ONION PARK RESEARCH NATURAL AREA

BOTANICAL AND ECOLOGICAL RESOURCES INVENTORY, MAPPING AND ANALYSIS

With Recommendations Towards
the Development of a Long-Term
Monitoring and Research Program

USDA Forest Service
Tenderfoot Creek Experimental Forest and
Lewis and Clark National Forest
Contract #43-84M8-2-0705

By Earle F. Layser
Land Management Services
Route 1 Box 3393
Alta, Wyoming via Driggs Idaho 83422

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I. INTRODUCTION

A. THE STUDY AREA

Onion Park is a floristically rich naturally occurring mountain meadow and wetland complex which is surrounded by subalpine forest. The grass- and wetlands comprising the Park contribute biological diversity to an otherwise predominantly lodgepole pine-forested, subalpine setting.

Onion Park is located at 7400' elevation in the Little Belt Mountains, five miles west of the town of Neihart, Meagher County, Montana. It is within the USDA Forest Service Tenderfoot Creek Experiment Forest on the Lewis and Clark National Forest (Figure 1).

A 1,173 acre Research Natural Area (RNA) encompassing Onion Park and its surrounding forest environs has been proposed (Chadde, 1991-Figure 2).

This study provides an overview of the flora and plant communities for the entire RNA, but focuses detailed inventory, mapping and analysis primarily on the meadow and wetland vegetation at Onion Park (Figure 3).

FIGURE 1 vicinity **MAP**

FIGURE 2 **ONION PARK RNA**

FIGURE 3 **ONION PARK STUDY AREA**

B. ADMINISTRATIVE STATUS

In 1961 the Tenderfoot Creek Experimental Forest was established, through agreement between the Lewis and Clark National Forest and the Intermountain Forest and Range Experiment Station, for purposes of research relating primarily to the management of lodgepole pine forests. The Experimental Forest designation placed restrictions on certain uses such as grazing and overnight camping, which has afforded the vegetation at Onion Park protection that other nearby parklands has not had (Tenderfoot Creek Expt. Establishment Rept., 1961).

The Montana Natural Areas Committee, in continuation of earlier workshops, prepared a section for the USDA Forest Service Northern Region Guide (1983) in which natural area needs and objectives were identified for National Forests (Schmidt and Dufour, 1975: Pfister, 1986). One of the types "targeted" for the Lewis and Clark National Forest was: Deschampsia **caespitosa/Carex spp.** habitat type (ht.); wet, subalpine mountain meadow.

The Lewis and Clark National Forest Plan (1986) proposed Onion Park, within the Tenderfoot Creek Experimental Forest, as a RNA that would satisfy that Regional ht. objective. A draft Establishment Record designating a 1,173 acre Onion Park RNA (Figure 2) is in progress (Chadde, 1991).

C. STUDY DESCRIPTION

In July 1992 the USDA Forest Service Intermountain Forest and Range Experiment Station contracted this study (#43-84M8-2-0705) to provide the preliminary basis for long-term ecological research and monitoring at the Onion Park RNA.

This study identifies and describes the vascular plants and plant communities present at the Onion Park RNA, their relative abundance, and their areal distribution. Sensitive plant (Lesica and Shelly, 1991) occurrences are also mapped.

From this work, preliminary opportunities and recommendations may be identified for the initiation of a research and ecological monitoring program. Onion Park is a logical site for a program for such studies, not only because of its ecological features, but because of its history of protection and use for experimental and research purposes.

II. PURPOSE

The purposes of this study are to:

1. Identify, and through sampling, quantitatively describe the plant communities comprising the Onion Park wetlands and meadows, and the RNA in general.
2. Prepare a detailed map of plant communities for the meadow and wetlands (with the objective of minimizing variation within polygons for sampling, monitoring, and study purposes).
3. Identify and map location(s) of occurrence for rare, sensitive, threatened or endangered plant species; and any unique ecological features.
4. Develop a vascular plant list for the Onion Park RNA.
5. Develop an Onion Park vegetation mapping case history and comparative analysis.
6. Identify preliminary opportunities, methods, and/or procedures to initiate long-term ecological status monitoring at Onion Park RNA.

III. METHODS

This study utilized and followed standard field research techniques and procedures, i.e.:

1. Review of past work and applicable literature
2. Field reconnaissance and study design tailored to fit actual field conditions.
3. Mapping, sampling, and data collection
4. Analysis and interpretation of results
5. Identification of additional and potential research needs

All plant name abbreviations used in this report follow that of the "Standardized Plant Names and Alpha-Codes for the Northern Region"(USDA Forest Service, 1987).

A. REVIEW OF PAST VEGETATION ANALYSIS AT ONION PARK RNA

Files at the Lewis and Clark National Forest headquarters in Great Falls, the old Belt Ranger Station at Neihart, and the Forestry Sciences Laboratory at Bozeman, Montana were searched for historical and existing information. The applicable findings are listed below and referred to elsewhere in this report:

1. Chadde, S. 1991 (draft). Onion Park Research Natural Area Establishment Record. Lewis and Clark National Forest. 23 plus maps.

2. Field, D. 1990. Special Plant Survey For Agroseris lackschewitzii occurrence (at Onion Park). Lewis and Clark National Forest. 3p.

3. McConnell, R.C. (undated). Some hydrologic characteristics, soil qualities, and soil management areas, Tenderfoot Creek Experimental Forest. Lewis and Clark National Forest, Montana. Forest Service 2550 file, 6 p plus map.

4. OEA Research Contract (In progress). Habitat Type Mapping for Lewis and Clark National Forest.

5. Pierce, J.R.; Johnson, J.L. 1984. Partial List of Plant Species for Onion Park, Supplemented by Wayne Phillips. Lewis and Clark National Forest. 2p.

6. USDA Forest Service. c1920-30. Herder Book (Lucas Ranch, Ringling, MT), Harley Park Grazing Allotment Map (in attic of old Belt R.S.), Neihart, MT.

7. USDA Forest Service. 1961. Tenderfoot Creek Experimental Establishment Report. Forestry Sciences Laboratory, Bozeman, MT.

8. USDA Forest Service. 1963. Timber Inventory Maps. Lewis and Clark National Forest.

9. USDA Forest Service. 1975. Habitat types Tenderfoot Creek Experimental Forest,

Lewis and Clark National Forest, MT (1p map)

10. USDA Forest Service. 1987 & 1990. Forest Inventory Stand Examination Field Records 2409.21.

B. LITERATURE REVIEW

Besides the USDA Forest Service file records listed above, there are no other known published papers or scientific studies on vegetation or vegetation monitoring for the Onion Park RNA; other than in general for existing habitat type classifications (Pfister, et al, 1977; Mueglller and Stewart, 1980; Hansen, et al, 1989). There are a number of recent papers and symposium proceedings related to ecological monitoring program at Onion Park (e.g. Schneider, R., 1992 draft; PNW Interagency Natural Areas Comm., 1990; Northern Region Ecosystem Classification Handbook: Chapt 4-ECODATA Sampling Methods, 1987; Johnson, J.L., et al.; 1984 et al.).

C. FIELD RECONNAISSANCE

The contractor conducted pre-mapping and on-site reconnaissance of the project area in mid-July. The purpose of the field reconnaissance was determine what plant communities may be present, and their abundance and spatial distribution; and also to determine whether any existing vegetation or habitat type maps provided adequate stratification for study and sampling purposes.

The conclusion, after reviewing existing vegetation maps (Figure 7-10) and observing the vegetation communities present, was that the polygons represented in those works lacked sufficient homogeneity or were otherwise inadequate, for purposes of sampling and monitoring.

For example, all previous vegetations mapping delineated the meadows and wetlands as single polygon representing one cover or habitat type (Figures 7-10). Field observation determined, in fact, ten habitat and community types were represented within the meadows and wetlands (Tables 1 and 2). In addition, pre-mapping and walk-through surveys resulted in discovery of three new locations (Figure 1) for occurrence of Agroseris lackschewitzii, considered a "sensitive plant species" for Montana (Lesica and Shelly, 1991).

D. MAPPING

A general 1:24,000 scale map of plant communities was prepared for the proposed Onion Park RNA utilizing information from existing maps and the author's field observations. The study area location consisting of the meadow and wetland complex is identified on this map (Figure 3 & 4).

Mapping of the meadows and wetland communities, and some adjacent forest area, was carried out at 8"=1 mile using a hand-held compass, pacing stick, and "Redi-mapper"(Figures 5, 6 & 7). The resulting 8"=1 mile map has been photographically enlarged in Figure 6. Figure 7 map is transferred onto a photographically enlarged contour map of approximately 8"=1 mile.

Methods and procedures for mapping vegetation-habitat types and plant communities have been described in numerous publications (Kuchler, 1967; Daubenmire, 1973; Deitschman, 1973; Layser, 1974; Pfister, et al., 1977; Leak, 1982; Steele, et al., 1983; et al.). Vegetation mapping is an art, not a science. The procedures applied in this work were an eclectic selection of established field methods, but in all cases, the ecotones mapped, and resultant polygons in map Figures 5, 6 & 7, were observed an/or measured in the field, not extrapolated.

The plant communities (polygons and/or stands) mapped were/are discrete and recognizable entities. Stands were mapped, for example, by changes in life forms,

species composition and dominance, among other things. These in turn generally correspond to changes in the physical environment or habitat. More specifically, the transition between communities was, in some cases, mappable on the basis of a single species being well-represented or absent; e.g., the transition between Festuca idahoensis/Deschampsia caespitosa ht. and Deschampsia caespitosa/Carex spp. ht. is marked by, among other things, Festuca idahoensis being well-represented in the former and absent in the latter. The ecotone can be located and traversed in the field on that basis. Likewise, the Alopecurus alpinus community type (ct.) is characterized by the dominance of Alopecurus alpinus, an easily identified grass, and the literal absence of it in contiguous communities. In certain other situations specific communities were restricted to mappable features such as a single forest opening; as for example, the Eriophorum chamissonia/Carex spp. ct.

Over 13 traverses were completed using the "Redi-mapper" technique. Some trial and error experimentation was done to determine a scale which best appeared to serve the intended study purposes considering the size and configuration of polygons involved. An 8"=1 mile scale appeared to give best results. This scale is also recommended in the literature for this type of purpose (Steele, et al., 1983). An initial traverse was done to circumscribe the exterior parkland and forest ecotone. Interior wetland and grassland stands polygons were then positioned and mapped in relation to selected reference points. Minor adjustments were later made for some polygon boundaries based on results of sampling.

E. SAMPLING

It was decided to use rectangular 10"x20" size ECODATA plot to sample the meadow and wetland areas because of the density of the graminoid vegetation.

The canopy coverage classes employed for the macroplot sampling were based on Daubenmire (Appendix C) with minor modification:

Coverage Class	Range of Coverage	Midpoint of Range
T	<1%	0.5%
1	1<5%	2.5%
2	5<25%	15%
3	25<50%	37.5%
4	50<75%	62.5%
5	75<95%	85%
6	95-100%	97.5%
+	present in stands, but not in plots	

For macroplots 10% coverage classes, as described in the Forest Service ECODATA Handbook (1987), were applied.

Thirteen graminoid dominant stands were sampled using 109 microplots. The plots were randomly located at pre-determined intervals within subjectively selected representative stands. Sample data from three stands were later combined (Appendix A).

A forested polygon (#4) identified and mapped on the basis of its unique physiogomy, species composition, and physical environment was also sampled using a 1/10 acre ocular macroplot method (ECODATA, 1987).

IV. DISCUSSION OF RESULTS

Spatial and juxtaposition map information (Figures 3-6), combined with the quantitative and quantitative information (Appendix A), and floristic lists, provide a detailed description of the vegetation at Onion Park.

A. PLANT COMMUNITIES REPRESENTED

Seventeen plant communities were identified to occur in the Onion Park RNA. These consist of six forest, one forb, two shrub, and eight graminoid dominated types (Table 1). They represent plant associations for which habitat types, habitat type phases, community and site types have been previously described in the literature, as well as what appear to be heretofore undescribed community types.

TABLE 1. List of Habitat and Community Types, the Climax Formation, Map Unit Number, Acres and Ecological Classification Status at Onion Park.

Ht or Ct Name	Map #	Formation	Acres	Ecological Classification Status for Montana
1. Descae/Carex Spp.	1	Subalpine wetland (seasonal)	34*(+4**)	Mueggler & Stewart, 1980
2. Fesida/Descae	2	Subalpine grassland	24*	Mueggler & Stewart, 1980
3. Fesida/Agrcan/ Gervis	2A	Subalpine grassland	2*	Mueggler & Stewart, 1980
4. Ericha/Carex Spp.	3	Subalpine wetland	1*	New for Montana, but described for Alaska
5. Aloalp/Carex Spp.	5	Subalpine wetland (Seasonal)	10*	New, previously undescribed
6. Descae/Carex Spp. (wet)	6	Subalpine wetland	1*	A perennially saturated soil phase of Descae/Carex above
7. Mercil/Sentri	7	Subalpine riparian forbland	4*	Hansen, et al., 1989
8. Fesida/Agrcan/ Melspi	8	Subalpine grassland	1*	New, previously undescribed
9. Carros/Descae	None	Subalpine wetland	1*	Hansen, et al., 1989
10. Salgey/Carros	9	Subalpine riparian shrubland	21	Hansen, et al., 1989
11. Salgey/Calcan	9	Subalpine riparian shrubland	21	Hansen, et al., 1989
12. Picea/Salix/ Carex	4	Subalpine forest	4*	New, but would key Picea/Calcan in Hansen et al., 1989
13. Abilas/Calcan	10	Subalpine forest	80	Pfister, et al., 1977
14. Abilas/Vacsco	11	Subalpine forest	761	Pfister, et al., 1977
15. Abilas/Calcan/ Vacsco	12	Subalpine forest	40	Pfister, et al., 1977
16. Abilas/Vacglo	13	Subalpine forest	60	Pfister, et al., 1977
17. Forest Scree	14	Subalpine forest	125	Pfister, et al., 1977

*Areas mapped and measured in this study, all other type acres estimated based on combination of field mapping and observations, Chadde (1991), and the Tenderfoot Creek Experimental Forest Habitat Type Map (1975).

**An addiitonal estimated 4 acres of Descae/Carex spp. ht. occurs above Quartzite Ridge, but was not included within the area mapped at 8"=1 mile.

TABLE 2. Summary of the ten wetland and meadow habitat and community types mapped in detail within the primary study area (Table 5).

Plant Community or Habitat Type Name	No. of Life Forms	No. of Spp. Recorded	No. of Map Plots (n)	Map Unit	Acres
Descae/Carex spp.	3	40	25	1	34
Fesida/Descae	2	43	20	2	24
Fesida/Agrcan/Gervis	2	32	10	2A	2
Ericha/Carex spp.	2	15	9	3	1
Aloalp/Carex spp.	3	49	15	5	10
Descae/Carex spp. (wet)	3	21	10	6	1
Mercil/Sentri	2	12	5	7	4
Fesida/Agrcan/Melspi	2	27	10	8	1
Carros/Descae	3	7	5	None	1
Picea/Salix/Carex	5	34	2(Macro)	4	4

* Bryophytes were not recorded as a life form, but in some types (e.g. map units 3, 4 & 7) the bryophytic flora was a significant feature.

FIGURE 4: 1:24,000 map of HTs & CTs for RNA

FIGURE 5: Detailed 8"=1 mile map of HTs & CTs for study area

FIGURE 6: Detailed contour map of HTs & CTs study area

FIGURE 7: Photographically enlarged HT & CT map study area

B. MAPPING

Sampling and data analysis resulted in combining or grouping similar stands or polygons. All polygons delineated at the 8"=1 mile scale (Figures 5, 6 & 7) contain less than 5% dissimilar vegetation. Essentially there are no inclusions within the map units at the level of detail mapped. The term polygon and stand are equivalent and used interchangeably for purposes of this study. The results of mapping are displayed in Figures 4, 5, 6 & 7.

C. SAMPLING

Data from the 12 graminoid, one forbland, and one forest stand sampled are given in Appendix A.

The data for the 14 sample stands were combined in some cases on the basis of similarity of species composition and canopy coverage values to represent 10 communities (Table 2).

Descriptions of the 10 plant communities based on sample data are given below. Only 10 dominant species, or species having the most significant coverage and constancy, for the different life forms represented are given. For an entire species listing by community and total coverage and constancy values, the reader is referred to Appendix A. Relative coverage figures in the summaries below are based on the entire species list for each stand, not just for those listed in the following summary.

The plant communities or stands have been named using existing classifications where they apply or exist; otherwise, the plant names identifying a stand are based on the sample data results, or the apparent relative importance a particular species may have been given in existing vegetation classifications in attempt to retain consistency. The plant name abbreviations follow the "Standardized Plant Names and Alpha-Codes for the Northern Region" (USDA Forest Service, 1987).

Eighty percent of the stands identified can be forced to "key out" applying existing vegetation classifications, thus reducing or collapsing the number of types by some 30%. This approach, while tending to simplify or reduce complexity, will not meet the study objectives for homogeneity within the stands.

For example, stand #5 can be forced to "key" to Festuca idahoensis/Deschampsia caespitosa ht. (Mueggler and Stewart, 1980). At some places in stand #5 Festuca idahoensis is well-represented, and Deschampsia caespitosa is present; but to "key" to that type, one must ignore the 50-95 coverage, and a constancy value of 10, for Alopecurus alpinus, as well as obvious differences in the physiogamy one can observe in the field between stands #5 and #3. Where stand #5 has its best development it appears to be too moist for the occurrence of Festuca idahoensis. The argument might be made that Alopecurus alpinus is seral on the Festuca idahoensis/Deschampsia caespitosa ht., but there is no scientific basis or data to make such an assertion that the author is aware of. The conclusion of this study is that stand #5 represents a previously undescribed graminoid community type. Likewise, stand 3, 4 & 8 are considered to be previously undescribed community types (Table 1).

D. STAND DATA and MAP UNIT DISCUSSION SUMMARIES

Tables 1 and 2 are summary listings of all habitat type and community types

known to occur within Onion Park RNA and the primary study area. The summaries are correlated to map figures 4-7. More detailed discussion and description of the individual map units and sample stands within the primary study area are given below.

Map Unit #1 represents the Descae/Carex spp. ht. It contains sample stands #2, 4 and 10. It is the most common seasonal wetland community present in Onion Park, comprising about 38% of the Parklands.

TABLE 3. Summary Map Unit #1

Name.....Descae/Carex spp. ht.
Sample stands.....#2, 4, 10
Acres.....34 (38% of meadow/wetland study area)
Microplot transect.....n=25
No. of life forms.....3
No. of species recorded...40

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Descae	1-50	25	18	9
Carex spp.	1-95	50+	35	10
Calcan	0-75	5	4	3
Polbis	0-50	25	18	7
Camqua	0-50	5	4	6
Pedgro	0-25	5	4	7
Astfol	0-25	5	4	7
Sensph	0-50	5	4	3
Trilon	0-25	5	4	5
Allsch	0-5	5	4	3

Map Unit No. 2 represents the Festuca/Descae ht. It contains sample stands #3 and 7 (Appendix A). It is the second most common ht. comprising the Parklands. The habitat type is characterized by Fesida being well-represented (5%+ canopy cover), and the presence of Descae. Map units 2A, 5, 8 and 11 might also be "keyed" to this ht. (as per earlier discussion), but have been segregated for purposes of this study.

TABLE 4. Summary Map Unit #2

Name.....Fesida/Descae ht.
Sample stands.....#3, 7
Acres.....24 (27% of meadow/wetland study area)
Microplot transect.....n=20
No. of life forms.....2
No. of species recorded..43

Species	%Coverage Range	%Absolute Coverage	%Relative Coverage	Constancy
Fesida	0-75	50	36	8
Agrcan	0-75	25	18	7
Phlpra	0-75	5	4	2
Descae	0-25	5	4	3
Astfol	0-50	5	4	7
Cerhoo	0-90	5	4	3
Trilon	0-25	5	4	6
Trolax	0-75	5	4	3
Allgey	0-5	1	1	5

Map Unit #2A represents a transitional type. It contains sample stand #1 (Appendix A). A walk-through of the stand indicates the presence of Descae in very small amounts. Descae did not occur in any of the plots, yet it is present, therefore the stand would key to Fesida/Descae ht. However, this is the only stand sampled with relatively high constancy values for Potgra and Gervis. That, combined with a high constancy for Agrcan and the near absence of Descae, puts this stand borderline between Fesida/Agrcan ht. Gervis phase and Fesida/Descae ht.

TABLE 5. Summary Map Unit 2A.

Name.....Fesida/Agrcan/Gervis phase (transitional to Fesida/Descae ht.)
Sample stand.....#1
Acres.....2(2% of meadow/wetland study area)
Microplot transect.....n=10
No. of life forms.....2
No. of species recorded....32

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Fesida	5-75	50	47	10
Agrcan	0-1	5	5	4
Melspe	0-25	5	5	4
Descae	0-+	+	+	0
Potgra	0-50	5	5	6
Gervis	0-50	5	5	5
Astfol	0-25	5	5	8
Collin	0-25	5	5	5
Rumpac	0-25	5	5	4
Camrot	0-1	1	<1	3

Map Unit #3 is represented by a previously undescribed plant community for our area. Based on the stand (#8) sample data (Appendix A) it is treated here as a Ericha/Carex spp. ct. Similar Eriophorum/Carex communities have been described for Alaska (Kiereck and Dyrness, 1980). The Ericha/Carex spp. ct., while very restricted in occurrence within the study area, is a distinct and locally ecologically unique plant community. The ct., as described here, is not to be confused with where Ericha casually occurs in scattered small amounts in wet places. The physiogomy of the Ericha/Carex spp. ct is very distinct as represented by stand #8. Coverage of Sphagnum (constancy value=6), Mnium, Philonotis and other moss species is notable. Sphagnum was present in only one other community stand sampled (#14). Agrostis exarata, alpha order spp. Eriophorium chamissonus, and Carex bigelowii were collected only from stands #3 & 14 (see p 16, Map Unit #4 descriptions). Spiranthes romanzoffiana was observed to occur only in this ct. within the study area.

TABLE 6. Summary Map Unit #3.

Name.....Ericha/Carex spp. ct.
Sample stand.....#8
Acres.....1(1% of meadow/wetland study area)
Microplot transect.....n=9
No. of life forms.....2
No. of species recorded....15

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Ericha	5-25+	25	28	10
Carex spp. (C. bigelowii and C. rostrata)	25-75	50	57	10
Agrexa	0-25	5	6	8
Agrsca	0-+	+	+	0
Phealp	0-25	1	1	2
Viola sp.	0-75	5	6	3
Spirom	0-1	<1	<1	1
Epialp	0-1	<1	<1	1

MAP UNIT #5 is represented by graminoid stands dominated by Alopecurus alpinus. Two stands were sampled, #6 and #11 (Appendix A). This is a previously undescribed ct. A diversity of graminoid species are represented in the ct. including: Fesida, Descae, Melspe, Phlalp, Agrcan, Junbal, Poa, and Agrostis.

TABLE 7. Summary Map Unit #5.

Name.....Aloalp/Carex spp. ct.
Sample Stand.....#6 and #11
Acres.....10(11% of meadow/wetland study area)
Microplot transect.....n=15
No. of life forms.....3
No. of species recorded.....49

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Aloalp	25-95	50+	33	10
Descae	0-25	5	3	3
Carex spp.	0-95	25+	17	9
Pedgro	0-50	1	<1	3
Camqua	0-5	1	<1	4
Astfol	0-95	25	17	6
Sentri	0-50	5	3	3
Allgey	0-5	5	3	6
Geumac	0-25	1	<1	3
Arnmol	0-50	5	3	7

MAP UNIT #6 represents a wet extreme or phase of the Descae/Carex spp. ht. One stand, #8, was sampled (Appendix A). It had apparent low coverage or occurrence for forb species, as contrasted with stands 2, 4 and 10, and had a very distinct graminoid dominated physiogamy. The surface soil was saturated or very wet in late summer.

TABLE 8. Summary Map Unit #6

Name.....Descae/Carex spp. wet phase
Sample stand.....#8
Acres.....1(1% of meadow/wetland study area)
Microplot transect.....n=10
No. of life forms.....3
No. of species recorded.....21

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Descae	1-95	50	38	10
Carex spp.	5-95	50	38	10
Calcan	0-75	5	4	5
Phlpre	0-75	5	4	3
Junbal	0-5	1	<1	3
Equarv	0-95	5	4	1
Geumac	0-75	5	4	3
Achmil	0-5	5	4	5
Aloalp	0-5	5	4	4
Astfol	0-5	5	4	1

MAP UNIT #7 is represented by the Mercil/Sentri ct (Hansen, et al., 1989; Youngblood, et al., 1985). One stand #12 was sampled (Appendix A) although the ct is present in scattered small amounts throughout. In the author's experience this is a widespread and common subalpine riparian type in southwestern and north-central Montana, and in northwest Wyoming. It is never present over large areas, but is consistent in occurrence about seeps, springs, rivulets and runnels in the mountains. Mercil and Sentri are dominant almost to the exclusion of other species.

TABLE 9. Summary Map Unit #7

Name.....Mercil/Sentri ct.
Sample stand.....#12
Acres.....~4(5% of the wetland/meadow study area)
Microplot transect.....n=5
No. of life forms.....2
No. of species recorded...12

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Poalep	0<5	1	<1	6

Calcan	0<5	1	<1	2
Mercil	50-100	75	30	10
Sentri	5-95	75	30	10
Trolax	0-75	25	10	2
Epialp	5-50	50	20	10
Carbre	5-25	25	10	6
Geumac	+	-	-	-
Mimlew	+	-	-	-
Saxarg	+	-	-	-
Gerric	+	-	-	-

MAP UNIT #8 represents a stand dominated by Melica spectabilis. Based on sample stand #5 data (Appendix A), it might be classified as a Fesida/Descae or Fesida/Agrcan ht. Melspe phase. Melspe occurs elsewhere in small amounts in map units 2 and 2A, in which Fesida is dominant, but nowhere else in the study area, except stand #8, was it a dominant graminoid. The permanence of this dominance is not known. The relative abundance of annuals (Appendix A) in the stand may suggest past disturbance.

TABLE 10. Summary Map Unit #8.

Name.....Fesida/Agrcan/Melspe
Sample stand.....#5
Acres.....1(1% of the meadow/wetland study area)
Microplot transect.....n=10
No. of life forms.....2
No. of species recorded....27

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Melspe	25-75	50+	45	10
Fesida	0-50	5	5	5
Agrcan	0-25	5	5	7
Brocar	0-50	5	5	6
Descae	+	-	-	-
Poldou	0-75	25+	23	10
Collin	0-50	5	5	9
Cerhoo	0-25	1	<1	3
Allgey	0-25	1	<1	6
Linnut	0-50	1	<1	4

MAP UNIT #4 represents a forest community type occurring in a boggy habitat situation where the soil is saturated with standing or seeping water. Trees are invading the edges and occurring on hummocks. Picea engelmannii is the dominant tree species. There is a shrub layer consisting of Salix drummondiana and Salix monticola. The forb and graminoid component is diverse Carex bigelowii and Carex rostrata are the dominant sedges. Agrostis exarata is consistently present as is Eriophorum chamissonis. Sphagnum moss is also present. This stand would key to Hansen's et al. (1989) Picea/Calcan ct, but differs from that ct. description in having a shrub layer and in the range and diversity of plant species present. The stand does not occupy a large area, but the ct. was also observed to occur in O'Brien Creek, an adjacent drainage. Based on sample data (stand #14) it is treated here as a previously undescribed ct. Adjacent communities are represented by Abilas/Calcan and Salgey/Calcan or Carros.

TABLE 11. Summary Map Unit #4.

Name.....Piceng/Sal/Car
Sample stand.....#4
Acres.....4(5% of the wetlands in study area)
Ocular macroplot.....n=2
No. of life forms.....5
No. of species recorded....34

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Piceng	30-40	35	13	10
Abilas	1-10	5	2	10
Salix	30-50	40	15	10
Carex	60-70*	65+	24	10
Descae	10-10+	10	4	10
Calcan	0-10	5	2	5
Ericham	0-1	<1	0.3	10
Angarg	10-20	15	6	10
Arnmol	10-20	15	6	10
Sentri	20-20+	20+	8	10
Equarv	10-20	15	6	10
Agrexa	T-1	<1	0.5	10

NOT MAPPED #13. Sample stand #13 represented by small (<1 acre) areas dominated by Carros. The scattering of small areas representing this ct. were not individually mapped. The type would key to Descae/Carex spp. (Mueggeu and Stewart, 1980), but it is clearly a different plant community by virtue of the conspicuous limited occurrence of forbs, obvious dominance in nearby pure stands by Carros riparian site type, Descae phase. In the study area, sample stand #6 was the most ecologically similar ct.

TABLE 12. Summary Stand #13 (not mapped).

Name.....Carros/Descae ct.
Sample stand.....#13
Acres.....Not measured(~1% of wetland/meadow area)

Microplot transect.....n=5
No. of life forms.....2
No. of species recorded....7

Species	% Coverage Range	% Absolute Coverage	% Relative Coverage	Constancy
Carros	50-100	95	48	10
Carex spp.	5-50	25	13	4
Descae	1-25	25	13	10
Agrsca	5-25	25	13	4
Arnmol	5-25	25	13	4
Epialp	1-25	5	3	10

E. FLORISTIC LIST

Prior to this study, 118 species of vascular plants were recorded from the Onion Park RNA (Appendix B). In addition to the species listed in Appendix B, the following 39 species are added to the list as a result of this study.

Scientific name	Common name
Shrubs:	
Salix monticola	Mountain willow
Vaccinium caespitosum	Dwarf huckleberry
Graminoids:	
Agropyron caninum	Slender wheatgrass
Agrostis exarata	Spike bentgrass
Agrostis idahoensis	Idaho bentgrass
Agrostis scabra	Rough bentgrass
Alopecurus alpinus	Alpine foxtail
Bromus carinatus	Mountain brome
Carex bigelowii	Bigelow's sedge
Carex norvegica	Scandinavian sedge
Juncus ensifolius	Sword-leaved rush
Poa leptocoma leptocoma	Bog bluegrass
Trisetum wolfii	Wolf's trisetum
Forbs:	
Agroseris aurantiaca	Orange agoseris
Allium geyeri temerum	Geyer's Onion (w/
Antennaria corymbosa	Plains pussytoes
Aster foliaceus parryi	Leafy aster
Cardamine breweri	Brewer's cardamine
Castilleja cusickii	Cusick's paintbrush
Collinsia parvifolia	Small-flowered blue-
Crepis elegans	Elegant hawksbeard
Epilobium ciliatum	Autumn willow herb
Gentiana affinis	Pleated gentian
Hieracium albiflorum	White hawkweed
Hieracium cynoglossoides	Hound's tounge
Linanthus nuttallii	Nuttall's linanthus
Mimulus lewisii	Lewis' Monkey flower
Parnassia frimbriata	Fringed grass-of-
Perideridia gairdenri	Gairdner's yampah
Polygonum douglasii	Douglas's knotweed
Prunella vulgaris	Self-heal
Pyrola asarifolia	Pink wintergreen
Saxifraga occidentalis	Western saxifrage
Senecio pseudaureus	Golden streambank
Senecio sphaerocephalus	Mountain-marsh
Spiranthes romanz offiana	Hooded ladies-tresses
Stellaria longifolia	Long-leaved starwort
Trifolium pratense	Red clover

Veronica americana	American speedwell

F. HISTORY OF VEGETATION MAPPING AT ONION PARK - A COMPARATIVE ANALYSIS

1. Vegetation Map Limitations

Maps portraying vegetation for a given area can be strikingly different for reasons of purpose, scale, differences in interpretations and classification of vegetation and changes in the vegetation itself over time (Figure 8-12). Vegetation maps, as well as the classifications they incorporate, regardless of how detailed, are abstractions which simplify or abstract ecological complexity or reality.

Daubenmire (1973) in a comparison of approaches to mapping forest land for intensive management, pointed out, "any map that provides only an inventory of a...perishable resource is short-lived, whereas a map which portrays the productive capacity of the land (i.e. habitat types, soils) is as permanent as the land itself." That this concept has merit is demonstrated by wide acceptance and application in the mapping of habitat types for the planning and management of natural resources in the western U.S. in recent years (see Dutton, 1987 for application examples).

2. Onion Park Vegetation Mapping Case History

Figures 8-12 display five vegetation and/or habitat type maps for Onion Park from the period c1920-to date. Original 14 range (Figure 8) and timber surveys (Figure 9) classified and mapped the parkland meadows and wetlands as "grassland". A 1975 habitat type map (Figure 10), prior to the existence of any grassland ht. classifications for the area, mapped the parkland as a forest ht. (Abilas/Calcan). The ht. map (Figure 11) included in the draft Onion Park RNA Establishment Record (Chadde, 1991) showed the park wetland and meadows as one grassland ht. (Descae/Carex ssp.). Another map, not figured here, in the draft RNA Establishment Record for forest cover types simply shows the parkland as "non-forest".

The above maps may serve specific intended purposes, but with the exception of Figure 10 which describes one of the grassland hts. present, contribute little knowledge about the ecological complexity; and, in fact, may in their simplicity convey a false sense of, or even bias, knowledge about the biological diversity and ecological richness at Onion Park.

In contrast Figure 12 which incorporates so called "minor types" and recognizes situations which do not readily fit current classifications describes nine habitat and community types comprising the parklands (Tables 1 and 2) and provides a better idea of the complexity of the vegetation communities comprising the wetland-meadow complex.

FIGURE 7. 1920 GRAZING ALLOTMENT MAP

FIGURE 8. 1963 TIMBER INVENTORY MAP

FIGURE 9. 1975 HT MAP

FIGURE 10. RNA Establishment Record HT Map

FIGURE 11. SAME AS FIGURE 4

While theoretically mapping habitat types closely approximates the goal of ecological site, perhaps more than most other approaches in vegetation mapping, as stated by Daubenmire (1973) above, there are potential short-comings which can arise in application.

First there is a tendency for field ecologists and land managers to accept existing vegetation classifications as all inclusive. All types are made to fit the classification scheme in use (Figure 9); those which don't are ignored (Figure 11), or for reasons of scale they are omitted. Since the development of classifications progresses through series of approximations, and the relative recent development of classifications has concentrated on major types, there remains yet undescribed or imperfectly classified situations.

Secondly, Dutton (1987) has pointed out that "vegetation mapping projects are often undertaken by individuals with expertise in some particular aspect of vegetations and it is these aspects upon which the map focuses."(Figures 8, 9 and 10). This kind of bias may be further compounded by purpose and inevitable administrative requirements to reduce complexity.

Thus, vegetation, including habitat type, maps are reflections of the classification employed, and they may incorporate bias as a result of purpose, or the preparer's training, and the need to simplify to accommodate scale. While vegetation maps may elegantly serve intended purposes, their use and application must be tempered by knowledge of their inherent limitations.

3. Vegetation Maps as Means to Assist Biological Diversity Assessments

Natural area programs have generally emphasized representativeness or rarity in protecting biological diversity. Yet richness and diversity depends on the number of items, as well as the variety of items in a set. If one of the primary objectives of RNA designation (FSM 4063.02),and in public land management, is to preserve diversity, then it is logical to pay attention to the many, but small, habitat situations occurring across the landscape, as well as the many species occupying them. This should be especially true in the natural area designation process where the protection of biological diversity is a goal.

If limitations are imposed on natural feature descriptions by existing classification systems, agency administrative procedures or expediency, then as shown by the map case history above, a great deal of what really represents biological diversity of richness simply goes unrecorded or descriptively falls through the cracks. Table 1 and Maps 8-12 clearly demonstrate that if so called "minor" types or habitats are not described, along with representative vegetation, that any assessment of biological richness would be understated, and useful perhaps only for broad regional purposes

V. RECOMMENDATIONS AND APPLICATIONS FOR LONG-TERM RESEARCH AND ECOLOGICAL MONITORING

This study provides preliminary basis for the development of long-term research and ecological monitoring programs through detailed inventory, description, and map delineation of plant communities at Onion Park RNA.

Purposes for, and the basic kinds of monitoring in research and management, have been researched and discussed in literature elsewhere (Macdonald, et al., 1991; PNW Interagency Nat. Area Comm., 1990; Platts, et al., 1987; Johnson, J. et al., 1984). The intent here is to describe and point out, based on the study above, opportunities for research and monitoring at Onion Park.

Methods and procedures for monitoring are described in Lichthardt, 1992; Platts, et al., 1987; ECODATA Ecosystem Classification Handbook, 1987; Todd, 1982; et al. Any future permanent plot location might be assisted through use of a global positioning system (GPS).

A. MONITORING

1. Plant Communities

a. Ecological Status and Trend

(1) Plant communities with apparent narrow habitat requirements, e.g.: Ericha/Carex spp.; Aloalp/Carex spp.; Fesida/Agrcan/Melspe; Picea/Salix/Carex. The two cts which appear to have the most narrow ecological amplitudes, or are the most specific in terms of habitat, are the Ericha/Carex spp. and Picea/Salix/Carex cts.

(2) Plant communities with broader ecological amplitudes and which are more widespread in occurrence, e.g. Fesida/Descae; Descae/Carex spp.

Monitoring would focus on ecological status and trends with emphasis on determining stability, seral status, and successional changes, if any, within the plant communities over time.

Methods may include permanent ECODATA plot installations, involving analysis of species composition and coverage, measurements of ecotone changes (advances or declines in area occupied by communities) and photo points.

b. Community Pattern Dynamics Over Time-Figure 5 map of plant communities could be transferred to a large or similar scale aerial photo. Subsequent photos over time would provide means of detecting changes. Causes for any changes could be investigated by on-site investigations.

c. Succession in Willow/Riparian Communities-Changes in structure, coverage and species composition of ungrazed willow riparian communities.

2. Species Population Monitoring

a. Frequency and Occurrence of Selected Forb Species Over Time. The Descae/Carex spp., Aloalp/Carex spp., Fesida/Descae cts. at Onion Park have a notably rich composition of forbs, the distribution of which is not even within the communities or stands mapped even though they are identified as the same ht. Are the occurrences of the forb concentrations random, or are environmental, plant reproductive, or past disturbance factors involved?

Monitoring selected species-e.g.:Camassia quamash, Allium schoenoprasum, Satifraga oregana, Senecio sphaerocephalus, Valeriana sitchensis, Cardamine breweri, population status and distribution over time may provide insight into the dynamics of forb populations within ungrazed versus grazed mountain grasslands or wetlands.

b. Monitoring of Sensitive Species Populations. Agoseris lackschewitzii population status and dynamics might be monitored to assess status over time in undisturbed, natural, environments.

B. RESEARCH

1. **Plant Community/Soils Correlation**-Study of the relationship or correlation between soil/site factors and the occurrence and distribution of the plant communities at Onion Park. Particularly in respect to soil moisture, pH, nutrients, and water table depth.

2. **Sensitive Plant Species Occurrence and Population Status**-Agroseris lackschewitzii at Onion Park RNA as compared to surrounding mountain parklands (Harley, O'Brien, etc.) that are grazed or have been grazed in recent past.

3. **Species Composition**-(for forbs and Descae) of grassland, wetland and riparian habitat types at Onion Park where they have not been grazed (except for occasional unauthorized use) for three decades, as compared to similar habitat types in adjacent parklands that have been consistently grazed over the years.

4. **Natural Succession** on roadbed, ripped and closed to traffic which crosses subalpine grassland and wetland at Onion Park.

5. **Effects of global climatic changes** on ecological status of selected plant communities over time, especially in relation to cts. with narrow amplitudes or that occur in very restricted environments, eg. Ericham/Carex spp. ct.

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APPENDIX B. Horistic Lists--Vascular plant lists for Onion Park from Chadde (1991) and Lewis and Clark National Forest Files.

Vascular flora of Onion Park RNA from draft Establishment Report (Chadde 1991):

Scientific Name	Common Name	ABILAS/ VASSCO	ABILAS/ CALCAN	WET MEADOW
Trees				
Abies lasiocarpa	Subalpine fir	x	x	x
Picea engelmannii	Engelmann sprucex	x	x	
Pinus contorta	Lodgepole pine	x	x	
Pinus lasiocarpa	Whitebark pine	x		
Shrubs and Vines				
Berberis repens	Oregon grape			
Juniperus communis	Common juniper	x		
Linnaea borealis	Western twinflower	x		
Lonicera utahensis	Utah honeysucklex			
Ribes lacustre	Swamp currant	x	x	
Rosa acicularis	Prickly rose			
Rubus idaeus	Red raspberry	x		
Salix drummondiana	Drummond willow		x	x
Shepherdia canadensis	Buffalo berry			
Salix lutea	Yellow willow		x	
Symphoricarpos albus	Common snowberryx			
Vaccinium globulare	Globe huckleberry	x	x	
Vaccinium scoparium	Grouse whortleberry	x	x	
Graminoids				
Bromus ciliatus	Fringed brome			x
Bromus inermis	Smooth brome			x
Bromus vulgaris	Columbia brome			x
Calamagrostis canadensis	Bluejoint reedgrass	x	x	x
Calamagrostis rubescens	Pinegrass	x	x	
Carex aquatilis	Water sedge			x
Carex atrata	Blackened sedge			x
Carex geyeri	Elk sedge	x		x
Carex microptera	Smallwinged sedge	x		x
Carex raynoldsii	Raynold's sedge			x
Carex rostrata	Beaked sedge			x
Carex spp.	Sedge		x	
Dactylis glomerata	Orchard-grass			x
Deschampsia cespitosa	Tufted hairgrass x	x	x	
Eriophorum chamissonis	Chamisso cottonsedge		x	
Elymus glaucus	Blue wildrye			x
Festuca idahoensis	Idaho fescue			x
Juncus balticus	Baltic rush			x

Juncus mertensianus	Merten's rush	x
Luzula campestris	Field woodrush	x
Melica spectabilis	Showy oniongrass	x

Graminoids (cont.) Scientific Name	Common Name	ABILAS/ VASSCO	ABILAS/ CALCAN	WET MEADOW
Phleum alpinum	Alpine timothy			x
Poa pratensis	Kentucky bluegrass			x
Poa spp.	Bluegrass			x
Stipa occidentalis	Western needlegrass			x
Trisetum spicatum	Spike trisetum	x	x	
Forbs and Ferns				
Achillea millefolium	Common yarrow			x
Agoseris glauca	Pale agoseris		x	
Agoseris lackschewitzii	Pink agoseris		x	
Allium brevistylum	Short-style onion			x
Allium geyeri	Geyer's onion			x
Allium schoenoprasum	Chives		x	x
Anaphalis margaritacea	Pearly-everlasting			x
Angelica arguta	Sharptooth angelica			x
Antennaria racemosa	Raceme pussytoes	x	x	
Arabis nuttallii	Nuttall's rockcress			x
Arenaria congesta	Ballhead sandwort		x	
Arnica cordifolia	Heartleaf arnica	x	x	
Arnica latifolia	Broadleaf arnica	x	x	
Arnica mollis	Hairy arnica			x
Aster integrifolius	Thickstem aster	x	x	x
Camassia quamash	Common camas			x
Campanula rotundifolia	Lady's thimble			x
Castilleja spp.	Indian paintbrush			x
Chimaphila umbellata	Common prince's-pine	x	x	
Cirsium arvense	Canada thistle			x
Cirsium hookerianum	Hooker's thistle		x	x
Collomia linearis	Narrow-leaf collomia		x	
Cryptogramma crispa	Rockbrake	x		
Cystopteris fragilis	Brittle bladderfern	x	x	
Delphinium bicolor	Little larkspur			x
Dodecatheon pulchellum	Few-flowered shooting star		x	x
Epilobium angustifolium	Fireweed		x	
Epilobium alpinum	Alpine willowherb	x	x	
Equisetum arvense	Field horsetail	x	x	
Erigeron peregrinus	Subalpine daisy	x	x	
Erigeron speciosus	Showy fleabane	x	x	
Erythronium grandiflorum	Glacier-lily	x	x	x
Fragaria virginiana	Virginia strawberry	x	x	x
Galium boreale	Northern bedstraw			x
Geranium richardsonii	White geranium		x	x
Geranium viscossimum	Sticky geranium			x
Geum macrophyllum	Large-leaved avens		x	
Geum triflorum	Prairie-smoke			x
Habenaria dilatata	White bog-orchid		x	x
Habenaria saccata	Slender bog-orchid		x	
Habenaria viridis	Frog orchis		x	
Heracleum lanatum	Cow-parsnip		x	
Heuchera cylindrica	Roundleaf alumroot	x		

Listera cordata	Heart-leaf twayblade	x			
Lithophragma sp.	Fringecup	x			
Lupinus argenteus	Silvery lupine	x	x		
Mertensia ciliata	Mountain bluebell			x	
Mimulus guttatus	Common monkey-flower				x
Mitella breweri	Brewer's mitrewort	x	x		
Osmorhiza chilensis	Mountain sweet-root		x		
Pedicularis groenlandica	Elephanthead				x
Pedicularis racemosa	Sickletop lousewort	x	x		x
Phleum pratense	Timothy				
Polygonum bistortoides	American bistort		x		x
Polygonum viviparum	Viviparous bistort	x			x

Forbs and Ferns (cont.)		ABILAS/	ABILAS/	WET
Scientific Name	Common Name	VASSCO	CALCAN	MEADOW
Potentilla diversifolia	Diverse-leaved cinquefoil	x	x	
Potentilla gracilis	Northwest cinquefoil		x	x
Pyrola chlorantha	Green wintergreen	x	x	
Pyrola secunda	One-sided wintergreen	x		
Rumex paucifolius	Mountain sorrel		x	
Saxifraga arguta	Brook saxifrage		x	x
Saxifraga oregana	Oregon saxifrage	x	x	
Sedum stenopetalum	Wormleaf stonecrop	x		
Senecio triangularis	Arrowleaf groundsel	x	x	x
Smilacina stellata	Starry solomonplume	x	x	x
Streptopus amplexifolius	Twisted-stalk	x	x	
Taraxacum officinale	Common dandelion		x	x
Thalictrum occidentale	Western meadowrue	x	x	
Trifolium longipes	Longstalk clover		x	x
Trifolium repens	White clover	x		
Trollius laxus	American globeflower	x	x	x
Valeriana dioica	Northern valerian			x
Valeriana sitchensis	Sitka valerian	x	x	
Veratrum viride	Green false hellebore	x		x
Veronica americana	American speedwell		x	x
Veronica wormskjoldii	Wormskjold speedwell		x	x
Viola orbiculata	Round-leaved violet	x	x	
Viola spp.	Violet	x		x
Zigadenus elegans	Glaucous zigadenus	x	x	
Zizia aptera	Heart-leaved Alexanders		x	

PARTIAL LIST OF PLANT SPECIES FOR ONION PARK

John R. Pierce and Janet L. Johnson

July 18, 1984

CAMPANULACEAE
Campanula rotundifolia

CARYOPHYLLACEAE
Arenaria congesta
Cirsium hookerianum

COMPOSITAE
Sencio triangularis
Taraxacum officinale

CRUCIFERAE
Arabis nuttallii

CYPERACEAE
Carex microptera
Carex raynoldsii

EQUISETACEAE
Equisetum arvense

GERANIACEAE
Geranium viscosissimum

GRAMINEAE
Bromus inermis
Deschampsia cespitosa
Melica spectabilis
Phleum alpinum
Trisetum spicatum

JUNCACEAE
Luzula campestris

LILIACEAE
Allium geyeri
Allium brevistylum
Allium schoenoprasum
Camassia quamash
Erythronium grandiflorum
Zigadenus elegans

ONOGRACEAE
Epilobium glandulosum

ORCHIDACEAE
Habenaria dilatata
Habenaria saccata

RUBIACEAE
Galium boreale

SAXIFRAGACEAE
Lithophragma spp.
Saxifraga spp.
Saxifraga arguta

SCOPHULARIACEAE
Pedicularis groenlandica

Habenaria viridis

POLEMONIACEAE
Collomia linearis

POLYGONACEAE
Polygonum bistortoides

ROSACEAE
Fragaria virginiana
Geum macrophyllum
Geum triflorum

Supplemental List of Plant Species for Onion Park
Wayne Phillips
July 18, 1984

Cyperaceae

Eriophorum sp.

Gramineae

Calamagrostis canadensis
Elymus glaucus
Festuca idahoensis

Compositae

Arnica latifolia

Geraniaceae

Geranium richardsonii

Leguminosae

Trifolium longipes

Ranunculaceae

Delphinium bicolor
Thalictrum occidentale
Trollius laxus

Valerianaceae

Valeriana sp.

Boraginaceae

Mertensia sp.

Saxifragaceae

Mitella sp.

Scrophulariaceae

Castilleja sp.

Pinaceae

Abies lasiocarpa
Picea engelmannii
Pinus contorta

A CANOPY-COVERAGE METHOD OF VEGETATION ANALYSIS

(Based on Daubenmire (1950) with minor modifications)

I. ORIGINAL DEVELOPMENT FOR DETAILED QUANTITATIVE MEASUREMENT

OBJECTIVE: To obtain a 2-dimensional evaluation of the influence each plant taxon exerts over the other components of its ecosystem.

EQUIPMENT: (1)a frame of 3/16" steel with inside dimensions 20X50 cm, legs about 2 cm long at each corner, and painted to indicate quarters (as in figure) with 2 sides of a square 71X71 mm indicated in one corner; (2)tape, or cord with knots at half meter intervals; (3)stakes for ends of tape; (4)paper ruled to facilitate recording coverage of several dozen taxa in no more than 50 plots.

METHOD OF RECORDING DATA:

Consider all individuals of one taxon in the plot as a unit, ignoring for the moment all other kinds of plants.

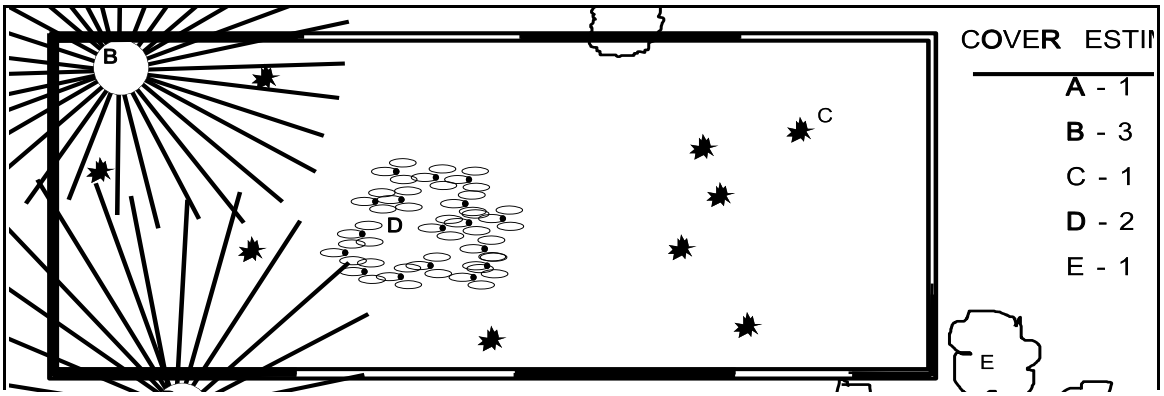
Imagine a line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescences) and project these polygonal images onto the ground. This projection is considered "canopy-coverage."

Decide which of the classes (see table) the canopy coverage of the taxon falls into, and record this value. Then consider the remaining taxa in turn. (see example in figure)

The painted design of the frame provide visual reference areas equal to 5, 25, 50, 75, and 90% of the plot area.

Not that a plant doe snot have to be rooted in the plot to have coverage over it, and accidents of foliage dispersal within the projected canopy outline are ignored.

COVERAGE-CLASS	RANGE OF COVERAGE	MIDPOINT OF RANGE
1	0-5%	2.5%
2	5-25	15
3	25-50	37.5
4	50-75	62.5
5	75-95	85
6	95-100	97.5



II. MODIFICATIONS FOR RECONNAISSANCE SAMPLING

OBJECTIVE: To obtain a rapid, semi-quantitative estimate of canopy coverage.

METHOD OF ESTIMATING COVERAGE:

1. Layout boundaries of a 375 m2 plot:

Circular with radius of 10.92 m (35.8 ft.)
Rectangular - 15 x 25 m.

2. Estimate canopy coverage class ocular for the entire plot using same principles as above, except use:
   T = 0-1% coverage (midpoint 0.5%)
   T = 1-5% coverage (midpoint 3.0%)
3. Compare estimated ocular coverage of given species with a fixed area to "calibrate" your eyeball.
   1% coverage = radius of 1.09 m (3.6 ft.)
   = square with sides of 1.94 m (6.4 ft.)
   5% coverage = radius of 2.44 m (8.0 ft.)
   = square with sides of 4.33 m (14.2 ft.)

Appendix A. Summary of sample data results by stands, and map units for meadows and wetlands in Onion Park Research Natural Area.

Sample	14	2,4,10	3,7	1	8	6,11	9	12	5	13
Stand Nos.										
Map Unit No. (See table 2)	4	1	2	2A	3	5	6	7	8	8
No. of Plots	n=2(macro)	n=25	n=20	n=10	n=9	n=15	n=10	n=5	n=10	n=5

CC & Const	CC RG	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC (K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)
SPECIES																				
(by Life Form)																				
TREES																				
Abilas	T-1	1(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Piceng	3-4	4(10)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pinalb	0-1	T(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pincon	0-1	1(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SHRUBS																				
Saldru	3-5	4(10)	--	+	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
Salmon	3-5	4(10)	--	+	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
GRAMINOIDS																				
Agrcan	--	--	0-2	T(1)	0-4	2(7)	0-T	T(4)	--	--	0-T	T(1)	--	--	--	--	0-2	1(7)	--	--
Agrida	T	T(5)	--	--	--	--	--	--	--	--	0-T	T(1)	--	--	--	--	--	--	--	--
Agrexa	T-1	T(10)	--	--	--	--	--	--	0-2	1(7)	--	--	--	--	--	--	--	--	--	--
Agrsca	0-T	T(5)	0-3	T(2)	--	+	0-T	T(1)	--	+	0-2	T(1)	--	--	--	--	--	--	1-2	2(4)
Aloalp	--	--	--	--	--	--	--	--	--	--	2-5	3(10)	0-2	T(2)	--	--	--	--	--	--
Brocar	--	--	--	--	0-2	T(1)	0-T	T(2)	--	--	--	--	--	--	--	--	0-3	1(6)	--	--
Brocil	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--
Broine	--	--	--	--	--	--	--	+	--	--	--	--	--	--	0-T	--	--	--	--	--
Calcan	0-1	1(5)	0-4	1(3)	0-2	T(1)	--	--	--	+	0-T	T(1)	0-4	1(5)	--	0-T	--	--	--	--
Carmic	--	--	--	--	--	--	--	--	--	--	0-2	T(1)	--	--	--	--	--	--	--	--
Carros	--	--	--	--	--	--	--	--	--	--	0-T	T(1)	--	--	--	--	--	--	3-6	5(10)
Car spp.	6-7	7(10)	T-5	3+(10)	0-2	T(2)	--	--	2-4	3(10)	0-5	2(8)	1-5	3(10)	--	--	--	--	1-3	2(4)
Danint	--	--	--	--	0-T	T(1)	--	+	--	--	--	--	--	--	--	--	--	--	--	--
Descae	1	1(10)	0-3	2(9)	0-2	1(3)	--	+	--	--	0-2	1(3)	T-5	3(10)	--	--	--	+	T-2	2(10)
Ericha	T	T(10)	--	--	--	--	--	--	1-2+	12(10)	--	--	--	--	--	--	--	--	--	--
Fesida	--	--	--	+	0-4	3(8)	1-4	3(10)	--	--	--	--	--	--	--	--	0-3	1(5)	--	--

Junbal	T	T(10)	0-1	T(5)	0-1	T(3)	--	--	--	--	0-1	T(1)	0-1	T(3)	--	--	0-T	T(1)	--	--
Junens	0-T	T(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Junmer	0-T	T(5)	0-T	T(1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Luzcam	0-T	T(5)	--	--	--	--	--	+	--	--	--	--	--	--	--	--	--	--	--	--
Melspe	--	--	--	--	0-1	T(2)	0-2	T(4)	--	--	0-1	T(1)	--	--	--	--	2-4	3+(10)	--	--
Phlalp	T	T(10)	0-2	T(2)	0-T	T(1)	0-T	T(1)	0-2	T(2)	0-1	T(1)	--	--	--	--	--	--	--	--
Phlpra	--	--	--	+	0-4	1(2)	0-2	T(2)	--	--	--	--	0-4	1(3)	--	--	--	+	--	--
Poalep	0-T	T(4)	--	--	--	--	--	--	--	--	--	--	--	--	0-T	T(4)	--	--	--	--
Poa spp.	--	--	--	--	0-1	T(2)	0-T	T(2)	--	--	0-T	T(1)	0-T	T(1)	--	--	--	--	--	--
Trispi	+	T(1)	--	--	--	--	--	--	--	--	0-T	T(2)	--	--	--	--	--	--	--	--
Triwol	--	--	--	--	--	--	--	--	--	--	0-T	T(1)	--	--	--	--	--	--	--	--

Appendix A. (Continued)

Sample	14	2,4,10	3,7	1	8	6,11	9	12	5	13
Stand Nos.										
Map Unit No.	4	1	2	2A	3	5	6	7	8	8
(See table 2)										
No. of Plots	n=2(macro)	n=25	n=20	n=10	n=9	n=15	n=10	n=5	n=10	n=5

CC & Const	CC RG	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC (K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)
SPECIES																				
(by Life Form)																				
FERNS																				
Equarv	1-2	2(10)	--	--	--	--	--	--	--	--	0-T	T(1)	0-5	1(1)	--	--	--	--	--	--
FORBS																				
Achmil	--	--	0-2	T(3)	0-2	1(3)	0-1	T(3)	--	--	0-2	T(2)	0-1	--	--	--	0-2	T(5)	--	--
Agolac	0-T	T(5)	--	+	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agoglu	--	--	0-T	T(1)	--	--	0-1	T(1)	--	--	--	+	--	--	--	--	--	+	--	--
Allbre	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--
Allgey	--	--	0-1	T(1)	0-1	T(5)	--	--	--	--	--	1(6)	--	--	--	--	0-2	T(6)	--	--
Allsch	--	--	0-1	T(3)	0-2	T(3)	--	--	--	--	0-1	T(1)	--	--	--	--	--	--	--	--
Alys sp.	--	--	--	--	0-T	T(1)	0-T	T(2)	--	--	0-1	--	--	--	--	--	0-T	T(3)	--	--
Angang	1-2	2(10)	--	--	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--
Antcor	--	--	--	+	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ante sp.	--	--	--	--	0-T	T(1)	--	--	--	+	--	--	--	--	--	--	--	--	--	--
Aranut	--	--	--	--	--	+	0-T	T(3)	--	--	--	+	--	--	--	--	--	--	--	--
Arecon	--	--	--	--	--	--	0-T	T(4)	--	--	--	--	--	--	--	--	--	--	1-2	--
Arn mol	1-2+	2(10)	0-4	T(3)	0-2	T(2)	--	--	--	--	--	1(7)	--	+	--	--	0-2	T(1)	--	2(4)
Astfol	T	T(10)	0-2	1(5)	0-3	1(7)	0-2	1(8)	--	+	0-3	2(6)	0-T	T(1)	--	--	0-T	T(1)	--	--
Camrot	--	--	--	--	--	--	0-T	T(3)	--	+	0-5	--	--	--	--	--	--	--	--	--
Camqua	--	--	0-3	1(6)	0-1	T(2)	--	--	--	--	--	T(4)	0-T	T(1)	--	--	--	+	--	--
Carbre	--	--	--	--	--	--	--	--	--	--	0-1	--	--	--	0-2	2(6)	--	--	--	--
Cascus	--	--	--	--	--	+	--	--	--	--	--	+	--	--	--	--	0-T	T(1)	--	--
Cerarv	--	--	--	--	0-T	T(2)	0-T	T(2)	--	--	--	--	--	--	--	--	0-T	T(1)	--	--
Cerhoo	--	--	--	+	0-5	1(3)	0-1	T(1)	--	--	--	T(3)	--	--	--	--	0-2	T(3)	--	--
Collin	--	--	--	--	0-2	T(3)	0-2	1(5)	--	--	0-3	T(2)	--	--	--	--	0-3	1(9)	--	--
Colpar	--	--	--	--	--	--	--	+	--	--	0-T	--	--	--	--	--	>0-T	T(4)	--	--
Creele	--	--	0-1	T(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Delbic	--	--	--	--	0-T	T(1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dodpul	--	--	0-2	T(3)	0-1	T(2)	--	--	--	--	--	T(1)	--	--	--	--	--	--	--	--

Drab sp.	--	--	--	--	--	+	--	--	--	--	0-1	--	--	--	--	--	0-T	T(3)	1(10)	--
Epialp	T	T(10)	--				0-T	T(1)	--	--	0-1	T(4)	--	--	--	--	T+2	--	--	
Epicil	7	T(10)	0-2	T(1)	0-1	T(5)	--	--	--	0-1	T(4)	--	--	--	--	--	0-1	T(1)	--	--
Fravir	0-1	1(5)	--	+	--	--	0-3	1(5)	--	--	--	T(1)	--	--	1-3	3(10)	--	--	--	--
Galbor	--	--	0-2	T(1)	--	--	--	--	--	--	0-T	--	--	--	--	--	--	+	--	--
Genaff	--	--	--	+	0-T	T(1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gerric	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
Gervis	--	--	--	--	--	--	0-3	1(5)	--	--	--	--	--	--	--	--	--	--	--	--
Geumac	--	--	--	--	--	--	--	--	--	--	0-2	T(3)	0-4	1(3)	--	+	--	--	--	--
Geutri	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--	--	--	--	--

Sample	14	2,4,10	3,7	1	8	6,11	9	12	5	13
Stand Nos.										
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CC & Const	CC RG	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC (K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)	CC Rg	CC(K)
SPECIES																				
(by Life Form)																				
FORBS (Cont)																				
Habdil	0-T	T(10)	0-1	T(2)	--	--	--	--	--	--	0-T	T(1)	--	+	--	+	--	--	--	--
Habsac	0-T	T(5)	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--	--	--
Linnut	--	--	--	--	--	--	--	--	--	+	--	--	--	--	--	--	0-3	T(4)	--	--
Lith sp.	--	--	--	--	--	--	0-T	T(2)	--	--	--	--	--	--	--	--	--	--	--	--
Mercil	--	--	--	--	--	+	0-T	1(1)	--	--	0-3	0-3	--	--	3-6	4(10)	--	--	--	--
Mimlew	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
Parfim	0-T	T(5)	--	--	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
Pedgro	T-1	1(10)	0-2	1(7)	--	--	--	--	--	--	0-3	T(3)	--	+	--	--	--	--	--	
Polbis	T	T(10)	0-3	2(7)	0-2	T(4)	--	+	--	--	0-1	T(3)	0-1	T(3)	--	--	--	--	--	--
Poldou	--	--	--	--	0-2	T(2)	0-2	1(5)	--	--	--	--	--	--	--	--	0-4	2+(10)	--	--
Potdiv	--	--	--	--	0-2	T(1)	--	--	--	--	--	+	--	--	--	--	--	+	--	--
Potgra	--	--	--	--	0-T	T(1)	0-3	1(6)	--	--	--	--	--	--	--	--	--	--	--	--
Rann sp.	--	+									0-2	T(2)	0-1	T(4)	--	--	--	--	--	--
Rumpac	--	--	--	+	--	--	0-2	1(4)	--	--	--	+	--	--	--	--	--	--	--	--
Saxarg	--	+	--	--	--	--	--	--	--	--	--	--	--	--	--	+	--	--	--	--
Saxore	--	--	0-T	T(1)	0-2	T(1)	--	--	--	--	--	+	--	--	--	--	0-2	T(2)	--	--
Senpse	0-T	T(5)	--	--	--	--	--	--	--	--	--	+	--	--	--	--	--	--	--	--
Sensph	--	--	0-3	1(3)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sentri	2	2(10)	0-2	1(3)	--	--	--	--	--	--	0-3	1(3)	0-T	T(1)	1-5	4(10)	--	--	--	--
Spirom	--	--	--	--		--	--	--	0-T	0-T	--	--	--	--	--	--	--	--	--	--
Stelon	--	--	--	--	0-1	T(1)	--	--	--	--	0-T	T(2)	--	--	--	--	--	--	--	--
Tarofc	--	--	0-T	T(1)	0-1	T(1)	--	--	--	--	0-3	T(3)	0-T	T(1)	--	--	--	--	--	--
Trilon	T-1	(10)	0-2	1(5)	0-2	1(6)	--	+	--	--	0-T	T(1)	0-1	T(3)	--	--	--	--	--	--
Trolax	T-1	1(10)	0-3	t(2)	0-4	1(3)	--	--	--	--	--	+	--	--	0-5	2(2)	--	--	--	--
Valsit	0-T	T(5)	0-3	T(1)	--	--	--	--	--	--	0-2	T(1)		--	--	--	--	--	--	--
Viola sp.	--	--	--	--	--	--	--	--	0-4	0-4	--	--	--	--	--	--	--	--	--	--
Zigele	--	--	0-2	T(2)	0-1	T(1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--

LIST OF FIGURES

1. Location of Onion Park Research Natural Area in relation to towns and highways.

2. Onion Park Research Natural Area within Tenderfoot Creek drainage.

3. General location of Onion Park meadows and wetlands with study area encircled. (Scale 4" = 1 mile).

4. General 1:24,000 scale Onion Park RNA habitat type map showing primary study area.

5. Detailed 8" = 1 mile of Onion Park habitat and community types.

6. Detailed 8" - 1 mile scale contour with habitat and community types within primary study area.

7. Photographically enlarged map of habitat and community types within the primary study area.

8. Original grazing allotment map for Harley Park allotment c1920-30. Onion Park wetlands and meadows are mapped as 'grassland'.

9. USDA Forest Service 1963 timber inventory with Onion Park wetlands and meadows mapped and shown as "non-forest grassland".

10. Habitat type map (1975) of the Tenderfoot Creek Experimental Forest. Onion Park wetlands and meadows are mapped as subalpine fir/bluejoint reedgrass (*Abla/Caca* ht.).

11. Habitat type map from Onion Park RNA establishment record. Onion Park wetlands and meadows are mapped as one grassland habitat - tufted hairgrass/sedge (*Deca/Carex* spp.).

12. Map of Onion Park wetlands and meadows prepared for this study. Nine discrete plant communities comprising the parklands were identified and mapped.