bahia dissecta (Gray) Britton
Chrysothamnus nauseosus (Pall.) Britton
Cirsium ochrocentrum Gray
Conyza coulteri Gray
Crepis glauca (Nutt.) Torr. & Gray
Crepis occidentalis Nutt.
Erigeron concinnus (Hook. & Arn.) Torr. & Gray
Erigeron divergens Torr. & Gray
Erigeron flagellaris Gray
Helianthella parryi Gray
Helianthella quinquenervis (Hook.) Gray
Helianthus annuus L.
Hieracium fendleri Schultz. Bip.
Pericome caudata Gray
Solidago pallida (Porter) Rydb.
Tragopogon pratensis L.
Verbesina encelioides (Cav.) Benth. & Hook.
Viguiera longifolia (Robins. & Greene) Blake

CONVOLVULACEAE

CONVOLVULUS INCANA VAHL.

CORNACEAE

CORNUS STOLONIFERA MICHX.

CRUCIFERAE

ARABIS FENDLERI (WATS.) GREENE
DRABA BRACHYCARPA NUTT.
DRABA HELLERIANA GREENE
SISYMBRIUM LINEARIFOLIUM (GRAY) PAYSON

CUPRESSACEAE

JUNIPERUS MONOSPERMA (ENGELM.) SARG.

CYPERACEAE

CAREX ALBO-NIGRA MACKENZ.
CAREX SIMULATA MACKENZ.
CAREX WOOTONII MACKENZ.

EQUISETACEAE

EQUISETUM ARVENSE L.

ERICACEAE

MONESES UNIFLORA (L.) GRAY

EUPHORBIACEAE

EUPHORBIA SERPYLLIFOLIA PERS.

GERANIACEAE

GERANIUM LENTUM WOOT. & STANDL.
GERANIUM WISLIZENII WATS.

GRAMINEAE

AGROPYRON BAKERI E. NELS.
AGROPYRON DESERTORUM (FISCH.) SCHULT.
AGROPYRON SMITHII RYDB.
AGROSTIS ALBA L.
AGROSTIS IDAHOENSIS NASH
ARISTIDA LONGISETA STEUD.
BOUTELOUA GRACILIS (H.B.K.) LAG.

Bromus anomalus Rupr.
Bromus frondosus (Shear) Woot. & Standl.
Bromus marginatus Nees.
Bromus polyanthus Scribn.
Bromus tectorum L.
Danthonia californica Bolander
Elymus canadensis L.
Elymus glaucus Buchl.
Elymus virginicus L.
Glyceria striata (Lam.) Hitchc.
Hordeum jubatum L.
Melica porteri Scribn.
Muhlenbergia torreyi (Nutt.) Hitchc.
Poa annua L.
Poa bigelovii Vasey & Schribn.
Poa compressa L.
Poa pratensis L.
Poa rupicola Nash

Labiatae

Agastache pallidiflora (Heller) Rydb.
Agastache wrightii (Greene) Woot. & Standl.

Leguminosae

Astragulus tephrodes Gray
Lathyrus laetivirens Greene
Lotus wrightii (Gray) Greene
Lupinus alpestris A. Nels.
Lupinus argenteus Pursh var. argenteus
Lupinus concinnus Agardh. var. orcuttii (Wats.) C. P. Smith
Lupinus ingratus Greene
Lupinus kingii Wats. var. kingii
Lupinus palmeri Wats.
Lupinus parishii (Eastw.) Williams
Vicia pulchella H.B.K.

Liliaceae

Yucca elata Engelm.

Linaceae

Linum lewisii Pursh

Malvaceae

Sphaeralcea digitata (Greene) Rydb.

NYCTAGINACEAE

Oxybaphus linearis (Pursh) Robins.
Oxybaphus pumilus (Standl.) Standl.

ONAGRACEAE

Oenothera albicaulis Pursh

OXALIDACEAE

Oxalis amplifolia (Trel.) Dnuth.
Oxalis stricta L.

PINACEAE

Pinus edulis Engelm.

POLEMONIACEAE

Phlox austromontana Cov.
Phlox caespitosa Nutt.

POLYGONACEAE

Eriogonum alatum Torr.
Eriogonum racemosum Nutt.
Polygonum sawatchense Small
Rumex acetosella L.
Rumex crispus L.

RANUNCULACEAE

Clematis bigelovii Torr.
Clematis palmeri Rose
Ranunculus cymbalaria Pursh

ROSACEAE

Cercocarpus montana Raf.
Potentilla norvegica L.
Prunus virens (Woot. & Standl.) Shreve

SAXIFRAGACEAE

Heuchera versicolor Greene

SCROPHULARIACEAE

Castilleja austromontana Standl. & Blumer
Castillija integra Gray

ORTHOCARPUS PURPUREO-ALBUS GRAY
PEDICULARIS CENTRANTHERA GRAY
PENSTEMON LINARIOIDES GRAY
PENSTEMON OLIGANTHUS WOOT. & STANDL.
PENSTEMON VIRGATUS GRAY

SELAGINELLACEAE

SELAGINELLA DENSA RYDB.

VALERIANACEAE

VALERIANA ACUTILOBA RYDB.

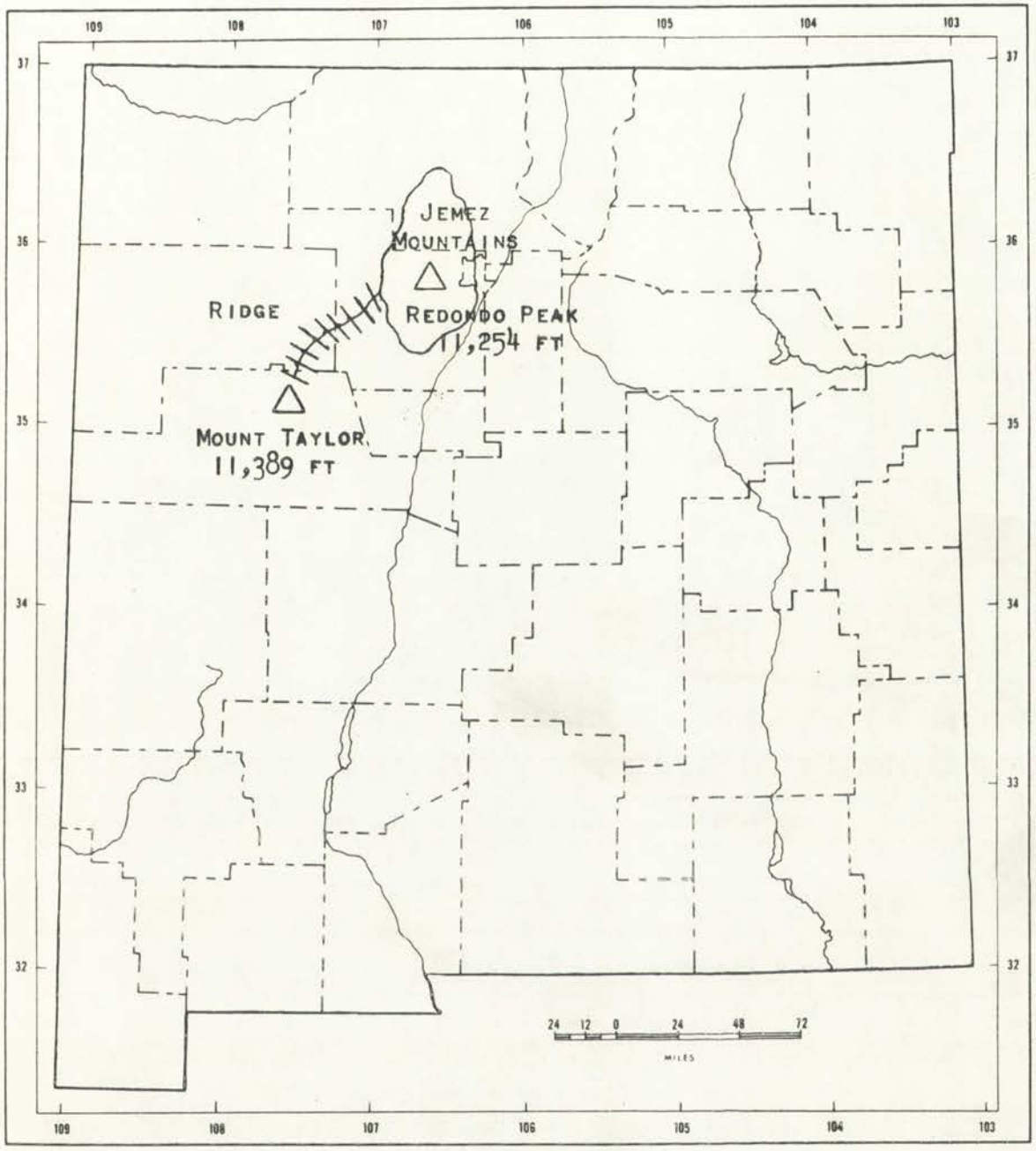
POPULATION STUDIES

With the exception of a greatly dissected ridge (elevation 6,800-8,100 ft) running in a northeasterly direction from Mount Taylor to the Jemez Mountains (Fig. 2), the flora of the higher elevations of Mount Taylor is isolated altitudinally from that of the Jemez Mountains and Redondo Peak by a series of low mesas (elevation 6,000-6,700 ft). The apparent isolation of these higher montane floras sets the stage for possible evolutionary trends or changes in gene frequencies. Population studies were made of three species common to both Mount Taylor and Redondo Peak.

Several investigators have proposed that the present life zones and snowline were depressed 1,500-4,500 ft during the last period of glaciation, Wisconsin III, and that this condition persisted until 15,000-20,000 years ago (Leopold, 1951). During Wisconsin III the higher montane floras were potentially sympatric, allowing possible genetic interchange between compatible populations.

Between 15,000 and 20,000 years ago the climate became gradually warmer and drier, and this change was followed by a retreat of life zones to higher elevations, creating disjunct areas of montane floras. The floras of Mount Taylor and Redondo Peak have thus been isolated for a possible 15,000-20,000 years.

In contrast to Leopold's opinion, a recent study by Paul S. Martin (1963) indicates a more moist climate for New Mexico 4,000-8,000 years ago, with an open oak woodland in the lower elevations. If the latter hypothesis is correct, populations of all three species may have been sympatric as recently as 4,000 years ago.



NEW MEXICO

MAP SHOWING THE LOW RIDGE CONNECTING MOUNT TAYLOR WITH THE JEMEZ MOUNTAINS.

FIG. 2.

THREE SPECIES, CAMPANULA ROTUNDIFOLIA, HELENIUM HOOPESII, AND IRIS MISSOURIENSIS, WERE SELECTED FOR POPULATION STUDIES BECAUSE OF THEIR ABUNDANCE, THEIR RESTRICTION TO THE HIGHER ELEVATIONS, AND THE LIMITED DISPERSAL OF THEIR DISSEMINULES.

OF THE THREE SPECIES, ONLY POPULATIONS OF IRIS MISSOURIENSIS, A SPECIES WHICH HAS AN EXTREME LOWER ELEVATIONAL LIMIT OF 8,000 FT, COULD POSSIBLY INTEGRATE VIA THE CONNECTING RIDGE. THIS IS A RARE POSSIBILITY BECAUSE EVEN THE HIGHER AREAS OF THE CONNECTING RIDGES ARE NOW UNSUITED TO THE GROWTH OF IRIS. THE POPULATIONS OF HELENIUM HOOPESII AND CAMPANULA ROTUNDIFOLIA, BOTH WITH A MINIMUM ELEVATIONAL LIMIT OF 8,500 FT, SHOW DEFINITE ALTITUDINAL ISOLATION BETWEEN THE TWO PEAKS.

SEVERAL MORPHOLOGICAL CHARACTERISTICS, INCLUDING TYPE OF PUBESCENCE, SEPAL LENGTH, LEAF WIDTH, LEAF LENGTH, COLOR OF PAPPUS SCALES (HELENIUM ONLY), AND ANTHER LENGTH (IRIS ONLY), WERE STUDIED IN THESE TAXA. FLOWER PARTS AND PUBESCENCE ARE ESPECIALLY RELIABLE FOR STUDY AS INDICATORS OF GENE FREQUENCY CHANGES AS THEY ARE NOT STRONGLY MODIFIED BY ENVIRONMENTAL CONDITIONS. ON THE OTHER HAND, SUCH VEGETATIVE CHARACTERISTICS AS LEAF AND STEM DIMENSIONS TEND TO BE CONSIDERABLY MODIFIED BY THE ENVIRONMENT.

CAMPANULA ROTUNDIFOLIA L.

ALTHOUGH MOST OF THE CHARACTERISTICS STUDIED IN THE TWO POPULATIONS OF CAMPANULA ROTUNDIFOLIA SHOW ONLY MINOR VARIATIONS, SEVERAL SIGNIFICANT DIFFERENCES ARE APPARENT. BOTH SEPAL LENGTH AND LEAF WIDTH ARE SIGNIFICANTLY DIFFERENT AT ABOVE THE 95% LEVEL OF CONFIDENCE;

However, leaf length measurements show no significant differences between the two populations.

Also, very definite pubescence differences are noted. For example, although all of the calyx lobes and calyx tubes from the Redondo Peak sample are glabrous, the calyx lobes and calyx tubes in the Mount Taylor sample range from glabrous throughout to variously pubescent (Fig. 3 & 4). Pubescent forms of the Mount Taylor sample include specimens having glabrous calyx tubes with one form of pubescence and lobes with another form of pubescence.

Helenium hoopesii Gray

Among the three taxa studied, the two isolated populations of Helenium hoopesii exhibit the most distinct divergences in gene frequencies, as both length and width of ray flowers of the two population samples differ significantly at above the 99% level of confidence.

Several other differences are also apparent and are substantiated by use of histograms. Two obvious divergences occur in regard to leaf pubescence and color of pappus bristles. The upper leaf surfaces of the Redondo Peak sample are glabrate in 78.8% of the specimens and woolly pubescent in 21.2% of the specimens. The frequency is reversed in the Mount Taylor sample where 80.8% of the specimens are woolly pubescent on the upper surfaces of the leaves and 19.2% are glabrate. Another interesting trend is noted in pappus bristle color. All of the pappus bristles of the Redondo Peak sample are tan, while only 63.5% of the pappus bristles of the Mount Taylor sample are tan, the remaining 36.5% being white.

FIG. 3. STEM LEAF WIDTH PLOTTED AGAINST STEM LEAF LENGTH OF CAMPANULA ROTUNDIFOLIA POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

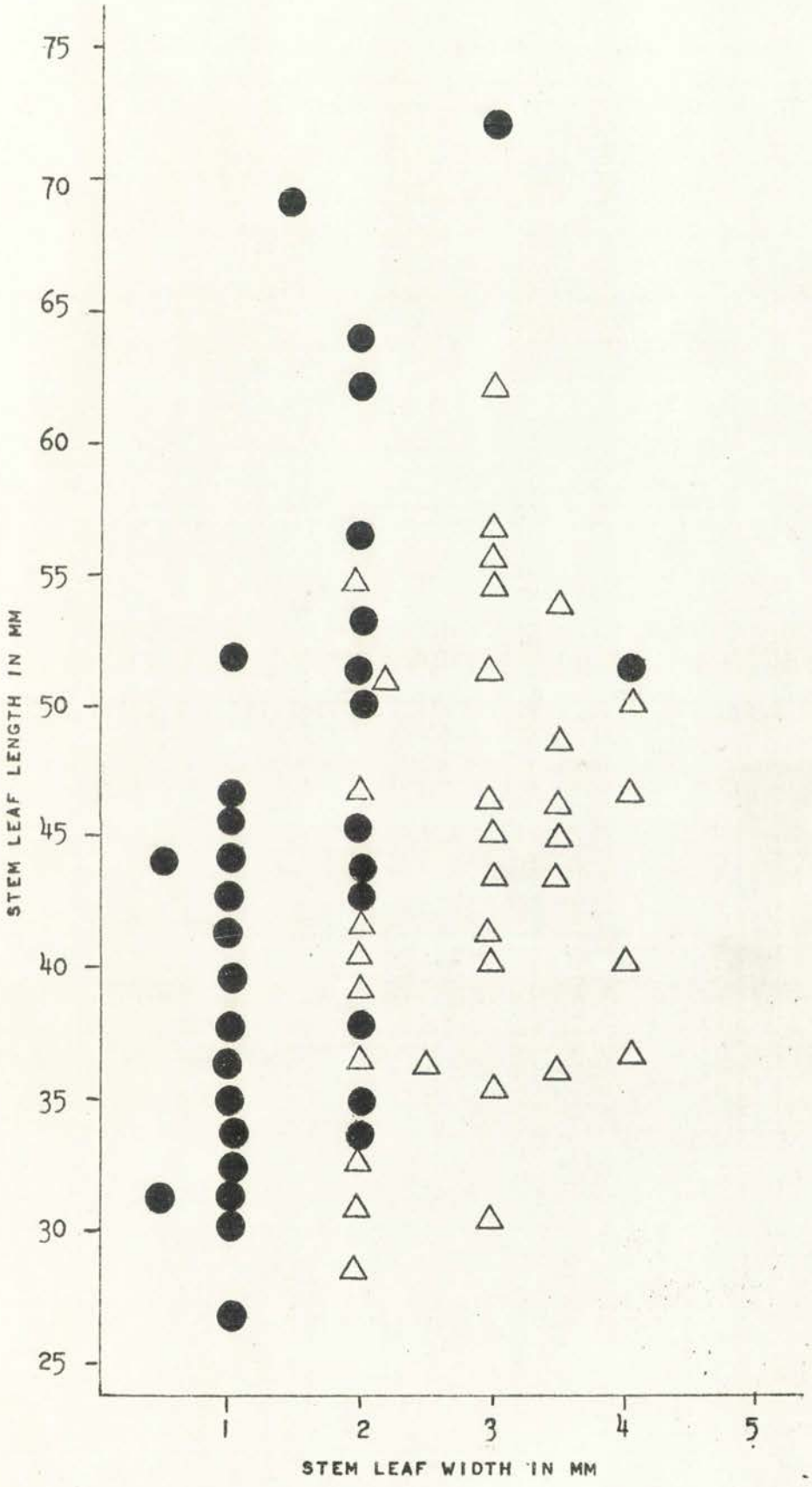


FIG. 3. CAMPANULA ROTUNDIFOLIA

FIG. 4. FREQUENCIES OF GLABROUS TO VARIOUS FORMS OF PUBESCENT CALYX LOBES AND CALYX TUBES OF CAMPANULA ROTUNDIFOLIA POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

G GLABROUS

GD GLANDULAR

H HIRSUTE

H GD HIRSUTE-GLANDULAR

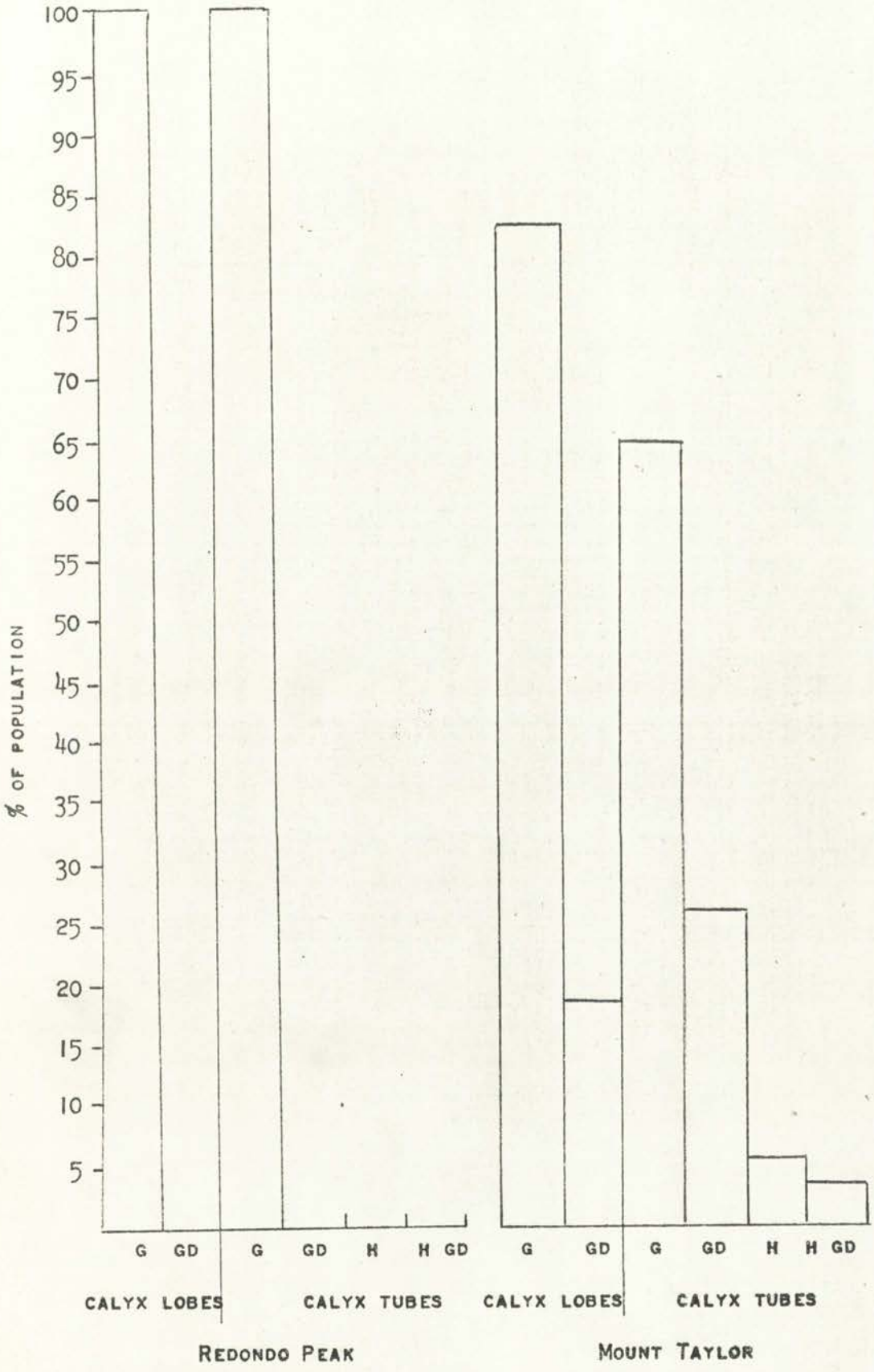


FIG. 4. CAMPANULA ROTUNDIFOLIA

THE APPARENT TREND TOWARD LONGER, NARROWER LEAVES IN THE REDONDO PEAK POPULATION, IN CONTRAST TO THE SHORTER, WIDER LEAVES IN THE MOUNT TAYLOR POPULATION, IS INTERESTING AND ALSO SIGNIFICANT ABOVE THE 95% LEVEL OF CONFIDENCE. BECAUSE LEAF DIMENSIONS ARE EASILY MODIFIED BY THE ENVIRONMENT, LITTLE CREDIBILITY IS PLACED ON DIFFERENCES IN LENGTH AND SHAPE OF LEAVES AS INDICATORS OF GENETIC DIFFERENCES (FIG. 5, 6, & 7).

IRIS MISSOURIENSIS NUTT.

POPULATIONS OF IRIS MISSOURIENSIS FROM THE TWO AREAS SHOW THE LEAST AMOUNT OF VARIATION OF ALL THE TAXA STUDIED. ALL OF THE SPECIMENS FROM BOTH POPULATION SAMPLES ARE GLABROUS AND LEAF LENGTH AND WIDTH AVERAGES ARE NEARLY IDENTICAL. DIVERGENCES OF GENE FREQUENCIES ARE APPARENT IN TWO CHARACTERISTICS AS SHOWN BY GREATER LENGTH OF BOTH SEPALS AND ANTHERS IN THE MOUNT TAYLOR SAMPLE (FIG. 8 & 9).

CONCLUSIONS

THE DATA, IN GENERAL, REVEAL A NUMBER OF SIGNIFICANT DIFFERENCES BETWEEN THE POPULATIONS OF MOUNT TAYLOR AND REDONDO PEAK; HOWEVER, THESE DIFFERENCES PROBABLY DO NOT YET AFFECT REPRODUCTIVE ISOLATION, AND HYBRIDIZATION WOULD PROBABLY OCCUR IF MEMBERS OF THE SAME SPECIES WERE BROUGHT TOGETHER INTO SYMPATRIC ASSOCIATION. THESE VARIATIONS REFLECT CHANGES IN GENE FREQUENCIES AND SUGGEST TWO GENERAL TRENDS OF DIVERGENCE, (1) THE MOUNT TAYLOR POPULATIONS OF ALL THREE TAXA HAVE LARGER FLOWERING PARTS AND (2) PLANTS OF THE MOUNT TAYLOR POPULATIONS ARE MORE FREQUENTLY PUBESCENT AND, WHEN PRESENT, PUBESCENCE IS FREQUENTLY DENSER.

THE APPARENT TREND TOWARD LONGER, NARROWER LEAVES IN THE LOW PEAK POPULATION, IN CONTRAST TO THE SHORTER, WIDER LEAVES IN THE LOW TAYLOR POPULATION, IS INTERESTING AND ALSO SIGNIFICANT ABOVE THE 5% LEVEL OF CONFIDENCE. BECAUSE LEAF DIMENSIONS ARE EASILY MODIFIED BY THE ENVIRONMENT, LITTLE CREDIBILITY IS PLACED ON DIFFERENCES IN LENGTH AND SHAPE OF LEAVES AS INDICATORS OF GENETIC DIFFERENCES (Fig. , , 7).

Iris missouriensis Nutt.

Populations of Iris missouriensis from the two areas on W the least amount of variation of all the taxa studied. All of the characters from both population samples are clearly very alike. Averages are nearly identical. Differences of these characters are apparent in two characteristics as shown by character length of sepals and anthers in the Mount Taylor sample (Figure 5).

Conclusions

The data, in general, reveal a number of significant differences between the populations of Mount Taylor and Colorado plant. However, these differences probably do not yet affect reproductive isolation, and hybridization would probably occur if members of the same species were brought together into sympatric association. These variations reflect changes in gene frequency and support two general trends of divergence: (1) the Mount Taylor populations of all three taxa have larger flowering parts and (2) heavier or more prominent, pubescence is frequently found.

FIG. 5. FREQUENCIES OF ACHENE SCALE COLOR AND FREQUENCIES OF GLABROUS TO VARIOUS FORMS OF PUBESCENCE ON THE LOWER AND UPPER LEAF SURFACES OF HELENIUM HOOPESII POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

ACHENE SCALE COLOR

T TAN

WH WHITE

LEAF SURFACES

G GLABROUS

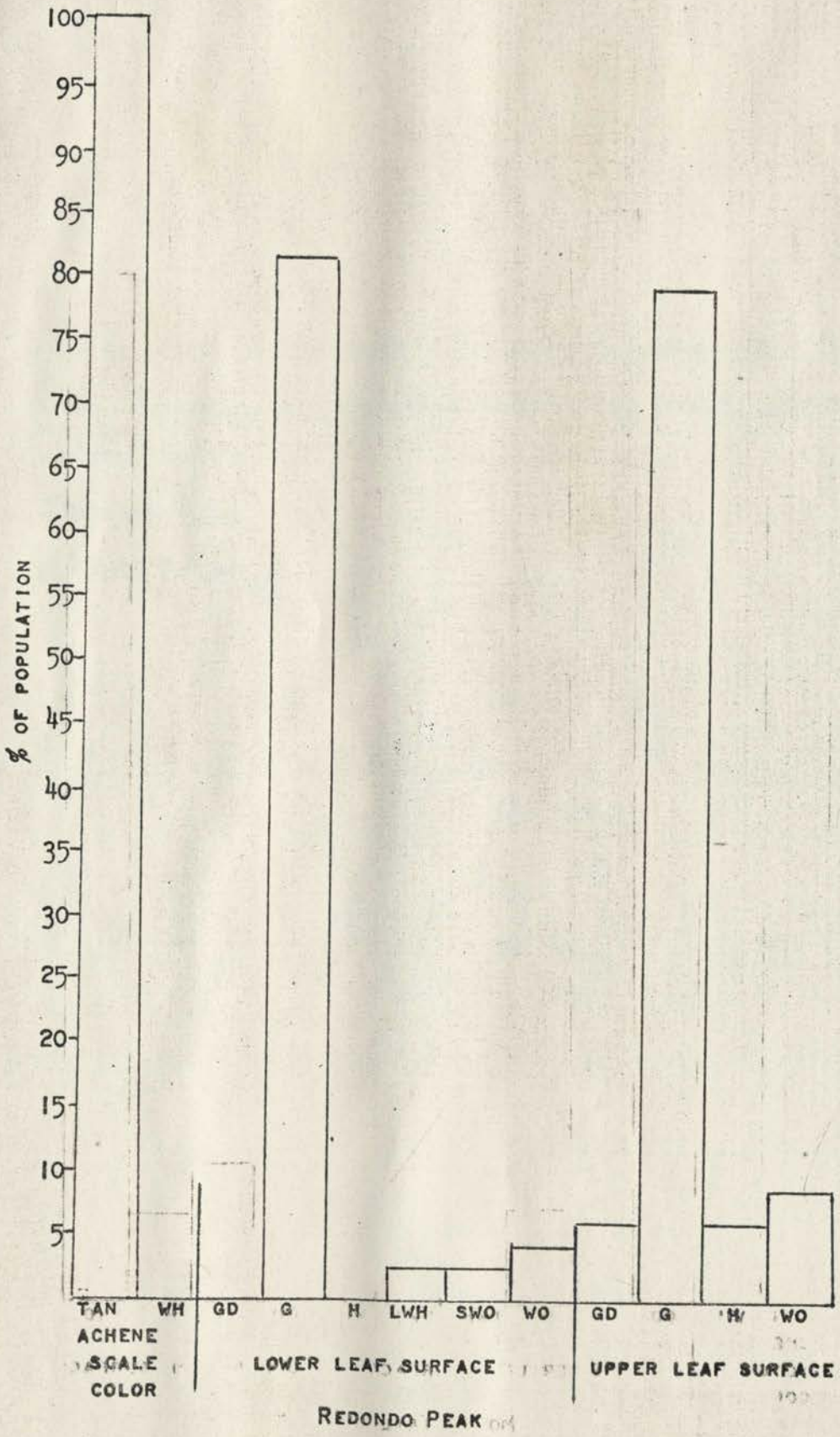
GD GLANDULAR

H HIRSUTE

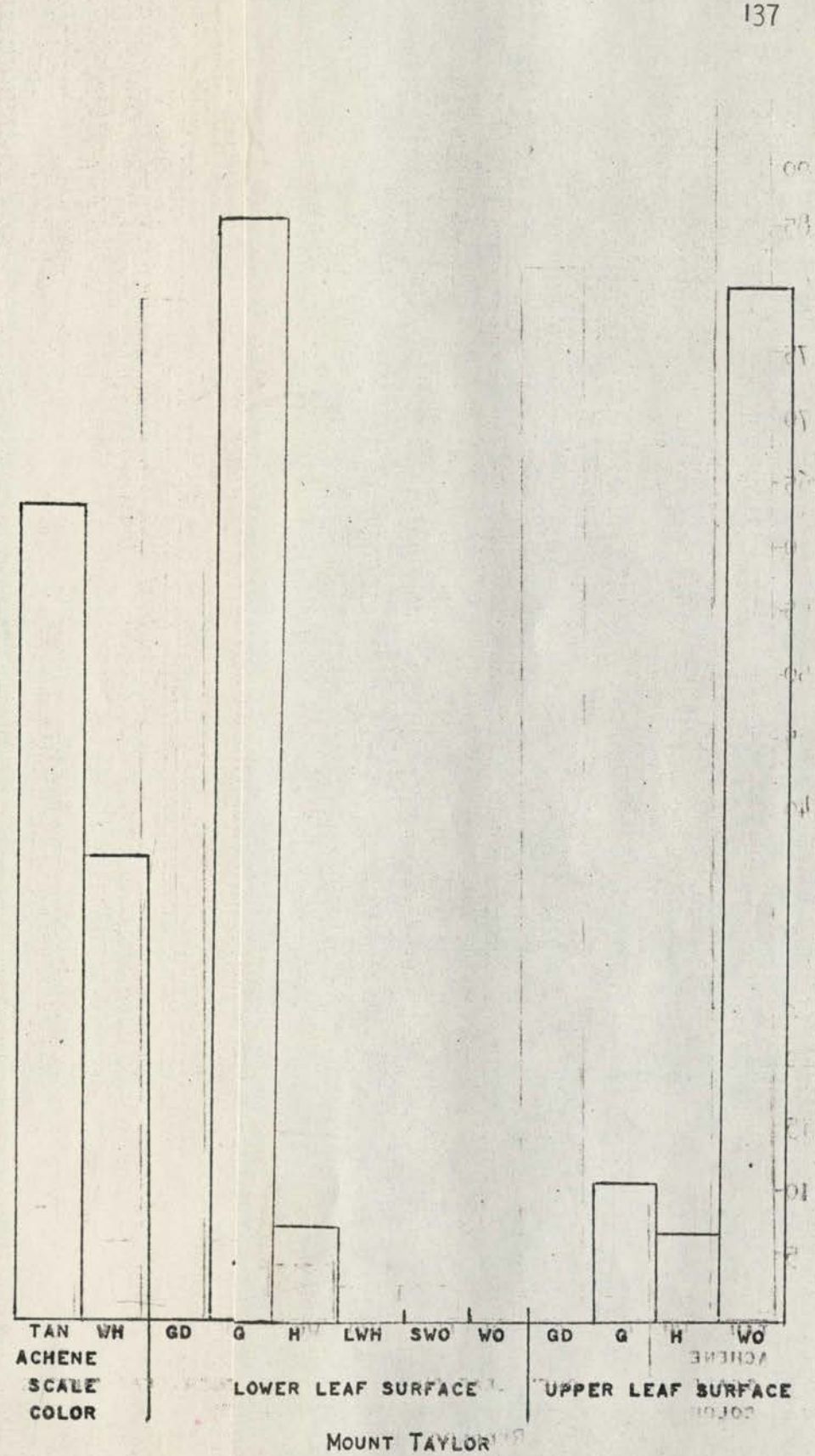
LWH LONG WHITE HAIRS

SWO SPARSE-WOOLLY

WO WOOLLY



REDONDO PEAK



MOUNT TAYLOR

FIG. 5. HELENIUM HOOPESII

FIG. 6. RATIO OF RAY LENGTH / RAY WIDTH TO LEAF LENGTH / LEAF WIDTH OF HELENIUM HOOPESII POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

FIG. 6. RATIO OF RAY LENGTH / RAY WIDTH TO LEAF LENGTH / LEAF WIDTH OF HELENIUM HOOPESII POPULATIONS FROM RECORDED PEAK AND MOUNT TAYLOR.

● RECORDED PEAK

△ MOUNT TAYLOR

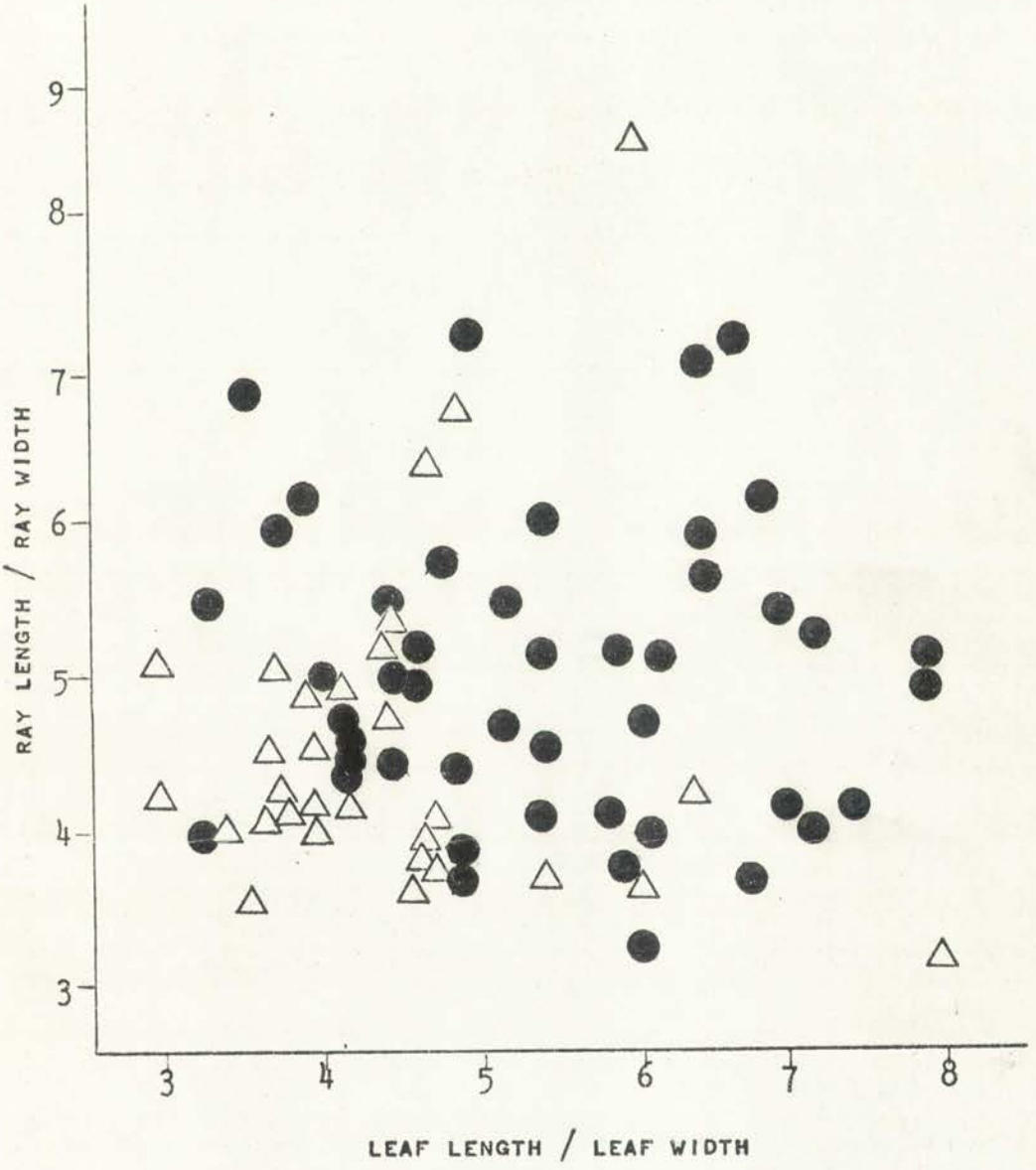


FIG. 6. HELENIUM HOOPESII

FIG. 7. RAY LENGTH AND WIDTH OF *HELENIUM HOOPESII* POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

◑ BOTH PEAKS

FIG. 7. RAY LENGTH AND WIDTH OF *Helianthus hoopesii* POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

◐ BOTH PEAKS

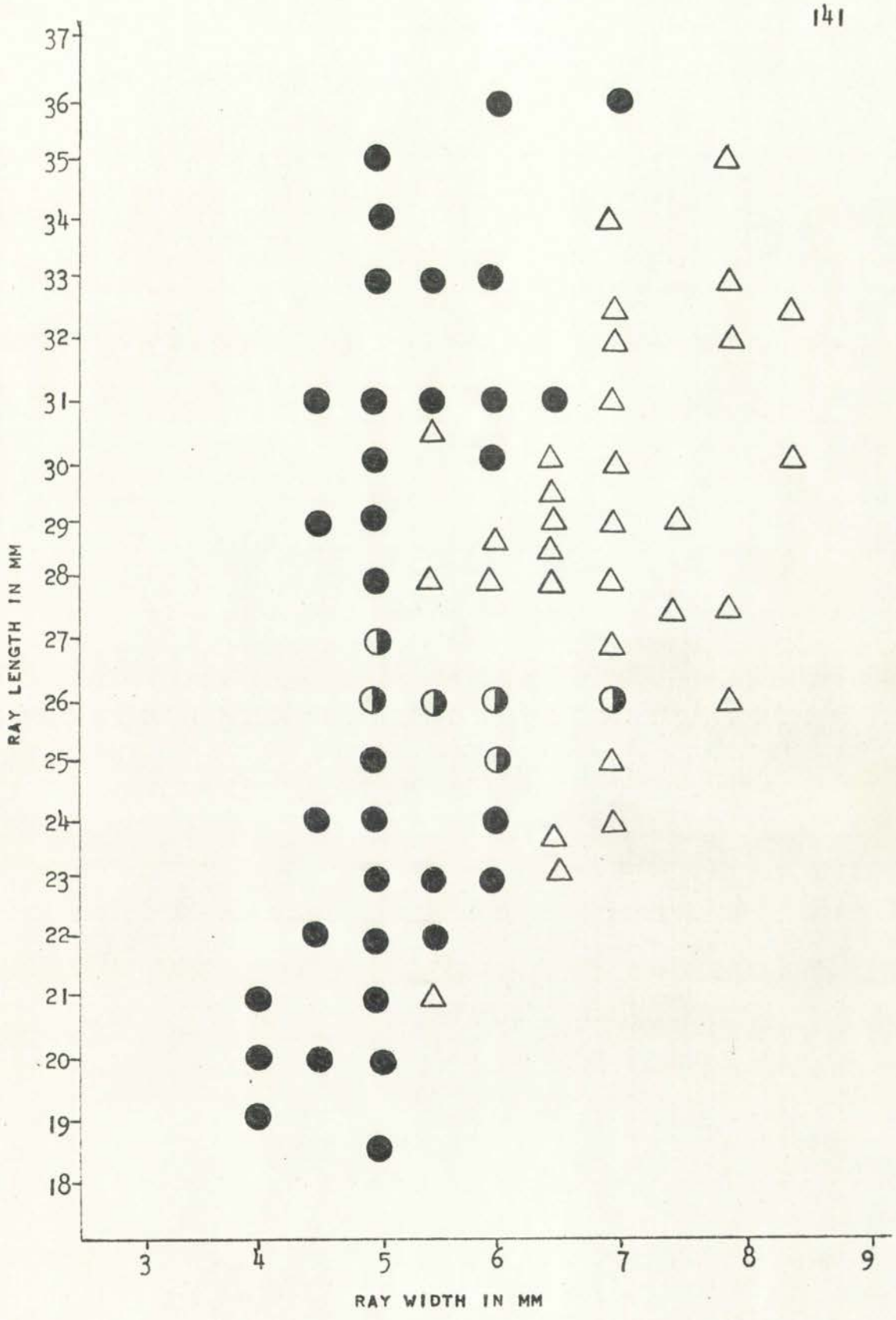


FIG. 7. HELENIUM HOOPESII

FIG. 8. SEPAL AND PETAL LENGTH OF IRIS MISSOURIENSIS POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

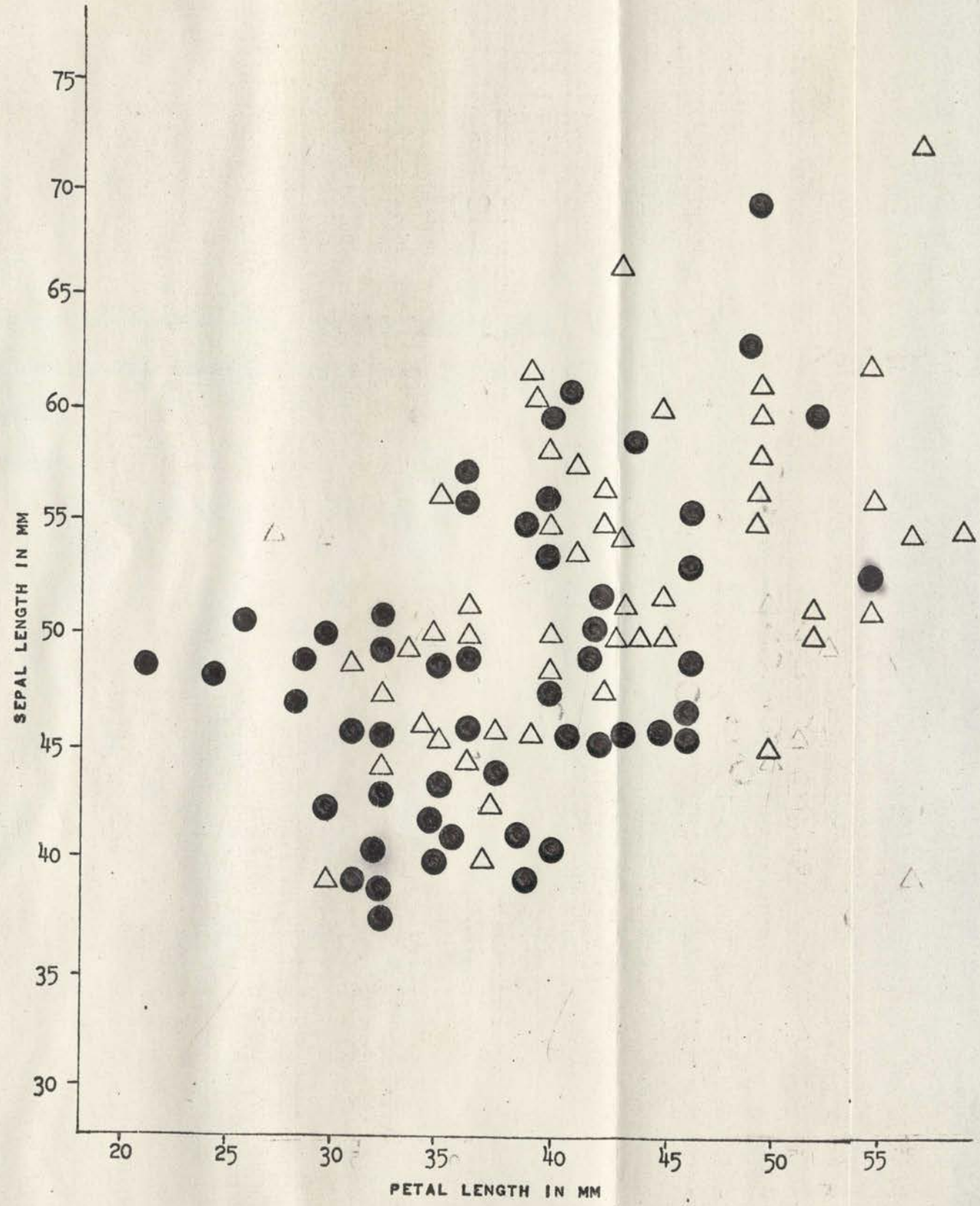


FIG. 8.

IRIS MISSOURIENSIS

FIG. 9. ANTHER AND FILAMENT LENGTH OF *IRIS MISSOURIENSIS* POPULATION SAMPLES FROM REDONDO PEAK AND MOUNT TAYLOR.

● REDONDO PEAK

△ MOUNT TAYLOR

FIG. 9. ANTHER AND FILAMENT LENGTH OF *LILIUM MISSOURIENSE* POPULATIONS SAMPLED FROM FLOWOOD PEAK AND MOUNT TAYLOR.

● FLOWOOD PEAK

△ MOUNT TAYLOR

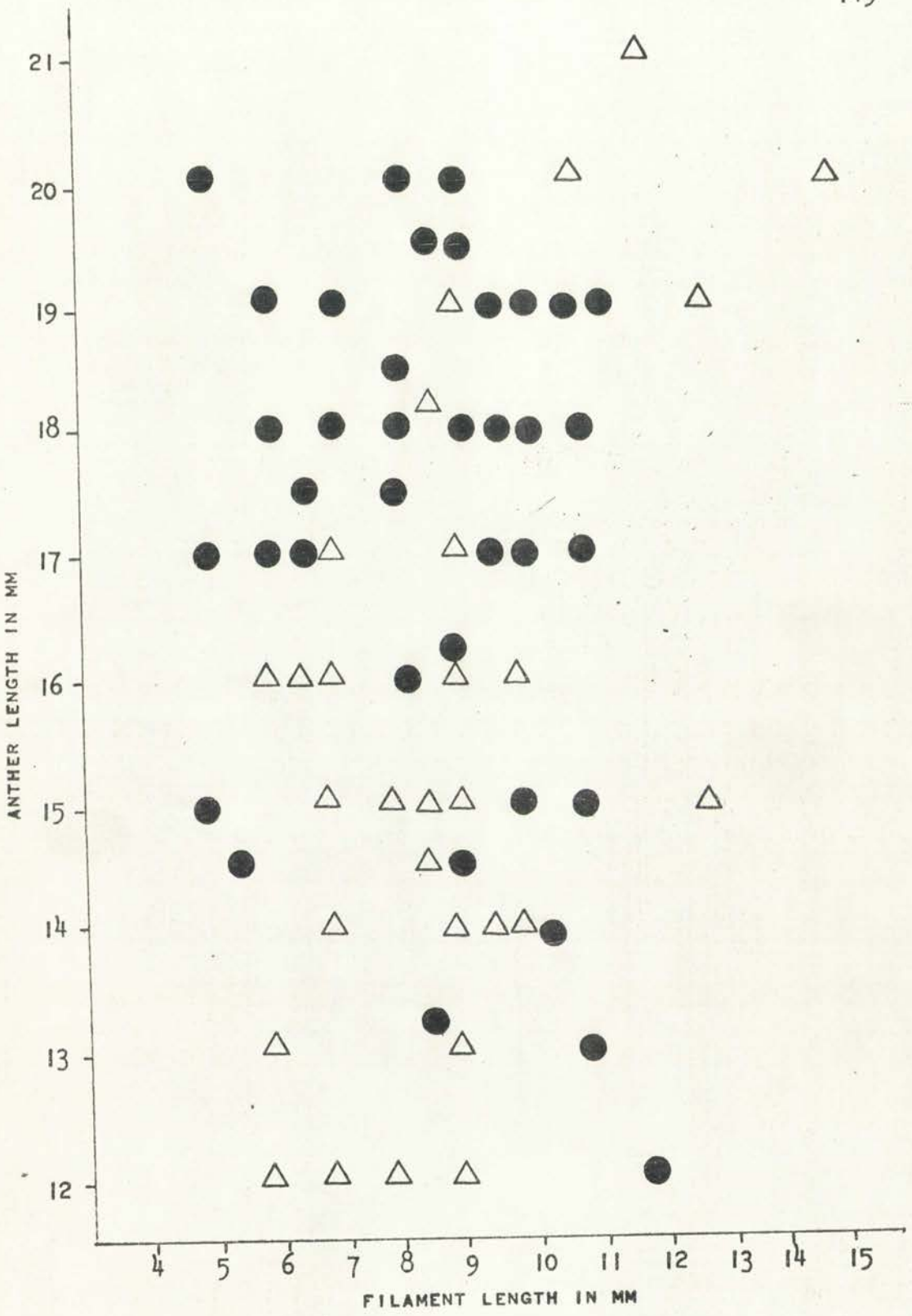


FIG. 9. IRIS MISSOURIENSIS

THE GREATEST AMOUNT OF DIVERGENCE LIES BETWEEN THE TWO ISOLATED POPULATIONS OF HELENIUM HOOPESII. IF WE ASSUME THAT ALL THREE TAXA HAVE BEEN ISOLATED FOR ABOUT THE SAME LENGTH OF TIME, THE GREATER DIVERGENCE FOUND IN HELENIUM IS RELATED TO THE GENERAL AGGRESSIVENESS FOUND IN THE FAMILY COMPOSITAE AS A WHOLE.

ALTHOUGH MOST DIFFERENCES BETWEEN THE ISOLATED POPULATIONS OF THESE TAXA ARE RELATIVELY SMALL, THERE SEEMS TO BE A CLEAR INDICATION THAT THE TAXA ARE ALREADY BEGINNING TO TRAVEL SEPARATE EVOLUTIONARY PATHS. THESE CHANGES OVER A LONG PERIOD OF TIME COULD LEAD TO GENETIC ISOLATION OF ELEMENTS OF THESE FLORAS. APPARENTLY THE PERIOD OF COMPLETE ISOLATION HAS BEEN COMPARATIVELY SHORT, BUT THE AMOUNT OF DIVERGENCE NOTED HERE COULD WELL HAVE OCCURRED IN AS SHORT A PERIOD OF TIME AS 4,000 YEARS.

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