

## THOMPSON CLOVER RESEARCH NATURAL AREA

Supplement No. 5<sup>1</sup>

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and Phillip D. McColley<sup>2</sup>*

The Research Natural Area described in this supplement is administered by the USDA Forest Service. Forest Service Research Natural Areas are located within Ranger Districts which are themselves administrative subdivisions of National Forests. Normal management and protective activities are the responsibility of District Rangers and Forest Supervisors. Scientific and educational uses of these areas are the responsibility of the research branch of the Forest Service. Therefore, a scientist interested in using one of the areas in Oregon and Washington should contact the Director of the Pacific Northwest Forest and Range Experiment Station (P.O. Box 3141, Portland, Oregon 97208) and outline the activity he plans. If extensive use of one or more Forest Service Research Natural Areas is planned, a brief cooperative agreement between the scientist and the Forest Service may be necessary. The Forest Supervisor and District Ranger administering the affected Research Natural Area will be informed of mutually agreed upon activities by the Experiment Station Director. A scientist should still visit the administering ranger station when beginning his studies and explain the nature, purpose, and duration of his activities. Permission for brief visits to Research Natural Areas for observational purposes can be obtained from the District Ranger.

The Research Natural Area described in this supplement is part of a Federal system of such tracts established for research and educational purposes. Each of these constitutes a site where some natural features are preserved for scientific purposes and natural processes are allowed to dominate. Their main purposes are to provide:

1. Baseline areas against which effects of human activities can be measured;

2. Sites for study of natural processes in undisturbed ecosystems; and
3. Gene pool preserves for all types of organisms, especially rare and endangered types.

A 1968 listing of the total Federal system is outlined in "A Directory of the Research Natural Areas on Federal Lands of the United States of America" (Federal Committee on Research Natural Areas 1968). Of the 58 Federal Research Natural Areas in Oregon and Washington, 49 are described in "Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators," including Supplements 1 through 4. This description is Supplement No.5 to that guidebook. Supplements will also be prepared to describe subsequent additions to the system.

The guiding principle in management of Research Natural Areas is to prevent unnatural encroachments, or activities which directly or indirectly modify ecological processes on the tracts. Logging and uncontrolled grazing are not allowed, for example, nor is public use which threatens significant impairment of scientific or educational values. Management practices necessary for maintenance of the ecosystem may be allowed.

<sup>1</sup>Supplement No.5 to "Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators," by Jerry F. Franklin, Frederick C. Hall, C. T. Dyrness, and Chris Maser (USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, 498 p., illus., 1972). The guidebook is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for \$4.90, stock number 001001.00259.

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Federal Research Natural Areas provide a uniquely valuable system of publicly owned and protected examples of undisturbed ecosystems which are available to the scientist. He can conduct his research with minimal interference and reasonable assurance that investments in long-term studies will not be lost to logging, land development, or similar activities. In return, the scientist wishing to use a Research Natural Area has some obligations. He must:

1. Obtain permission from the appropriate administering agency before using the area;
2. Abide by the administering agency's regulations governing the use of the natural area including specific limitations on the type of research, sampling methods, etc. allowed; and
3. Inform the administering agency on the progress of the research, published results, and disposition of collected materials.

The purposes of these limitations are simple to insure that the scientific and educational values on the tract are not impaired, to accumulate a documented body of knowledge about the tract, and to avoid conflict between new and old studies. Research on Research

Natural Areas must be essentially nondestructive in character; destructive analysis of vegetation is generally not allowed nor are studies requiring extensive forest floor modification or extensive soil excavation. Collection of plant and animal specimens should be restricted to the minimum necessary for provision of vouchers and other research needs and in no case to a degree which significantly reduces species population levels. Such collections must also be carried out in accordance with applicable State and Federal agency regulations. Within these broad guidelines, the appropriate uses of Research Natural Areas are determined on a case-by-case basis by the administering agency.

A scientist wishing to use a particular Research Natural Area must determine the administering agency,<sup>3</sup> contact it regarding the proposed use, and obtain the necessary permission. Each agency differs slightly in its requirements.

<sup>3</sup>There are five agencies cooperating in this program in the Pacific Northwest: Forest Service in the U.S. Department of Agriculture; Bureau of Land Management, Fish and Wildlife Service, and the National Park Service in the U.S. Department of the Interior; and the Atomic Energy Commission.

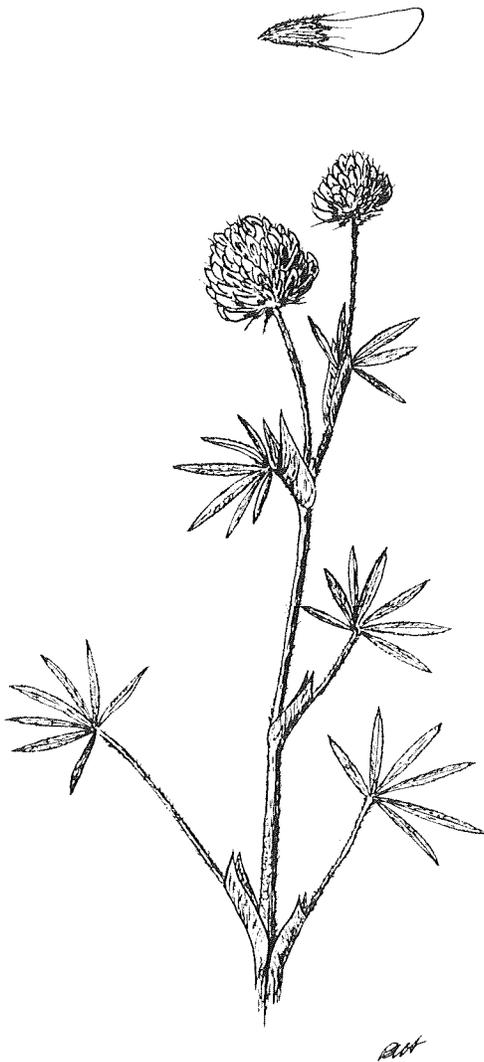
# THOMPSON CLOVER RESEARCH NATURAL AREA

A small tract of *Trifolium thompsonii* Morton, an endangered plant species, is situated proximate to the type location for the species.

The 81-ha (200-acre) Thompson Clover Research Natural Area was established by the USDA Forest Service in 1977 to preserve one of several small tracts of *T. thompsonii* Morton known to exist on Federal land. *T. thompsonii* is an endangered plant species<sup>4</sup> known only from the Swakane Canyon area near Wenatchee,

Wash. According to Hitchcock et al. (1961), *T. thompsonii* is an erect, taprooted perennial 2-7 dm (8-28 inches) tall with three to eight linear leaflets (fig. TC-1). The reddish-lavender flowers that fade to deep orchid appear from May to June. It is known only from the type locality where it is rather abundant on well-drained, grassy hillsides just below the edge of ponderosa pine woodland.

An 8-ha (20-acre) stand of the clover was first discovered in 1932 by Professor John W. Thompson and amateur botanist Clarence Seely along the base of the north-facing slope of Swakane Canyon at 325-m (1,066-ft) elevation about 2 km (1.2 miles) from the Columbia River.<sup>5</sup> The Research Natural Area is a steep, 81-ha, (200-acre) southwest-facing tract between 593- and 1 102-m (1,945- and 3,614-ft) elevation.<sup>6</sup>



**Figure TC-1.—*Trifolium thompsonii*. Plant is approximately one-third actual size. Individual flower is approximately actual size.**

## Access and Accommodations

The Research Natural Area is located entirely within the Wenatchee National Forest and includes the SW 114 and the NW 114 of the SE 114 of Section 15, T. 24 N., R. 20 E., Willamette meridian (fig. TC-2). The Swakane winter game range completely surrounds the tract.

Access is via State Route 97, 13.7 km (8.6 mil) north of Wenatchee (fig. TC-2). Turn west on the Swakane Canyon Road (County Road 252) and follow for 2.4 km (1.5 mil). Turn north on Forest Road 2452-H (Rattlesnake Spring Road) and follow for 6.4 km (4.0 mil) until crossing the National Forest boundary. This is a primitive road occasionally necessitating four-wheel drive capability. The Research Natural Area lies above the road at a sharp switchback about

<sup>4</sup>*Trifolium thompsonii* was listed as endangered in Part 4. U.S. Department of the Interior. Fish and Wildlife Service. Endangered and threatened species - Plants. Federal Register. V. 41. No. 117. p. 24524 to 24572. June 16, 1976.

<sup>5</sup>Personal communication from Professor John W. Thompson. Seattle. Wash.

<sup>6</sup>Site of the Research Natural Area was found by Mr. Joseph O. Gjertson. Range and Wildlife Staff. Wenatchee National Forest. Wenatchee. Wash.

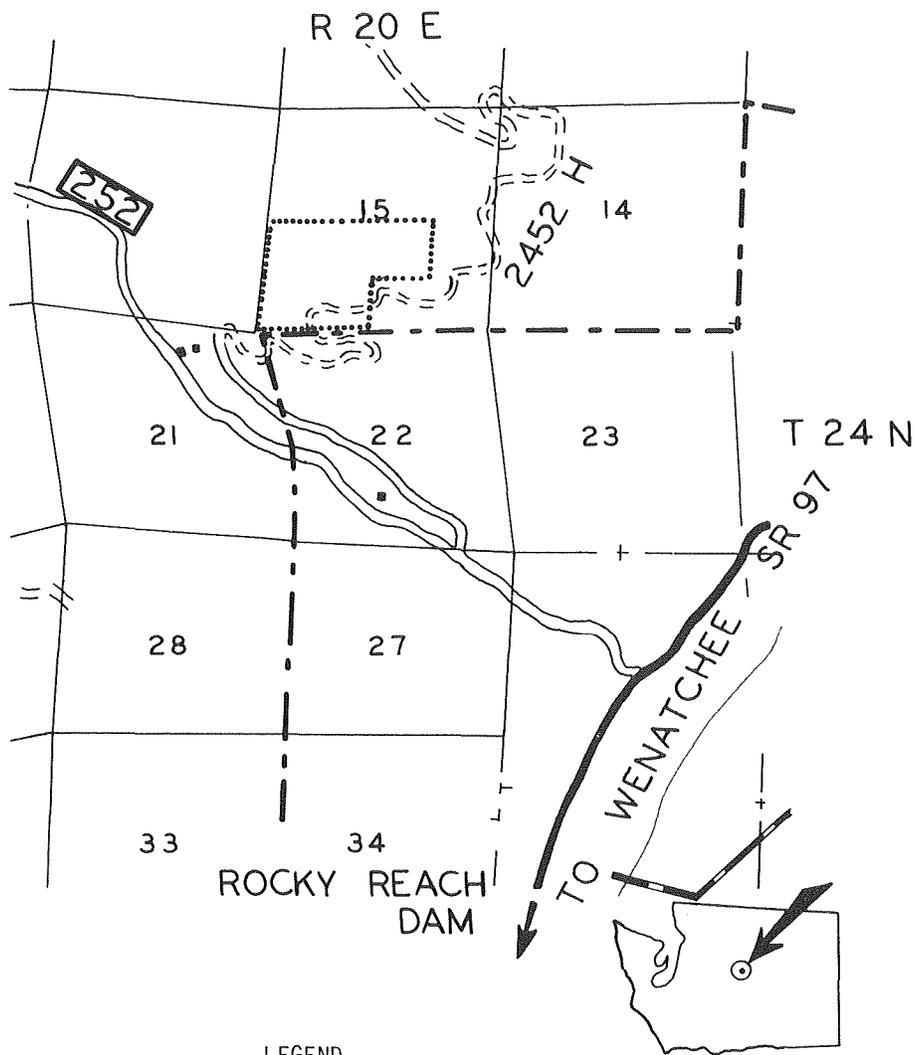
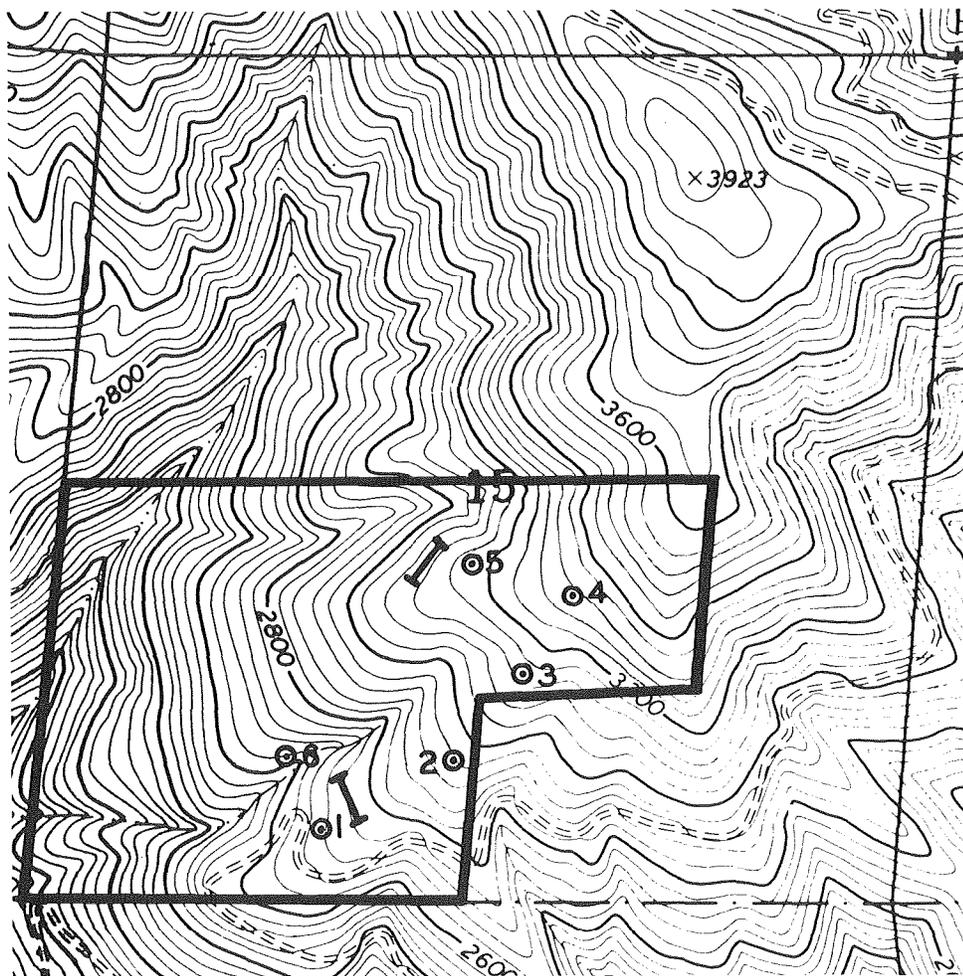


Figure TC-2.—Thompson Clover Research Natural Area, Chelan County, Washington.



LEGEND

===== FOREST ROAD

———— BOUNDARY, THOMPSON CLOVER RESEARCH NATURAL AREA

—— PERMANENT VEGETATION TRANSECT

⊙ SOIL PIT LOCATION

—— SECTION LINE

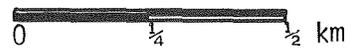
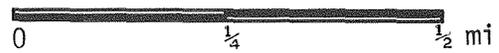


Figure TC-3.—Location of soil pits and permanent vegetation transects.

0.4 km (0.2 mil after the road enters the National Forest.

Wenatchee is the nearest community to the Research Natural Area. Good motel and restaurant accommodations are available there.

## Environment

Swakane Canyon is a steep to very steep, non-glaciated canyon draining southeast into the Columbia River. The valley bottom is narrow and filled with alluvium. Pre-upper Jurassic gneiss is the principal geologic formation in Swakane Canyon. This formation includes some schist. Bedrock is highly fractured but not deeply weathered; thus, it is fairly competent. Loose rock fragments are characteristically angular in shape and exhibit a wide range of sizes with most fragments less than 1 dm in diameter.

Climate is representative of the eastern slope of the Cascade Range with moderately cold winters and warm, dry summers. Most of the precipitation occurs as snow between November and April from moisture-laden Pacific storms that cross the area. Wenatchee, Washington, the nearest climatic station, receives 22 cm of precipitation and has mean temperatures of 22°C in July and August and -3°C in January. Mean annual temperature is HOC. The Research Natural Area probably receives more precipitation and is somewhat cooler in summer and colder in winter than Wenatchee.

Soils of the Natural Area are all Haploxerolls in either the Typic or Lithic subgroup. All are mixed, mesic and most are coarseloamy. Descriptions of six soil profiles are shown in table TC-1. Locations are keyed to numbers 1-6 on figure TC-3.

**Table TC-1 — Soil profile descriptions from six locations on the Thompson Clover Research Natural Area. Profiles are keyed to locations shown in figure TC-3**

Soil profile number and classification	Horizon	Depth, cm	Description
1. Coarse-loamy, mixed, mesic Typic Haploxeroll; slope — 35 percent; aspect — west; elevation — 774 m	A <sub>11</sub>	0-3	Very dark grayish brown (10YR3/2) loam; moderate fine granular structure; slightly sticky and slightly plastic; abundant roots
	A <sub>12</sub>	3-23	Dark brown (10YR3/3 moist) loam, moderate fine subangular blocky structure; slightly sticky and slightly plastic; abundant roots
	A <sub>3</sub>	23-41	Dark brown (10YR3/3) loam; strong fine and medium subangular blocky structure; slightly sticky and slightly plastic; abundant roots
	B <sub>1</sub>	41-58	Brown (10YR4/3) loam; moderate medium subangular blocky structure; slightly sticky and slightly plastic; plentiful roots
	B <sub>2</sub>	58-102	Brown (10YR4/3) loam; moderate medium subangular blocky structure; slightly sticky and slightly plastic; few roots
	C <sub>1</sub>	102 +	Brown (10YR4/3) loam; massive; nonsticky and nonplastic; very few roots

2. Coarse-loamy, mixed, mesic Lithic Haploxeroll; slope — 27 percent; aspect — west-southwest; elevation — 853 m	A	0-8	Dark brown (10YR3/3) coarse sandy loam; moderate fine subangular blocky structure; nonsticky and slightly plastic; 10 percent gravel; abundant roots
	B	8-33	Dark brown (10YR3/3) coarse sandy loam; moderate fine and medium subangular blocky structure; nonsticky and slightly plastic; 10 percent gravel; few roots
	R	33 +	Gneissic bedrock
3. Coarse-loamy, mixed, mesic Lithic Haploxeroll; slope — 27 percent; aspect — west; elevation — 914 m	00	3-1	Duff — pine needles
	A <sub>1</sub>	0-13	Very dark gray (10YR3/1) sandy loam; moderate fine and medium subangular blocky structure; nonsticky and nonplastic; 3 percent gravel; abundant roots
	A <sub>12</sub>	13-20	Very dark grayish brown (10YR3/2) sandy loam; moderate fine and medium subangular blocky structure; nonsticky and nonplastic; 3 percent gravel; abundant roots
	B	20-25	Dark brown (10YR3/3) sandy loam; moderate medium subangular blocky structure; slightly sticky and nonplastic; 5 percent gravel; few roots
	R	25 +	Weathered gneissic bedrock
4. Coarse-loamy, mixed, mesic Typic Haploxerolls; slope — 18 percent; aspect — west; elevation — 1014 m	A <sub>11</sub>	0-23	Very dark grayish brown (10YR3/2) sandy loam, moderate fine subangular blocky structure; slightly sticky and slightly plastic; abundant roots
	A <sub>12</sub>	23-41	Dark brown (10YR3/3) sandy loam; moderate fine and medium subangular blocky structure; slightly sticky and slightly plastic; plentiful roots
	B <sub>21</sub>	41-94	Brown (10YR4/3) sandy loam; moderate medium subangular blocky structure; slightly sticky and slightly plastic; few roots
	B <sub>22</sub>	94-102	Dark brown (10YR3/3) sandy clay loam; moderate medium subangular blocky structure; sticky and plastic; few roots; 10 percent gravel; clay bridging in pores and on ped faces
	R	102 +	Weathered gneissic bedrock

5. Coarse-loamy, mixed, mesic Lithic Haploxerolls; slope — 33 percent; aspect — west; elevation — 914 m	A	0-10	Dark brown (10YR3/3) sandy loam; moderate medium subangular blocky structure; nonsticky and nonplastic; abundant roots; 15 percent gravel
	C	10-23	Dark brown (10YR4/3) sandy loam; moderate medium and weak coarse subangular blocky structure; nonsticky and nonplastic; plentiful roots; 20 percent gravel
	R	23 +	Weathered schist bedrock
6. Sandy, mixed, mesic Lithic Haploxeroll; slope — 42 percent; aspect — south; elevation — 762 m	A	0-15	Dark brown (10YR3/3) coarse sandy loam; weak medium subangular blocky structure; nonsticky and nonplastic; plentiful roots; 10 percent gravel
	B	15-25	Brown (10YR4/3) loamy sand; massive; nonsticky and nonplastic; few roots; 20 percent gravel
	R	25 +	Weathered gneissic bedrock

Table TC-2 — Depth and texture of soil horizons from six locations on the Thompson Clover Research Natural Area

Soil profile number	Horizon	Depth	Silt Sand Clay		
			Percent		
		Cm	-----	-----	-----
1	A <sub>12</sub>	3-23	37.0	50.0	12.6
1	B <sub>2</sub>	58-101	39.4	48.0	12.6
2	A	0-8	18.0	74.4	7.6
3	A <sub>1</sub>	0-13	23.0	67.0	10.0
4	A <sub>12</sub>	23-41	31.0	56.0	13.0
4	B <sub>21</sub>	41-94	32.6	54.4	13.0
4	B <sub>22</sub>	94-102	23.0	57.0	20.0
5	A	0-10	22.0	69.0	9.0
6	A	0-15	19.0	75.0	6.0

Table TC-2 shows textural changes among depths of individual soil profiles. Samples from A and B horizons of soil profile 1 show a very close resemblance and are considered to be of the same origin (probably loessial). Samples from soil profile 4 show a marked difference in particle size between the B21 and B22 horizons for silt and clay fractions, suggesting the possibility of a lithologic discontinuity with loessial material overlying residuum.

Soil was collected from 0 to 5 cm at 19 random locations on the Natural Area. These samples were analyzed for pH and content of total carbon, total nitrogen, total sulfur, and available phosphorus. Results are presented in table TC-3.

Analysis of soil chemical characteristics reveals that nitrogen levels are below those previously encountered in grassland soils of the Northwest (Geist and Strickler 1970, Tiedemann et al. 1972). The ratio of N:S is favorable but levels of S are probably low enough to restrict nitrogen utilization and the formation of plant proteins (Klock et al. 1971). A available phosphorus is in the medium range (7 to 20 p/m) according to Black et al. (1965).

## Flora

The Research Natural Area is situated in the lower fringes of the *Pinus ponderosa* Zone in Swakane Canyon. Except for ravines, *Pinus* trees are sparsely scattered as individuals and

**Table TC-3 — Some chemical characteristics of the surface 5 cm of soil on the Thompson Clover Research Natural Area (n=19)**

Statistic	pH	Total nitrogen	Total sulfur	Total carbon	Available phosphorus
		----- Percent -----			p/m
$\bar{x}$	6.79	0.12	0.013	2.60	13.5
S <sup>2</sup>	.064	.0011	.00001	.993	16.4
S $\bar{x}$	.058	.0077	.00083	.229	.93

**Table TC-4 — Cover of shrub and herbaceous vegetation, Thompson Clover Research Natural Area, June 1974**

Vegetation	Cover	Frequency
	----- Percent -----	
<b>Shrubs:</b>		
<i>Artemisia rigida</i>	3.7	39
<i>Artemisia tridentata</i>	.4	8
Total shrubs	4.1	
<b>Forbs and halfshrubs:</b>		
<i>Achillea millefolium</i>	1.2	39
<i>Agoseris retrorsa</i>	T <sup>1</sup>	3
<i>Antennaria dimorpha</i>	1.2	22
<i>A. rosea</i>	T	p <sup>2</sup>
<i>Astragalus purshii</i>	.5	25
<i>A. leibergii</i>	T	P

Continued

Table TC-4 — Cover of shrub and herbaceous vegetation, Thompson Clover Research Natural Area, June 1974 — Continued

Vegetation	Cover	Frequency
<i>Balsamorhiza sagittata</i>	6.3	39
<i>Brodiaea</i> sp.	.2	28
<i>Chaenactis douglasii</i>	T	P
<i>Collinsia parviflora</i>	1.4 A <sup>3</sup>	58
<i>Collomia grandiflora</i>	.1 A	31
<i>Crepis barbigera</i>	.1	11
<i>Cryptantha torreyana</i>	.4 A	42
<i>Descurainia pinnata</i>	.1	14
<i>Erigeron linearis</i>	.3	8
<i>E. corymbosus</i>	.1	8
<i>E. filifolius</i>	T	P
<i>Eriogonum heracleoides</i> var. <i>minus</i>	4.1	42
<i>E. niveum</i>	T	P
<i>E. strictum</i> var. <i>flavissimum</i>	T	P
<i>E. elatum</i>	.4	6
<i>Galium boreale</i>	T	P
<i>Gayophytum nuttallii</i>	.2 A	14
<i>Haplopappus greenii</i>	.3	8
<i>Leptodactylon pungens</i>	T	P
<i>Lewisia rediviva</i>	.1	6
<i>Lithospermum ruderale</i>	.7	22
<i>Lomatium triternatum</i>	.2	17
<i>L. macrocarpum</i>	T	P
<i>Lupinus polyphyllus</i> var. <i>burkei</i>	.4	3
<i>Madia glomerata</i>	.5 A	14
<i>Penstemon pruinosus</i>	T	P
<i>P. fruticosus</i>	T	P
<i>Phacelia linearis</i>	.1	14
<i>Phlox speciosa</i>	.6	17
<i>Senecio integerrimus</i>	.1	8
<i>Silene douglasii</i>	.1	3
<i>Stephanomeria tenuifolia</i>	T	P
<i>Tragopogon dubius</i>	.1	6
<i>Trifolium thompsonii</i>	2.3	67
<b>Total forbs and halfshrubs</b>	<b>22.1</b>	
<b>Grasses:</b>		
<i>Agropyron spicatum</i>	5.6	69
<i>Bromus tectorum</i>	1.6	53
<i>Festuca idahoensis</i>	1.9	36
<i>Koeleria cristata</i>	.7	33
<i>Poa sandbergii</i>	1.4	50
<b>Total grasses</b>	<b>11.2</b>	
<b>Total cover</b>	<b>37.4</b>	

<sup>1</sup>T = cover less than 0.1 percent.

<sup>2</sup>P = frequency less than 1 percent.

<sup>3</sup>A = annual

in groups of two or three throughout the Research Natural Area. Tree cover is more continuous in ravines than on open grassy slopes (fig. TC-4). Density of *Pinus ponderosa*, although not measured, is greatest at the upper end of the Natural Area. The *Pinus* habitat can probably be assigned SAF forest cover type 237, Interior Ponderosa Pine (Society of American Foresters 1954), and Kuchler's (1964) Type 10, Ponderosa Shrub Forest.

Cover and frequency of understory vegetation were measured in June 1974 on permanent and random transects. Two permanent transects were located at northern and southern portions of the area. Approximate location of headstake and direction of each transect are shown on figure TC-3. Plots were spaced at 15-m intervals along the transect with I-em steel stakes used to permanently mark each plot along the transect. A 60- by 60dm steel frame was used as a reference for foliar cover estimates. Results of measurements on 17 permanent and 19 random plots are presented in table TC-4.

Total vegetal (foliar) cover on the Research Natural Area was 37.4 percent and was clearly dominated by forbs and halfshrubs with 21.7 percent cover. *Balsamorhiza sagittata*, *Eriogonum heradeoides*, *Trifolium thompsonii*, *Achillea millefolium*, and *Antennaria dimorpha* were the predominant perennial forbs and halfshrubs. These five species provided more than two-thirds of the cover of the forbs and halfshrubs class of vegetation.

Frequency of *T thompsonii* was 67 percent, indicating that distribution of this species is relatively uniform on the Natural Area.

Cover of annual forbs *Collinsia parviflora*, *Colomia grandiflora*, *Cryptantha torreyana*, *Gayophytum nuttallii*, and *Madia glomerata* was 2.6 percent - more than 10 percent of the cover provided by forbs and halfshrubs.

*Agropyron spicatum* was the major grass species, providing 5.6-percent cover. It was also the most uniformly distributed plant on the Natural Area with 69-percent frequency.

*Arternisia rigida* and *A. tridentata* form the principal shrub cover on the area, but shrubs were not a dominant form of vegetation, pro-

**Figure TC-4.—Two views of the Thompson Clover Research Natural Area. *Trifolium thompsonii* is a component of a *Pinus ponderosa*/*Artemisia rigida*/*Agropyron spicatum* community in Swakane Canyon.**

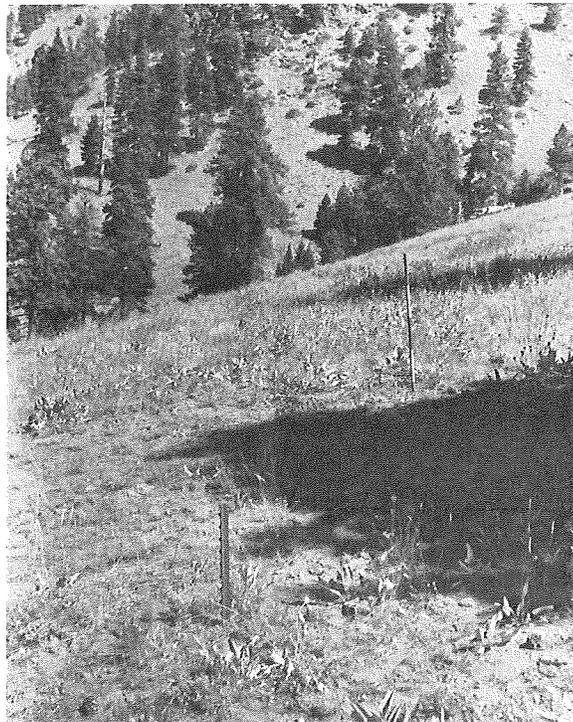
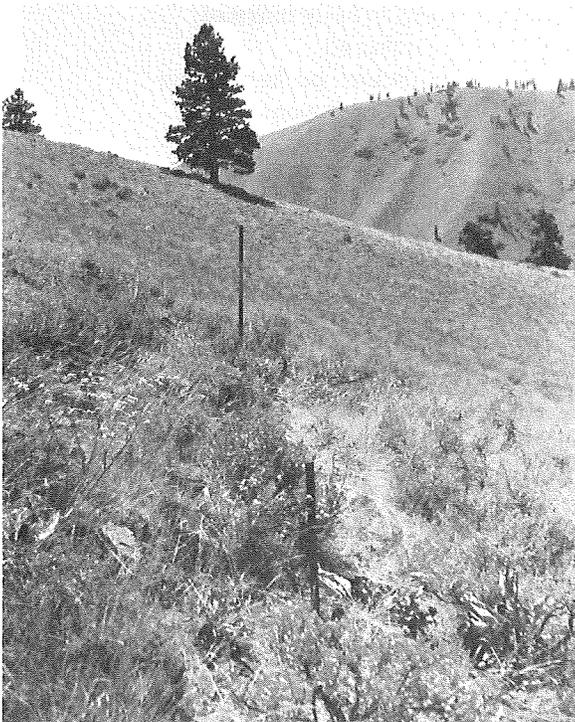


Table TC-5 — Observed and tentative mammals for the Thompson Clover Research Natural Area<sup>1</sup>

Order	Scientific name	Common name
<b>OBSERVED MAMMALIAN SPECIES<sup>2</sup></b>		
Rodentia	<i>Peromyscus maniculatus</i>	deer mouse
	<i>Eutamias amoenus</i>	yellow-pine chipmunk
Artiodactyla	<i>Odocoileus hemionus</i>	mule deer
	<i>Ovis canadensis californiana</i>	California bighorn sheep
<b>TENTATIVE MAMMALIAN SPECIES</b>		
Insectivora	<i>Sorex cinereus</i>	masked shrew
	<i>Sorex vagrans</i>	vagrant shrew
Chiroptera	<i>Myotis lucifugus</i>	little brown myotis
	<i>Myotis yumanensis</i>	yuma myotis
	<i>Myotis evotis</i>	long-eared myotis
	<i>Myotis volans</i>	long-legged myotis
	<i>Myotis californicus</i>	California myotis
	<i>Myotis subulatus</i>	small-footed myotis
	<i>Lasionycteris noctivagans</i>	silver-haired bat
	<i>Eptesicus fuscus</i>	big brown bat
	<i>Lasiurus cinereus</i>	hoary bat
	<i>Plecotus townsendi</i>	western big-eared bat
	<i>Antrozous pallidus</i>	pallid bat
Lagomorpha	<i>Sylvilagus nuttalli</i>	mountain cottontail
	<i>Lepus americanus</i>	snowshoe hare
	<i>Lepus townsendi</i>	whitetail jack rabbit
	<i>Lepus californicus</i>	blacktail jack rabbit
Rodentia	<i>Eutamias minimus</i>	least chipmunk
	<i>Eutamias townsendi</i>	Townsend chipmunk
	<i>Marmota flaviventris</i>	yellowbelly marmot
	<i>Tamiasciurus douglasi</i>	chickaree
	<i>Thomomys talpoides</i>	northern pocket gopher
	<i>Neotoma cinerea</i>	bushytail woodrat
	<i>Phenacomys intermedius</i>	mountain phenacomys
	<i>Lagurus curtatus</i>	sagebrush vole
	<i>Erethizon dorsatum</i>	porcupine
Carnivora	<i>Canis latrans</i>	coyote
	<i>Ursus americanus</i>	black bear
	<i>Procyon lotor</i>	raccoon
	<i>Martes americana</i>	marten
	<i>Mustela erminea</i>	shorttail weasel
	<i>Mustela frenata</i>	longtail weasel
	<i>Mustela vison</i>	mink
	<i>Taxidea taxus</i>	badger
	<i>Mephitis mephitis</i>	striped skunk
	<i>Felis concolor</i>	mountain lion
	<i>Lynx canadensis</i>	lynx
	<i>Lynx rufus</i>	bobcat
Artiodactyla	<i>Cervus canadensis</i>	elk

<sup>1</sup>Nomenclature follows Burt and Grossenheider (1976).

<sup>2</sup>Presence verified by sighting or collection.

viding only 4.1-percent foliar cover or slightly more than 10 percent of the total vegetative cover.

The Natural Area cannot readily be assigned any of the habitats described by Daubenmire (1970), Franklin and Dyrness (1973), or Hall (1973). The closest association based on composition and abundance as indicated by vegetal cover and frequency of individual species was an *Artemisia Tigida/Poa sanabergii* association or habitat type. *Agropyron spicatum*, however, was a minor component in stands described by Daubenmire (1970) and Franklin and Dyrness (1973). Composition of vegetation on the Natural Area was just the reverse: *Agropyron* was dominant and *Artemisia rigida* was subordinate. The Research Natural Area appears to be more analogous to the more productive sites of *Artemisia Tigida/Poa sandbergii* described by Hall (1973) than any other association found in the literature.

## Fauna

Thompson Clover Research Natural Area lies within the Swakane key winter range for mule deer (*odocoileus hemionus*). Late fall migrations cause heavy concentrations of deer along the Columbia River breaks below 900-m elevation. During severe winters, deer tend to use windswept, south-facing slopes within the mid elevation, or thermal zone. The Natural Area could be considered within "critical" winter range during severe weather conditions. Table TC-5 is a listing of observed and tentative mammal species for the Natural Area.<sup>7</sup>

Large predators such as the coyote (*Canis latmns*) and bobcat (*Lynx rufus*) follow the migrating deer herds to Swakane winter range. In rare instances, cougar (*Felis concolor*) visit the lower Swakane for easy prey. Resident coyote families and an occasional bobcat may be found throughout the year within Swakane Canyon. Although the black bear (*Ursus ameTicanus*) prefers more wooded areas on the Forest, stragglers could visit the Natural Area in search of rodents or carrion.

<sup>7</sup>Smith, Edwin R. 1973. Thompson Clover Research Natural Area vertebrate species account. Department of Biological Sciences, Central Washington State College, Ellensburg, Wash. Report on file at Forest Hydrology Laboratory, Wenatchee, Wash.

In 1969 nine California bighorn sheep (*OVI-S canadensis*) were transplanted to Swakane Canyon by the Washington State Department of Game. This trial herd increased to 24 head and expanded its range to the Entiat River. Survival success of this release will depend on how well the animal copes with disease and predators. There has been some decline in numbers since 1971. The Research Natural Area contributes a small portion of range for the introduced bighorn.

Although elk (*Cervus canadensis*) are not yet located within the Swakane, indications are that they will be soon. Small, pioneering groups from the main Colockum herd have become well established below the Wenatchee River, 13 air-km to the south. What effect this grazing animal will have on Thompson clover is unknown at present. We know the plant has survived grazing by other ungulates (refer to the following discussion on history of disturbance).

Table TC-6 is a list of observed and tentative avian and reptilian species (see footnote 7),

## History of Distu

The Research Natural Area was, from 1954 through 1965, part of a cattle allotment in Swakane Canyon. Slopes of the Swakane were grazed by 30 to 40 animal units for 3 months of the year. The home ranch for this allotment was located in the canyon bottom. There are no range developments such as fences or watering sites on the Natural Area. The use permit was terminated in 1965 and the area has received protection from domestic stock since that time.

Some areas of Swakane Canyon have been logged under a high-risk selection system, but there is no evidence of harvest activity in the Research Natural Area.

That portion of Swakane Canyon now owned by the Washington State Department of Game has been designated a Wildlife Recreation Area. Wildlife is considered to have priority use on both State and Federal lands within the area.

Recreational vehicles have traversed the Research Natural Area. Even though this form of disturbance is only occasional, there is noticeable damage to soil and vegetation because of the steep slopes.

Table TC-6 — Observed and tentative list of avian and reptilian species  
for the Thompson Clover Research Natural Area<sup>1</sup>

Order	Scientific name	Common name
<b>OBSERVED AVIAN SPECIES<sup>2</sup></b>		
Falconiformes	<i>Haliaeetus leucocephalus alascanus</i>	bald eagle
	<i>Aquila chrysaetos canadensis</i>	golden eagle
	<i>Cathartes aura</i>	turkey vulture
Galiformes	<i>Alectoris graeca</i>	chukar partridge
Columbiformes	<i>Zenaidura macroura marginella</i>	mourning dove
Piciformes	<i>Colaptes auratus</i>	yellow-shafted flicker
	<i>Asyndesmus lewis</i>	Lewis' woodpecker
Passeriformes	<i>Zonotrichia leucophrys</i>	white-crowned sparrow
	<i>Parus atricapillus</i>	black-capped chickadee
	<i>Corvus corax</i>	raven
	<i>Dendroica coronata</i>	myrtle warbler
	<i>Junco hyemalis</i>	slate-colored junco
	<i>Turdus migratorius</i>	robin
	<i>Pica pica</i>	black-billed magpie
	<i>Sturnella neglecta</i>	Western meadowlark
	<i>Cyanocitta stelleri</i>	Steller jay
	<i>Nucifraga columbiana</i>	Clark's nutcracker
<b>TENTATIVE AVIAN SPECIES</b>		
Falconiformes	<i>Accipiter gentilis</i>	goshawk
	<i>Accipiter striatus</i>	sharp-shinned hawk
	<i>Accipiter cooperii</i>	Cooper's hawk
	<i>Buteo jamaicensis</i>	red-tailed hawk
	<i>Buteo lagopus</i>	rough-legged hawk
	<i>Circus cyaneus</i>	marsh hawk
	<i>Falco mexicanus</i>	prairie falcon
	<i>Falco columbarius</i>	pigeon hawk or merlin
	<i>Falco sparverius</i>	sparrow hawk
Galiformes	<i>Dendragapus obscurus</i>	blue grouse
	<i>Bonasa umbellus</i>	ruffed grouse
	<i>Lophortyx californicus</i>	California quail
Columbiformes	<i>Columba livia</i>	rock dove or domestic pigeon
Strigiformes	<i>Otus asio</i>	screech owl
	<i>Bubo virginianus</i>	great horned owl
	<i>Glaucidium gnoma</i>	pygmy owl
	<i>Asio otus</i>	long-eared owl
	<i>Aegolius acadicus</i>	saw-whet owl
	<i>Chordeiles minor</i>	common nighthawk
Apodiformes	<i>Chaetura vauxi</i>	Vaux swift
	<i>Selasphorus rufus</i>	rufous hummingbird
	<i>Stellula calliope</i>	calliope hummingbird
Piciformes	<i>Sphyrapicus varius</i>	yellow-bellied sapsucker
	<i>Dendrocopos villosus</i>	hairy woodpecker
	<i>Dendrocopos pubescens</i>	downy woodpecker
Passeriformes	<i>Empidonax</i> sp.	flycatcher
	<i>Contopus sordidulus</i>	Western wood pewee

<i>Nuttallornis borealis</i>	olive-sided flycatcher
<i>Tachycineta thalassina</i>	violet-green swallow
<i>Iridoprocne bicolor</i>	tree swallow
<i>Petrochelidon pyrrhonota</i>	cliff swallow
<i>Corvus brachyrhynchos</i>	common crow
<i>Parus gambeli</i>	mountain chickadee
<i>Sitta carolinensis</i>	white-breasted nuthatch
<i>Sitta canadensis</i>	red-breasted nuthatch
<i>Ixoreus naevius</i>	varied thrush
<i>Sialia mexicana</i>	Mexican bluebird
<i>Sialia currucoides</i>	mountain bluebird
<i>Myadestes townsendi</i>	Townsend solitaire
<i>Regulus satrapa</i>	golden-crowned kinglet
<i>Regulus calendula</i>	ruby-crowned kinglet
<i>Bombycilla cedrorum</i>	cedar waxwing
<i>Lanius excubitor</i>	Northern shrike
<i>Lanius ludovicianus</i>	loggerhead shrike
<i>Sturnus vulgaris</i>	starling
<i>Vireo olivaceus</i>	red-eyed vireo
<i>Vermivora ruficapilla</i>	Nashville warbler
<i>Dendroica petechia</i>	yellow warbler
<i>Dendroica nigrescens</i>	black-throated gray warbler
<i>Dendroica townsendi</i>	Townsend's warbler
<i>Oporornis tolmiei</i>	Macgillivray warbler
<i>Wilsonia pusilla</i>	Wilson's warbler
<i>Icterus galbula</i>	Baltimore oriole
<i>Molothrus ater</i>	brown-headed cowbird
<i>Piranga ludoviciana</i>	Western tanager
<i>Hesperiphona vespertina</i>	evening grosbeak
<i>Carpodacus cassinii</i>	Cassin's finch
<i>Pinicola enucleator</i>	pine grosbeak
<i>Leucosticte tephrocotis</i>	gray-crowned rosy finch
<i>Spinus pinus</i>	pine siskin
<i>Spinus tristis</i>	American goldfinch
<i>Loxia curvirostra</i>	red crossbill
<i>Pipilo erythrophthalmus</i>	rufous-sided towhee
<i>Spizella passerina</i>	chipping sparrow
<i>Zonotrichia atricapilla</i>	golden-crowned sparrow

#### TENTATIVE REPTILIAN SPECIES

Squamata	<i>Crotalus viridis</i>	Western rattlesnake
	<i>Pituophis melanoleucus</i>	gopher snake
	<i>Thamnophis sirtalis</i>	common garter snake
	<i>Coluber constrictor</i>	common racer
	<i>Sceloporus graciosus</i>	sagebrush lizard
	<i>Sceloporus occidentalis</i>	Western fence lizard
	<i>Scaphiopus intermontanus</i>	Great Basin spadefoot toad
	<i>Gerrhonotus coeruleus</i>	northern alligator lizard

<sup>1</sup>Nomenclature follows Robbins et al. (1966) and Brown (1974)

<sup>2</sup>Presence verified by sighting.

## Research

Because *Trifolium thompsonii* is rare and apparently restricted to areas near the type location, this plant is an ideal subject for studies on factors that affect the distribution of the species. Research is presently underway

to determine causes of the restricted distribution of *Trifolium thompsonii*.<sup>8</sup>

<sup>8</sup>The ecological life history of *Trifolium thompsonii*, with emphasis on factors restricting its distribution. Graduate research by Ms. Joan E. Canfield, under direction of Dr. A. R. Kruckeberg, Department of Botany, University of Washington, Seattle, Wash.

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