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NEVADA RANGELAND PHENOLOGY

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ACKNOWLEDGMENT

INTRODUCTION

METHODOLOGY

ANALYSIS AND INTERPRETATION

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PHENOLOGY

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1979

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DISTRICT INFORMATION

BLM

WINNEMCCA

CARSON CITY

CARSON CITY (NORTH OF SPANISH)

ELY

LAS VEGAS

BATTLE MOUNTAIN

TOUCH

CARRIAGE

NRC, Inc.

Reno, Nevada

Garwin Lorain

Diane Ives

Paul T. Tueller

Carol Fisher

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ACKNOWLEDGEMENT

NRC would like to thank the field personnel in each BLM district. Everyone was very co-operative, and the project ran very smoothly the past four years. We would also like to thank Mike Phillips and Don Jarvis for their interest and cooperation.

INTRODUCTION

This is the fourth and final yearly report presenting phenological data obtained statewide in Nevada. The data has been summarized for each district, and the information presented here will be useful for predicting plant phenological events.

Objectives:

1. To obtain phenology information for selected species from sites distributed statewide on BLM jurisdiction lands
2. To compare data for the growing seasons for the years 1976, 1977, 1978, and 1979 for selected species and sites
3. To present this data to the BLM in a useful format, along with some qualitative interpretations to serve the BLM as a guideline for their use and continued analysis and interpretation

INTRODUCTION

This is the fourth and final yearly report submitted to the National Science Foundation in support of the research program. The report contains a summary of the work done during the year, and the results of the research. It also contains a list of the publications and reports that have been prepared during the year.

OBJECTIVES

1. To obtain chemical information for the identification of the compounds in the samples.
 2. To compare data for the compounds in the samples with data for the compounds in the literature.
 3. To present data for the compounds in the samples in a form that will be useful to the chemist and the biologist.
- and to obtain data for the compounds in the samples in a form that will be useful to the chemist and the biologist.

METHODOLOGY

Each BLM district (Elko, Winnemucca, Carson City, Ely, Las Vegas, and Battle Mountain [including Tonopah]) and NRC, Inc. utilized the same sites as the last three years (Map 1). Carson City also has additional sites north of Reno.

Methodology for plant community and species selection, and methods for measuring vegetation remain the same as discussed in the 1976 and 1977 reports.

Average vegetation phenophase and height/leader growth were rated and noted on the same form all four years. In addition to soil moisture depth (band of moisture), field personnel collected data on soil temperature. Temperatures (every site/each visit) were collected at the same place each week, 10 to 15 centimeters below the surface. Rain cans to measure precipitation were installed at most sites; Elko utilized soil moisture bars instead of rain cans. All measurements were recorded in millimeters or centimeters, and Celsius degrees.

Data gathering began early, with some districts beginning as early as January (Las Vegas). Generally, sites were visited weekly March through May, approximately every 10 days in June and July, every other week in August and September, and at least once in October. Some districts gathered data in November, which was the cut-off date. A few districts had problems with a restricted number of personnel, and were therefore not able to go into the field as often as would be desired.

Each district kept the same representative numeral, and

vegetation community numbers remained the same as in the past (Table 1). A complete description of each site included elevation, aspect, general soil type and steepness of slope (Table 2).

All phenological and soil moisture data recorded during the study was summarized (annual phenodynamic tables). In order to facilitate interpretation of the table, abbreviations of two key words in a particular phenophase were utilized (i.e., twig growth = TG).

NRC developed graphs comparing four year data sets to serve as examples of possible BLM utilization of the data.

Four types of graphs were designed; one to three examples of each were illustrated for every district. Phenology of various species for the prior three years was compared with that of the same species for 1979. Although it was very difficult to interpret, any possible correlation between soil moisture depth and phenophases of plants in the four years was depicted. In addition, soil moisture depth and its effect on height/leader growth in the four data sets were contrasted. In both of the aforementioned types of graphs, an "S" represents surface moisture and "D" represents soil dry (moisture found at a level greater than 30 centimeters). Bar graphs illustrating time of leaf growth and twig growth for shrubs; growth starts, full bloom, plants dry for forbs; and $\frac{1}{2}$ vegetative growth, flower stalks first appear, seed dissemination, and plants dry for grasses were formulated. This type of graph will enable range managers to discern at a glance the

Table 1. Key numbering system assigned to BLM district and NRC sites.

<u>DISTRICT</u>	<u>NUMBER</u>
Elko	01
Winnemucca	02
Carson City	03
Carson City (North of Reno)	03A
Ely	04
Las Vegas	05
Battle Mountain	06
Tonopah	06A
Carroll Summit	07

<u>VEGETATION TYPE</u>	<u>NUMBER</u>
Southern desert shrub	-1
Salt desert shrub	-2
Northern desert shrub	-3
Seeding	-4
Pinyon/juniper	-5
Mountain meadow	-7
Coniferous forest	-8
Salt marsh	-9
Degraded with annual grasses	-10
Riparian	-11

Table 1. Key reporting system designed to collect data on the status of the environment.

District	Number
King	01
Winnebago	02
Green Bay	03
Green Bay (South of Harbor)	04
Elk	05
La Crosse	06
Battle Ground	07
Yoshida	08
Central Wisconsin	09

Reporting System	Number
South of Green Bay	-1
East of Green Bay	-2
North of Green Bay	-3
Reading	-4
Elk River	-5
Winnebago	-6
Green Bay Forest	-7
Self report	-8
Controlled with annual process	-9
Uncontrolled	-10
Uncontrolled	-11

Table 2. Elevation, aspect, slope and soil type of BLM and NRC, Inc. sites in Nevada utilized for data gathering.

<u>SITE</u>	<u>ELEVATION</u>	<u>ASPECT</u>	<u>% OF SLOPE</u>	<u>SOIL TYPE</u>
Las Vegas:				
05-1-1 (So.D.S.)	2,780	Level	0	-
05-1-2 (So.D.S.)	4,080	South	3	Sandy loam
05-2 (S.D.S.)	4,800	Level	0	Loam
05-3 (N.D.S.)	5,600	Level	0	Loam
05-7 (M.B.)	6,000	S.W.	15	Sandy clay loam
Carson City:				
03-2-1 (S.D.S.)	5,040	Level	0	Gravelly sand
03-3-1 (N.D.S.)	5,080	Level	0	Sandy
03-3-2 (N.D.S.)	5,326	East	2	Sandy
03-5-1 (P/J)	5,720	West	1	Rocky-sandy
03-5-2 (P/J)	6,880	East	5	Sandy
03-5-3 (P/J; dropped)	6,840	N.W.	5	Rocky
03-5-4 (P/J)	6,410	West	2	Meadow
03-7-1 (M.B.)	7,800	North	10	Sandy rocky loam
03-7-2 (M.B.; dropped)	7,260	N.W.	5	Rocky-sandy
03-7-3 (M.B.)	6,280	East	1	Sandy
03A-3 (N.D.S.)	5,000	N.E.	10	Sandy
03A-4 (seeding)	5,400	South	5	Sandy
03A-5 (P/J)	5,200	N.E.	19	Sandy
03A-7-1 (M.B.)	5,740	Level	0	Sandy
03A-7-2 (M.B.)	6,400	N.E.	53	Sandy loam
03A-2 (S.D.S.)	4,240	S.E.	1-4	Sandy
Tonopah:				
06A-2-1 (S.D.S.)	6,170	North	6	Clay loam
06A-2-2 (S.D.S.)	5,520	East	3	Sandy loam
06A-3 (N.D.S.)	6,400	East-wash	6	Sandy loam
Elko:				
01-3 (N.D.S.)	6,170	N.E.	4	Clay loam
01-4 (seeding)	5,870	N.E.	4	Clay loam
01-6 (M.M.)	5,676	Level	0	Loamy sand
01-7-1 and 2 (M.B.)	6,266	North	40	Silty clay loam
01-10 (A. grass)	5,676	S.W.	4	Sandy loam
Battle Mountain:				
06-2-1 (S.D.S.)	4,547	Level	0	Sandy
06-2-2 (S.D.S.)	4,740	S.E.	5	Clay

Table 1: Elevations of various points in the area of the ...
 (The text is mirrored and difficult to read due to the image quality.)

Point	Elevation (ft)	Notes
02-1 (S.D.S.)	5,785	
02-2 (S.D.S.)	4,980	
02-3 (S.D.S.)	4,800	
02-4 (S.D.S.)	5,000	
02-5 (S.D.S.)	5,000	
02-6 (S.D.S.)	5,000	
02-7 (S.D.S.)	5,000	
02-8 (S.D.S.)	5,000	
02-9 (S.D.S.)	5,000	
02-10 (S.D.S.)	5,000	
02-11 (S.D.S.)	5,000	
02-12 (S.D.S.)	5,000	
02-13 (S.D.S.)	5,000	
02-14 (S.D.S.)	5,000	
02-15 (S.D.S.)	5,000	
02-16 (S.D.S.)	5,000	
02-17 (S.D.S.)	5,000	
02-18 (S.D.S.)	5,000	
02-19 (S.D.S.)	5,000	
02-20 (S.D.S.)	5,000	
02-21 (S.D.S.)	5,000	
02-22 (S.D.S.)	5,000	
02-23 (S.D.S.)	5,000	
02-24 (S.D.S.)	5,000	
02-25 (S.D.S.)	5,000	
02-26 (S.D.S.)	5,000	
02-27 (S.D.S.)	5,000	
02-28 (S.D.S.)	5,000	
02-29 (S.D.S.)	5,000	
02-30 (S.D.S.)	5,000	
02-31 (S.D.S.)	5,000	
02-32 (S.D.S.)	5,000	
02-33 (S.D.S.)	5,000	
02-34 (S.D.S.)	5,000	
02-35 (S.D.S.)	5,000	
02-36 (S.D.S.)	5,000	
02-37 (S.D.S.)	5,000	
02-38 (S.D.S.)	5,000	
02-39 (S.D.S.)	5,000	
02-40 (S.D.S.)	5,000	
02-41 (S.D.S.)	5,000	
02-42 (S.D.S.)	5,000	
02-43 (S.D.S.)	5,000	
02-44 (S.D.S.)	5,000	
02-45 (S.D.S.)	5,000	
02-46 (S.D.S.)	5,000	
02-47 (S.D.S.)	5,000	
02-48 (S.D.S.)	5,000	
02-49 (S.D.S.)	5,000	
02-50 (S.D.S.)	5,000	
02-51 (S.D.S.)	5,000	
02-52 (S.D.S.)	5,000	
02-53 (S.D.S.)	5,000	
02-54 (S.D.S.)	5,000	
02-55 (S.D.S.)	5,000	
02-56 (S.D.S.)	5,000	
02-57 (S.D.S.)	5,000	
02-58 (S.D.S.)	5,000	
02-59 (S.D.S.)	5,000	
02-60 (S.D.S.)	5,000	
02-61 (S.D.S.)	5,000	
02-62 (S.D.S.)	5,000	
02-63 (S.D.S.)	5,000	
02-64 (S.D.S.)	5,000	
02-65 (S.D.S.)	5,000	
02-66 (S.D.S.)	5,000	
02-67 (S.D.S.)	5,000	
02-68 (S.D.S.)	5,000	
02-69 (S.D.S.)	5,000	
02-70 (S.D.S.)	5,000	
02-71 (S.D.S.)	5,000	
02-72 (S.D.S.)	5,000	
02-73 (S.D.S.)	5,000	
02-74 (S.D.S.)	5,000	
02-75 (S.D.S.)	5,000	
02-76 (S.D.S.)	5,000	
02-77 (S.D.S.)	5,000	
02-78 (S.D.S.)	5,000	
02-79 (S.D.S.)	5,000	
02-80 (S.D.S.)	5,000	
02-81 (S.D.S.)	5,000	
02-82 (S.D.S.)	5,000	
02-83 (S.D.S.)	5,000	
02-84 (S.D.S.)	5,000	
02-85 (S.D.S.)	5,000	
02-86 (S.D.S.)	5,000	
02-87 (S.D.S.)	5,000	
02-88 (S.D.S.)	5,000	
02-89 (S.D.S.)	5,000	
02-90 (S.D.S.)	5,000	
02-91 (S.D.S.)	5,000	
02-92 (S.D.S.)	5,000	
02-93 (S.D.S.)	5,000	
02-94 (S.D.S.)	5,000	
02-95 (S.D.S.)	5,000	
02-96 (S.D.S.)	5,000	
02-97 (S.D.S.)	5,000	
02-98 (S.D.S.)	5,000	
02-99 (S.D.S.)	5,000	
02-100 (S.D.S.)	5,000	

BAILE

WINNEMUCCA

CARROLL
SUMMITCARSON CITY
(NORTH)

Table 2 Continued-

<u>SITE</u>	<u>ELEVATION</u>	<u>ASPECT</u>	<u>% OF SLOPE</u>	<u>SOIL TYPE</u>
06-2-3 (S.D.S.)	4,590	East	2	Sandy loam
06-3 (N.D.S.)	6,100	West	85	Rocky
06-7 (M.B.)	6,150	East	-	-
Winnemucca:				
02-2 (S.D.S.)	4,800	East	2	Loamy
02-3-1 (N.D.S.)	6,200	S.E.	25	Clay skeletal
02-3-2 (N.D.S.)	5,200	East	4	Loamy
02-6 (M.M.)	6,900	S.E.	8	Clay skeletal
02-7 (M.B.)	7,200	S.E.	21	Clay skeletal
02-11 (Riper.)	5,600	East	7	Loamy
Ely:				
04-2 (S.D.S.)	6,600	West	5	Loam
04-3 (N.D.S.)	6,800	East	5	Loam
04-5 (P/J)	7,520	S.E.	5	Loam
04-6 (M.M.)	7,280	South	5	Silty loam
04-7 (M.B.)	8,000	Level	0	Stony loam
04-8 (Con.F.)	8,600	N.W.	30	Stony loam
04-9 (S.M.)	6,520	East	5	Silty loam
Carroll Summit:				
07-2 (S.D.S.)	5,200	N.W.	4	Stony loam
07-3 (N.D.S.)	6,080	S.W.	3	Loam
07-5 (P/J)	6,650	South	38	Sandy loam
07-6 (M.M.)	7,360	N.W.	14	Clay loam
07-7 (M.B.)	7,520	North	40	Rocky loam

the time period in which important phenophases occur and how they vary from year to year.

Graphs and complete data sets are listed by district, and include a discussion with each. A district map showing specific location of each sample site is provided.

Common and scientific names of all plants used in the study are listed in Appendix I.

In order to facilitate interpretation of the data sets, please refer to "Reading and Understanding the Annual Phenodynamic Tables".

the time period in which important changes took place

they vary from year to year.

Graphs and descriptive data are listed in Appendix I, and

include a discussion with each. A list of the names of the

cities included in each sample is given.

Common and scientific names of all plants listed in the

study are listed in Appendix II.

In order to facilitate interpretation of the data given

please refer to "Frequency and Distribution of Plants" under

Dynamic Tables.

ANALYSIS AND INTERPRETATION

This project has generated four years of plant phenological data on important range plant species throughout Nevada. A good cross-section of important range sites and environments have been sampled.

The data have been summarized, plotted, and subjectively interpreted. The strength of the correlations between phenophase development and influential parameters such as soil moisture, soil temperature, and precipitation should be statistically analyzed.

In order to accomplish these analyses, it would be useful to key punch the data onto cards for computer analysis. Several statistical routines should be used to test the relationships suggested during the course of the study. The purpose would be to determine the probability that these relationships will hold true during the time frame of proposed management plans designed for rangelands in the future.

ANALYSIS AND INTERPRETATION

The project has generated four years of plant production data on important range plant species throughout Nevada. A good cross-section of important range sites and environments have been sampled.

The data have been summarized, plotted, and statistically interpreted. The strength of the relationships between plant phase development and influential environmental factors such as soil moisture and temperature, and their effects on plant growth statistically analyzed.

In order to accomplish these analyses, it would be helpful to say that the data were first for computer analysis. Several statistical routines should be used to test the relationships suggested during the course of the study. The purpose should be to determine the probability that these relationships will hold true during the time frame of projected management plans designed for rangelands in the future.

GENERAL RESULTS AND CONCLUSIONS

Full benefit from the data will be derived only after the information has been entered into the computer, where a series of comparisons can be easily made. After four years, however, it appears that some patterns are emerging relative to the growth and development of the key species measured or followed during these studies.

There are some relatively prominent relationships between the development of a given species and the contemporary moisture and temperature patterns. There appears to be some strong correlations between the initiation of twig and leaf growth and the receipt of some level of precipitation during the preceding 30 days. There is also quite likely an interaction with soil temperature. For example, the development of grasses is highly dependent upon April, May and June precipitation, but significant growth of both vegetative and reproductive culms does not occur until soil temperatures warm up above 12-13 °C. The data points this out clearly, and while this has generally been a known factor about grass development, the data presented here will better establish the timing and thresholds for development that have been difficult to determine in the past.

For many species, plotting of all four years showed that the phenophases were extremely close irrespective of moisture and temperature regimes. In other words, development was essentially the same for all four years. This included the initiation of growth, the length of the reproductive period

ANNUAL REPORT OF THE COMMISSIONER OF THE GENERAL LAND OFFICE

Full details of the work done will be found in the annual report.

The information has been entered into the computer, and a series of computer print-outs can be made. It is, however, to be noted that some of the data are not reliable to the extent and development of the system described or followed during these studies.

There are some relatively small but significant differences between the development of a given system and the development of any system and temperature patterns. These differences are some of the correlations between the development of the system and the results of the development of the system. During the period of the study, there is also some fairly an interest in with soil temperature. The results of the development of the system is highly dependent upon the soil and the development of the system. The data points for the system are up above 15-17°C. The data points for the system are, and while this has generally been a known factor about the development of the system, the data points for the system are established for the system and the system for the system that have been difficult to determine in the past.

For many species, including all four species shown in the photographs were extremely close to the system of the system and temperature system. In other words, development was essentially the same for all four species. This included the initiation of growth, the length of the reproductive period

and onset of maturation. All phenophases occurred on nearly the same dates and for the same number of days. However, the opposite was true for numerous other species, wherein the phenodynamic showed considerable variation when the four years were compared. It would appear that four years is enough for certain species to define variation, while others need more than four years to define variability.

Many grasses and forbs complete their life cycle more rapidly when soil moisture is limiting. Some species show this potential, while others do not. The amount of variation found suggests that there may be no pat answers to phenodynamic analyses. These data strongly suggest that each site selected for a grazing management program will require an evaluation of the phenodynamics of key species.

and cause of resistance. All phenotypes occurred on the same date and for the same reason of day. However, the opposite was true for the other species, wherein the phenotypes showed considerable variation over the four years were observed. It would appear that for a single for certain species to define variation, while others need more than four years to define variability.

Many processes and forms developed during the early stages of life. The soil moisture is limited. The phenotypes show this potential, while others do not. The degree of variation thus suggests that there may be no real answer to phenotypic analysis. There is a large degree of variation and for a single measurement to define all variation of the phenotypes is not possible.

PHENODYNAMIC TABLE GUIDELINES

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(NORTH)

READING AND UNDERSTANDING THE
ANNUAL PHENODYNAMIC TABLES

To facilitate interpretation of the data, look at the "Symbol Sheet" with the phenophase abbreviations.

Each graph is divided into months which are subdivided into weekly time periods. An abbreviation appearing within the first time period signifies that it occurred approximately between day 1 and day 7 of that month.

Soil moisture depth is listed in centimeters for all sites. The first number represents where moisture started (distance from the top of the surface), and the second shows to what depth the moisture continues. If the latter number is listed with no period after it, the moisture is considered to continue (i.e., 15-30 = 15-30+ centimeters). Field personnel were often unable to dig much deeper due to hardpan, rocks, etc. If soil moisture is listed with a period after it, the moisture is considered as stopping at that point (i.e., 5-8.). Soil temperature is listed in Celsius degrees, and precipitation, in inches.

The scientific symbol for each plant is listed with its phenophases depicted. Phenophases are listed once and considered to continue until another phenotype is depicted.

Toward the latter months, some species had regrowth and that is shown with underlining.

In September, October, and November, data was sometimes collected only once or twice per month; therefore, some

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WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

THE EFFECT OF TEMPERATURE ON THE RATE OF
REACTION OF HYDROGEN PEROXIDE WITH
FERROUS SULFATE

The rate of reaction of hydrogen peroxide with ferrous sulfate was studied at various temperatures. The reaction is exothermic and the rate increases with increasing temperature. The following table shows the results of the experiment.

Temperature (°C)	Rate of Reaction (mol/l.s)
10	0.0012
20	0.0025
30	0.0050
40	0.0100
50	0.0200

It is evident from the above table that the rate of reaction increases with increasing temperature. This is due to the fact that the molecules of the reactants have more energy at higher temperatures and are therefore more likely to collide with sufficient energy to overcome the activation energy barrier.

The activation energy of the reaction can be calculated from the above data. The Arrhenius equation is given by:

$$\ln k = \ln A - \frac{E_a}{RT}$$

where k is the rate constant, A is the pre-exponential factor, E_a is the activation energy, R is the gas constant, and T is the absolute temperature.

By plotting $\ln k$ against $1/T$, a straight line is obtained. The slope of this line is $-E_a/R$. The activation energy of the reaction is found to be 40 kJ/mol.

The reaction is first order with respect to ferrous sulfate and first order with respect to hydrogen peroxide. The overall order of the reaction is therefore 2.

The rate of reaction is also affected by the concentration of the reactants. The rate increases with increasing concentration of ferrous sulfate and hydrogen peroxide.

The reaction is exothermic and the heat of reaction is 100 kJ/mol. The reaction is therefore self-accelerating and can become a runaway reaction if not properly controlled.

phenophases may have been missed. In these instances, phenophases in-between will have to be interpolated.

Various abbreviations have been used on the graphs. The following is an explanation:

gu = green up

sn = snow

fr = frozen

gr = grazed

phenomena are not limited to the above cases.

These phenomena are not limited to the above cases.

The following is a list of the phenomena.

1. The first phenomenon is the

the second phenomenon is the

the third phenomenon is the

the fourth phenomenon is the

the fifth phenomenon is the

Legend for 1976 through 1979

<u>1976</u>	<u>1977-1979</u>	<u>Data Sheets</u>	<u>Phenophase</u>
<u>SHRUBS</u>	<u>SHRUBS</u>		
	D	0-9	Dormant
\\	LG	10-19	Leaf Growth
////	TG	20-29	Twig Growth
○	BV	30-39	Flower Buds First Visible
□	FG	40-49	Leaves Full Grown
◇	1B	50-59	First Bloom
◆	FB	60-69	Full Bloom
●	BO	70-79	Bloom Over
△	SR	80-89	Seed Ripe
▲	SD	90-99	Seed Dissemination
◊	LY	100-109	Leaves Turn Yellow
◆	LD	110-120	Leaves Dry & Drop
<u>GRASSES</u>	<u>GRASSES</u>		
	D	0-9	Dormant
\\	GS	10-19	Growth Starts
□	$\frac{1}{2}$ V	20-29	$\frac{1}{2}$ Vegetative Growth
○	FS	30-39	Flower Stalks Appear
◆	HO	40-49	Heads Out Fully
*	An	50-59	Anthesis
△	DS	60-69	Dough Seed Set
△	HS	70-79	Hard Seeds
▲	SD	80-89	Seed Dissemination
◊	BD	90-99	Plants Begin to Dry
◆	PD	100-	Plants Dry-Summer

Legend for 1975-1976

1975	1975-1976	1976
SHEDS	SHEDS	SHEDS
11	10	10
12	11	11
13	12	12
14	13	13
15	14	14
16	15	15
17	16	16
18	17	17
19	18	18
20	19	19
21	20	20
22	21	21
23	22	22
24	23	23
25	24	24
26	25	25
27	26	26
28	27	27
29	28	28
30	29	29
31	30	30
32	31	31
33	32	32
34	33	33
35	34	34
36	35	35
37	36	36
38	37	37
39	38	38
40	39	39
41	40	40
42	41	41
43	42	42
44	43	43
45	44	44
46	45	45
47	46	46
48	47	47
49	48	48
50	49	49
51	50	50
52	51	51
53	52	52
54	53	53
55	54	54
56	55	55
57	56	56
58	57	57
59	58	58
60	59	59
61	60	60
62	61	61
63	62	62
64	63	63
65	64	64
66	65	65
67	66	66
68	67	67
69	68	68
70	69	69
71	70	70
72	71	71
73	72	72
74	73	73
75	74	74
76	75	75
77	76	76
78	77	77
79	78	78
80	79	79
81	80	80
82	81	81
83	82	82
84	83	83
85	84	84
86	85	85
87	86	86
88	87	87
89	88	88
90	89	89
91	90	90
92	91	91
93	92	92
94	93	93
95	94	94
96	95	95
97	96	96
98	97	97
99	98	98
100	99	99

Legend for 1976 through 1979

<u>1976</u>	<u>1977-1979</u>	<u>Data Sheets</u>	<u>Phenophase</u>
<u>FORBS</u>	<u>FORBS</u>		
	D	0-9	Dormant
⋈	GS	10-19	Growth Starts
○	FS	20-29	Flower Stalks Appear
◇	1B	30-39	First Bloom
◆	FB	40-49	Full Bloom
◊	BO	50-59	Bloom Over
△	SR	60-69	Seeds Ripe
▲	DS	70-79	Dissemination Starts
◊	BD	80-89	Plants Begin to Dry
◆	PD	90-	Plants Dry
◊	GR		Grazed

Soil Moisture Depth:

S= surface moisture

D= soil dry

BR= any soil condition which prevents further digging. (i.e,
hardpan, rocks, etc.)

fr= frozen

gr= grazed

gu= green-up

sn= snow

BATTLE
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SUMMIT
CARSON CITY
(NORTH)

DISTRICT INFORMATION

BAILEY

WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

DISTRICT INFORMATION

BAILE

WINNEMUCCA

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SUMMIT

CARSON CITY
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ELKO

The fourth season of data further establishes the general pattern of growth and development for range species near Elko (Figures 1 and 2). The phenology of bitterbrush (Purshia Tri-
dentata) is notable for the rather close correspondence among the four years. For this species four years of data seems to define well the phenological development. Phenology of the perennial sandberg bluegrass (Poa sandbergii) shows somewhat more variability among the four years. However, another perennial grass, squirreltail grass (Sitanion hystrix), shows a tight pattern for the four years (figure 3). Height growth of this species shows little relationship to soil moisture depth, although a dry period in June of 1977 slowed development (Figure 4).

Leader growth of green rabbitbrush (Chrysothamnus viscidiflorus) is not clearly related to soil moisture depth (Figure 5), although it may be related to quantity of soil moisture.

Among the grasses at the Elko sites, the initiation of vegetative growth is rather consistent, while the appearance of flower stalks, seed dissemination and maturity varies over several weeks depending upon the year (Figure 6). For shrubs, initiation of leaf and twig growth are both quite variable from year to year (Figure 7). Twig growth of green rabbitbrush began somewhat earlier than either bitterbrush or wild buckwheat (Eriogonum sp.). Forbs showed growth patterns with greater consistency than the shrubs (Figure 8). Maturity of balsamroot

(Balsamorhiza saggitata) was several weeks later than bluebells (Mertensia oblongifolia).

A review of the leader growth data for all species (Table 1) suggests that the 1978 and 1979 growth years were somewhat better than either 1976 or 1977. Such data should be reviewed in comparison to climatic data for the years involved.

Elko utilized soil moisture bars instead of rain cans to measure their "precipitation". A reading of $-.2$ represents saturation of the soil, -5.5 represents dry, and -15 means wilting point for the plants.

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(Balsamorhiza hirsuta) was reported from the same locality

(Morphology of the plant)

A review of the literature has not yet been published

It suggests that the 19th century data are more reliable
better than, either 1906 or 1917. Such data should be reviewed
in connection to climate data for the same locality.

Like utilized soil moisture data, the 19th century data on

measured their "precipitation" is recorded at 1906/1917

saturation of the soil. It is assumed that the 19th century

wilting point for the plant.

NEW LEAF
 GROWTH
 LEAVES DRY
 AND DROP
 LEAVES TURN
 YELLOW
 SEED
 DISSEMINATION
 SEED RIPE
 BLOOM OVER
 FULL BLOOM
 FIRST BLOOM
 LEAVES FULL
 GROWN
 FLOWER BUDS
 FIRST VISIBLE
 TWIG GROWTH
 LEAF GROWTH
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ————
 1977 ————
 1978 ————
 1979

Fig. 1. Phenology of
Purshia tridentata
 on mountain brush vege-
 tation type (site 01-7),
 Elko District.

BATTLE
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1976 - - - - -
 1977 —————
 1978 / / / / /
 1979

Fig. 2. Phenology of *Poa sandbergii* on northern desert shrub vegetation type (site 01-3), Elko District.

BATTLE
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CARROLI
SUMMIT
CARSON CITY
(NORTH)

1976 - - - - -
 1977 —————
 1978 —+—+—+—+—
 1979

Fig. 3. Phenology of *Sitanion hystrix* compared to soil moisture depth (inches) on northern desert shrub vegetation type (site 01-3), Elko District.

ATTACHED

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

1971-1972

BATTLE
WINNEMUCCA
CARROLL
CARSON CITY
(NORTH)

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 4. Height growth (mm) of Sitanion hystrix compared with soil moisture depth (inches), mountain brush vegetation type (Site 01-7), Elko District.

BATTLE
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CARROLL
CARSON CITY
(NORTH)

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ---
1977 —
1978 //
1979 •

Fig. 5. Leader growth (MM) of *Chrysothamnus viscidiflorus* compared with soil moisture depth (inches) on northern desert shrub vegetation type (site 01-3), Elko District.

1902

1903

1904

1905

1906

1907

1908

1909

1910

1911

1912

1913

1914

1915

1916

1917

1918

BATTLE
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(NORTH)

$\frac{1}{2}$ VEGETATIVE GROWTH

FLOWER STALKS FIRST APPEAR

SEED DISSEMINATION

PLANTS DRY

Fig. 6. Occurrence of various phenophases of selected grasses, Elko District

LEAF GROWTH

TWIG GROWTH

Fig. 7. Occurrence of leaf and twig growth of selected shrubs, Elko District.

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(NORTH)

01-3
Meob

1976

1977

1978

1979

01-7
Basa

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

GROWTH STARTS

FULL BLOOM

PLANTS DRY

Fig. 8. Occurrence of various phenophases of selected forbs, Elko District.

Table 1. Leader (Shrubs) and Height
(Grasses) Growth in the Elko
District for 1976, 1977, 1978,
and 1979.

		Millimeters						
	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 01-3</u>								
<u>SHRUBS</u>								
1. Artr	70		110		140		92	
2. Chvi	70		120		180	LG*	148	
<u>GRASSES</u>								
1. Elci	750		820		1000		805	
2. Stwe	220	100	200		250		222	12
3. Posa	300	60	200		230	95	379	60
4. Sihy	300	100	240		250	130	280	12
<u>FORBS</u>								
1. Lone	50		40		80		72	
2. Meob	92		80		120		131	
3. Asle	110				170	10	85	
4. Phdi			50		50	9	23	
5. Lule	110		100		210		220	
<u>Site 01-4</u>								
<u>SHRUBS</u>								
1. Artr	110		200		150		140	
2. Chnac					240		160	
<u>GRASSES</u>								
1. Agcr	380		370		450	155	370	70

*Leaf growth

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Table 1. *Juniperus communis* and *Juniperus horizontalis* growth in the field. Summary for 1970, 1971, 1972, and 1973.

1970									
Site 01-1									
SHRUBS									
1. Arct.	70	110	140	150	160	170	180	190	200
2. Crab.	70	110	140	150	160	170	180	190	200
GRASSES									
1. Blue.	70	110	140	150	160	170	180	190	200
2. Blue.	70	110	140	150	160	170	180	190	200
3. Blue.	70	110	140	150	160	170	180	190	200
4. Blue.	70	110	140	150	160	170	180	190	200
FOREST									
1. Pine	70	110	140	150	160	170	180	190	200
2. Spruce	70	110	140	150	160	170	180	190	200
3. Fir	70	110	140	150	160	170	180	190	200
4. Spruce	70	110	140	150	160	170	180	190	200
Site 01-2									
SHRUBS									
1. Arct.	70	110	140	150	160	170	180	190	200
2. Crab.	70	110	140	150	160	170	180	190	200
GRASSES									
1. Blue.	70	110	140	150	160	170	180	190	200
2. Blue.	70	110	140	150	160	170	180	190	200
3. Blue.	70	110	140	150	160	170	180	190	200
4. Blue.	70	110	140	150	160	170	180	190	200

*Least growth

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

01-4 Con't.

2. Sihy 200 210 2310 100 185 20

3. Posa 200 230 140 55 320

FORBS

1. Rhlox
sp. 30 90 25 2 30

2. Rate 25 27

Site 01-6

SHRUBS

1. Saal 1000 470 370 138

GRASSES

1. Cane 650 450 550 650

2. Juba 740 570 600 635

3. Agst 540 900 246 35

4. Popr 450 800 625 22

5. Brin 760 1130 635 30

FORBS

1. Migu 220 450 245

2. Rumex
sp. 700 670 920 461 30

3. Mear 250 540 366

Site 01-7

SHRUBS

1. Artr 210 160 205 84

2. Putr 70 110 135 64

3. Chvi 220 140 150 151

BATTLE

WINNEMUCCA

CARROLL
SIMPSON

CARSON CITY
(NORTH)

1905 Research 1917 Research 1917 Research 1917 Research

Site 01-1				Site 01-2			
SHRUBS				SHRUBS			
1. Ash	100	100	100	1. Ash	100	100	100
2. Elm	100	100	100	2. Elm	100	100	100
3. Oak	100	100	100	3. Oak	100	100	100
4. Pine	100	100	100	4. Pine	100	100	100
5. Spruce	100	100	100	5. Spruce	100	100	100
6. Fir	100	100	100	6. Fir	100	100	100
7. Birch	100	100	100	7. Birch	100	100	100
8. Willow	100	100	100	8. Willow	100	100	100
9. Alder	100	100	100	9. Alder	100	100	100
10. Poplar	100	100	100	10. Poplar	100	100	100
11. Cottonwood	100	100	100	11. Cottonwood	100	100	100
12. Sycamore	100	100	100	12. Sycamore	100	100	100
13. Magnolia	100	100	100	13. Magnolia	100	100	100
14. Dogwood	100	100	100	14. Dogwood	100	100	100
15. Redwood	100	100	100	15. Redwood	100	100	100
16. Juniper	100	100	100	16. Juniper	100	100	100
17. Cypress	100	100	100	17. Cypress	100	100	100
18. Palm	100	100	100	18. Palm	100	100	100
19. Bamboo	100	100	100	19. Bamboo	100	100	100
20. Fern	100	100	100	20. Fern	100	100	100
21. Moss	100	100	100	21. Moss	100	100	100
22. Lichen	100	100	100	22. Lichen	100	100	100
23. Mushroom	100	100	100	23. Mushroom	100	100	100
24. Spider	100	100	100	24. Spider	100	100	100
25. Beetle	100	100	100	25. Beetle	100	100	100
26. Butterfly	100	100	100	26. Butterfly	100	100	100
27. Frog	100	100	100	27. Frog	100	100	100
28. Snake	100	100	100	28. Snake	100	100	100
29. Squirrel	100	100	100	29. Squirrel	100	100	100
30. Chipmunk	100	100	100	30. Chipmunk	100	100	100
31. Mouse	100	100	100	31. Mouse	100	100	100
32. Rat	100	100	100	32. Rat	100	100	100
33. Weasel	100	100	100	33. Weasel	100	100	100
34. Skunk	100	100	100	34. Skunk	100	100	100
35. Fox	100	100	100	35. Fox	100	100	100
36. Wolf	100	100	100	36. Wolf	100	100	100
37. Coyote	100	100	100	37. Coyote	100	100	100
38. Bobcat	100	100	100	38. Bobcat	100	100	100
39. Mountain Lion	100	100	100	39. Mountain Lion	100	100	100
40. Jaguar	100	100	100	40. Jaguar	100	100	100
41. Leopard	100	100	100	41. Leopard	100	100	100
42. Panther	100	100	100	42. Panther	100	100	100
43. Tiger	100	100	100	43. Tiger	100	100	100
44. Lion	100	100	100	44. Lion	100	100	100
45. Elephant	100	100	100	45. Elephant	100	100	100
46. Giraffe	100	100	100	46. Giraffe	100	100	100
47. Zebra	100	100	100	47. Zebra	100	100	100
48. Horse	100	100	100	48. Horse	100	100	100
49. Donkey	100	100	100	49. Donkey	100	100	100
50. Mule	100	100	100	50. Mule	100	100	100
51. Camel	100	100	100	51. Camel	100	100	100
52. Llama	100	100	100	52. Llama	100	100	100
53. Alpaca	100	100	100	53. Alpaca	100	100	100
54. Vicuña	100	100	100	54. Vicuña	100	100	100
55. Guanaco	100	100	100	55. Guanaco	100	100	100
56. Ostrich	100	100	100	56. Ostrich	100	100	100
57. Emu	100	100	100	57. Emu	100	100	100
58. Kangaroo	100	100	100	58. Kangaroo	100	100	100
59. Wallaby	100	100	100	59. Wallaby	100	100	100
60. Koala	100	100	100	60. Koala	100	100	100
61. Possum	100	100	100	61. Possum	100	100	100
62. Quokka	100	100	100	62. Quokka	100	100	100
63. Tasmanian Devil	100	100	100	63. Tasmanian Devil	100	100	100
64. Wombat	100	100	100	64. Wombat	100	100	100
65. Sugar Glider	100	100	100	65. Sugar Glider	100	100	100
66. Flying Squirrel	100	100	100	66. Flying Squirrel	100	100	100
67. Arctomys	100	100	100	67. Arctomys	100	100	100
68. Peromyscus	100	100	100	68. Peromyscus	100	100	100
69. Mus musculus	100	100	100	69. Mus musculus	100	100	100
70. Rattus norvegicus	100	100	100	70. Rattus norvegicus	100	100	100
71. Sorex araneus	100	100	100	71. Sorex araneus	100	100	100
72. Talpidae	100	100	100	72. Talpidae	100	100	100
73. Erinaceidae	100	100	100	73. Erinaceidae	100	100	100
74. Marmota	100	100	100	74. Marmota	100	100	100
75. Citellus	100	100	100	75. Citellus	100	100	100
76. Onychomys	100	100	100	76. Onychomys	100	100	100
77. Neotoma	100	100	100	77. Neotoma	100	100	100
78. Reithrodontomys	100	100	100	78. Reithrodontomys	100	100	100
79. Hesperomys	100	100	100	79. Hesperomys	100	100	100
80. Perognathus	100	100	100	80. Perognathus	100	100	100
81. Zonotrichia	100	100	100	81. Zonotrichia	100	100	100
82. Quercus	100	100	100	82. Quercus	100	100	100
83. Pinus	100	100	100	83. Pinus	100	100	100
84. Juniperus	100	100	100	84. Juniperus	100	100	100
85. Taxus	100	100	100	85. Taxus	100	100	100
86. Picea	100	100	100	86. Picea	100	100	100
87. Abies	100	100	100	87. Abies	100	100	100
88. Larix	100	100	100	88. Larix	100	100	100
89. Cedrus	100	100	100	89. Cedrus	100	100	100
90. Cupressus	100	100	100	90. Cupressus	100	100	100
91. Thuja	100	100	100	91. Thuja	100	100	100
92. Taxodium	100	100	100	92. Taxodium	100	100	100
93. Ginkgo	100	100	100	93. Ginkgo	100	100	100
94. Cycas	100	100	100	94. Cycas	100	100	100
95. Sago Palm	100	100	100	95. Sago Palm	100	100	100
96. Pandanus	100	100	100	96. Pandanus	100	100	100
97. Rhizophora	100	100	100	97. Rhizophora	100	100	100
98. Sonchus	100	100	100	98. Sonchus	100	100	100
99. Helianthus	100	100	100	99. Helianthus	100	100	100
100. Zea mays	100	100	100	100. Zea mays	100	100	100

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

01-7 Con't.

4. Rosa sp.	90	100	80	62
5. Arar	150	110	200	130
6. Qnac	200	210	270	166
7. Amut		50	122	60

GRASSES

1. Feid	570		480		460	100	517	8
2. Elci	1230		960		1350		1131	
3. Posa	350	50	230		300	70	372	10
4. Agsp	610	100	530		450	105	710	
5. Sihy	300	100	180		300	125	370	12
6. Stth	470	70	230		450		450	
7. Brte					140	55	190	

FORBS

1. Meob	180	100	160	195		
2. Basa	600	270	450	410		
3. Maca	260		400	256	20	
4. Ragl			90	105		
5. Lupin sp.			320	400		
6. Eriog sp.	270	100	150	210		

Site 01-10

SHRUBS

1. Artr	140	190	290	189		
2. Chvi	100	160	150	LG*	122	LG*
3. Tegl					100	

* Leaf growth

BATTLE

WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 Vegetation 1977 Vegetation 1978 Vegetation 1979 Vegetation

01-7 Cont.

4. Bush	40	100	60	60
5. Aster	100	100	100	100
6. Querc	100	100	100	100
7. Amary	100	100	100	100
GRASSES				
1. Field	500	400	400	500
2. Field	1000	800	1000	1000
3. Bush	100	100	100	100
4. Amary	100	100	100	100
5. Sily	100	100	100	100
6. Sily	100	100	100	100
7. Rice			100	100

FORBES

1. Herb	100	100	100	100
2. Herb	100	100	100	100
3. Herb	100	100	100	100
4. Herb	100	100	100	100
5. Herb	100	100	100	100
6. Eriog	100	100	100	100

01-10

SHRUBS

1. Arct	100	100	100	100
2. Crat	100	100	100	100
3. Test				100

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

01-10 Con't.

GRASSES

1. Brte	320	100	160	380	55	300	2
2. Elci	1330		940	1600		1160	
3. Agda			510	550	130	421	
4. Posa			300	115		215	

FORBS

1. Sial	250		310	750	10	430	
2. Erci	90	20	140	300	30	110	

▲ SITE LOCATIONS
(not all shown due
to closeness)

ELKO DISTRICT

BATTLE
MOUNTAIN

WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

1975-1976

▲ SITE LOCATIONS
(Not all shown due
to closeness)

ELKO DISTRICT

THE LOCATION
OF THE
STATION

1913

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)									S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	11-13- 30	S- 30	S- 30	10-10- 35	10-10- 35	6- 30	5- 30	6- 30	16- 30	16- 30	S- 30	B- 30						
SM Blocks (all readings are minus)									.3	.3	.2	.3	.3	.4	.5		.8	.25, 22, 20,	.2	.3	.4,							11.5	.6				
S.T. °C									1	5	2, 5	2	4, 5	6	8	13	15	21	19	22	25	24	25	16	14	15	9	1					
ELKO 01-3																																	
SHRUBS:																																	
Artr									D					LG	TG	TG																	
Chv1									D		LG																						
GRASSES:																																	
Elc1									D				GS		1/2 V	1/2 V																	
Posa									D	GS																							
Shy									D																								
Stwe									D																								
FORBS:																																	
Asle									D	GS																							
Lone									D																								
Lule									D																								
Meob									D																								
Phd1									D																								

BATTLE
MOUNTAIN

WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
SM Blocks (All readings are minus)																																	
S.T.-°C																																	
ELKO 01-4																																	
SHRUBS:																																	
Artr																																	
Chnac (var.)																																	
GRASSES:																																	
Agcr																																	
Posa																																	
Sihy																																	
FORBS:																																	
Phlox sp.																																	
Rate																																	

BATTLE
WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
SM Blocks (All readings are minus)																																	
S.T. °C																																	
ELKO 01-6																																	
SHRUBS:																																	
Saal																																	
GRASSES:																																	
Agst																																	
BrIn																																	
Cane																																	
Juba																																	
Popr																																	
FORBS:																																	
Mear																																	
Migu sp.																																	
Rumex sp.																																	

BATTLE
WINNEMUCCA
CARROLL
SUMMIT
CARSON CITY
(NORTH)

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)							S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30
SM Blocks (all readings are minus)																						
S.T.- ⁰ C																						
ELKO 01-7-1																						
SHRUBS:																						
Amut																						
Artr																						
Chnac																						
Chvi																						
Putr																						
Rosa																						
GRASSES:																						
Elci																						
Feld																						
FORBS:																						
Maca																						
Meob																						
Erlog sp.																						

BATTLE
WINNEMUCCA
CARROLL
SUMMIT
CARSON CITY
(NORTH)

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
SM Blocks (All readings are minus)																																	
S.T. - °C																																	
ELKO 01-7-2																																	
SHRUBS:																																	
Arar																																	
GRASSES:																																	
Agsp																																	
Brte																																	
Posa																																	
Sihy																																	
Stth																																	
FORBS:																																	
Basa																																	
Lupin sp.																																	
Ragl																																	

BATTLE
WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

BATTLE
MOUNTAIN

WINNEMUCCA

CARROLL
SUMMIT

CARSON CITY
(NORTH)

WINNEMUCCA

The grass species development depicted in Figures 1 and 2 show considerable variability among years. The greatest variability seems to be associated with seed dissemination. No one year seems to be the earliest or latest for this phenophase.

Height growth of the annual cheatgrass (Bromus tectorum) varied significantly among years with 1977 producing the least growth (Figure 3). By comparison, the leader growth of green rabbitbrush (Chrysothamnus viscidiflorus) shows less variability, although 1979 shows the least growth (Figure 4).

The phenology of bud sagebrush (Artemisia spinescens), snowberry (Symphoricarpos longiflorus) and squirreltail grass (Sitanion hystrix) show similarity in their developmental curves (Figures 5, 6 and 7). Bud sagebrush showed the tightest pattern when comparing the four years of the study. Squirreltail grass developed up to three weeks earlier in 1976 and 1979. Most perennial grass species had completed considerable growth by 1979 - mid-April.

Leader growth data for all species was difficult to interpret (Table 1). In general, no one year showed significantly greater growth when compared with the other three years. Their data should be compared with climatic data to enhance their interpretability.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

The present species investigated included in 1954 and 1955
I show considerable variability among years. The present
variability seems to be associated with some other factor.
No one year seems to be the earliest or latest for this species
phase.

Relative growth of the annual, *Phlox subulata*,
varied significantly among years with 1954 reaching the least
growth (Figure 1). In comparison, the least growth of *Phlox*
subulata (the species) was recorded in 1954, less variability,
although 1958 shows the least growth (Figure 2).

The phenology of our subjects, *Phlox subulata*, and
Phlox (Syrphantha) longiloba and *Phlox (Syrphantha) longiloba*
hybrida show similarity to their counterparts (Figure 3).
In 1954 and 1955, the earliest growth of *Phlox subulata* was
in the first year of the study. *Phlox (Syrphantha) longiloba*
to these years earlier in 1954 and 1955. *Phlox (Syrphantha) longiloba*
species had completed considerable growth by 1954 - 1955.
Larger growth than the all species was recorded in 1954.
In 1954, the one year, *Phlox (Syrphantha) longiloba*
greater growth was compared with the other species. *Phlox*
data should be compared with other data to determine their
reproducibility.

02-3-1
Agsp

1976

1977

1978

1979

02-7

Elci

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

VEGETATIVE
GROWTHFLOWER STALKS
FIRST APPEARSEED
DISSEMINATION

PLANTS DRY

Fig. 1. Occurrence of various phenophases for selected grasses Winnemucca District.

02-6
Hobr

1976

1977

1978

1979

02-2
Sihiy

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

VEGETATIVE
GROWTH

FLOWER STALKS
FIRST APPEAR

SEED
DISSEMINATION

PLANTS DRY

Fig. 2. Occurrence of various phenophases of selected grasses, Winnemucca District.

1000

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 3. Height growth (mm) of Bromus tectorum compared with soil moisture depth (inches) on salt desert shrub vegetation type (site O2-2), Winnemucca District.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 4. Leader growth (mm) of *Chrysothamnus viscidiflorus* compared with soil moisture depth (inches) northern desert shrub vegetation type (site 02-3-2), Winne-mucca District

BATTLE
MOUNTAIN TN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 - - - - -
1978 + + + + +
1979

Fig. 5. Phenology of *Artemisia spinescens* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 02-2), Winnemucca District.

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NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 ————
1978 + + + + +
1979

Fig. 6. Phenology of
Symphoricarpos longiflorus
in mountain brush vegeta-
tion type (site 02-7),
Winnemucca District.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 -----
1977 —————
1978 —+—+—+—
1979●.....

Fig. 7. Phenology of *Sitanion hystrix* in salt desert shrub vegetation type (site 02-2), Winnemucca District.

Table 1. Leader (Shrubs) and Height (Grasses) Growth in Winnemucca District for 1976, 1977, 1978, and 1979.

Millimeters						
	1976	Regrowth	1977	Regrowth	1978	Regrowth 1979 regrowth
<u>Site 02-2</u>						
<u>SHRUBS</u>						
1. Grsp	70		45		♀ 70 ♂ 55	♀ 36 ♂ 52
2. Arsp	25		15		30	29
3. Atco	80		53		85	39
<u>GRASSES</u>						
1. Brte	240		50		200	172
2. Sihy	240		135		270	50 295 132
3. Posa	300		110		260	20 270
<u>FORBS</u>						
1. Lepe	180		150		200	200
<u>Site 02-3-1</u>						
<u>SHRUBS</u>						
1. Arar	70		15		180	85
2. Artr	45		27		230	121
3. Tegl			60		100	109
4. Chna			110		130	109
<u>GRASSES</u>						
1. Agsp	600		330		350	30 395
2. Posa	200		63		280	15 280
3. Sihy	300		200		230	145

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

02-3-1 Con't.

4. Brte	200	80	90		190	10	138	
5. Stth			80		200	10	145	56

FORBS

1. Luca	180		55		300		305	
2. Crac	190		160		120		255	
3. Phho	50		6		100		86	
4. Casti sp.	200		180		180		267	
5. Astra sp.			65		50		112	

Site 02-3-2

SHRUBS

1. Chvi	110		120		160		51	
2. Tegl	70		65		100		56	
3. Atco			50		110		35	
4. Arsp			15		30		13	
5. Artr			20		220		109	

GRASSES

1. Posa			30	70	280	20	282	
2. Sihy			165		260	40	248	84
3. Brte			20	70	180	30	181	

FORBS

1. Phho	50		2		40		84	
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Site 02-6

SHRUBS

1. Salix sp.	140		155		110		♀ 52 ♂ 64	
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BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

02-6 Con't.

GRASSES

1. Pobu	250	55	340	102
2. Hobr	450	100	500	358
3. Juncu sp.	400	300	300	468
4. Carex sp.	120	100	160	308

FORBS

1. Taof	85	75	150	262
2. Iris sp.	500	450	400	510
3. Acla	300	290	340	311
4. Veca	1000	650	600	
5. Cirsi sp.		460	400	705

Site 02-7

SHRUBS

1. Amal	45	9	30	130
2. Arar	170	15	140	157
3. Sylo	70	130	80	45
4. Hodi	60	73	85	125

GRASSES

1. Agsp	610	400	500	445
2. Elci	1200	880	1220	990
3. Posa	400	75	270	20 252

FORBS

1. Pesl	60		70	
2. Phho	40	14	80	12
3. Luca	400	250	360	228

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1978 Regrowth 1979 Regrowth 1978 Regrowth

02-6 Cont.

GRASSES

1. Poda	250	25	100
2. Hobb	450	100	400
3. Juncu sp.	400	200	300
4. Carex sp.	150	100	150

FORBS

1. Tact	65	75	150
2. Leta sp.	200	450	400
3. Acla	200	150	150
4. Voca	1000	200	500
5. Clival sp.		400	400

Site 02-7

SHRUBS

1. Amal	45	5	30
2. Arar	170	10	150
3. Sylo	70	100	50
4. Hodi	60	75	85

GRASSES

1. Agap	870	400	500
2. Eici	1200	200	1250
3. Posa	400	75	270

FORBS

1. Peda	60	70	
2. Phbo	40	15	80
3. Luca	400	250	250

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

02-7 Con't.

4. Zigad
sp.

250

250

5. Haplo
sp.

12

60

85

Site 02-11

SHRUBS

1. Riau 90

105

180

152

2. Rowo 110

63

100

116

3. Artr 120

50

280

162

4. Prvi 160

120

120

17

5. Chna

185

180

185

6. Salix
sp.

210

120

♀ 135

♂ 130

7. Potr

90

260

142

GRASSES

1. Posa 310

97

280

20

292

2. Pobu 330

125

400

405

3. Elci

700

990

891

4. Brte

180

200

30

205

5. Carex
sp.

85

130

116

FORBS

1. Erci 60

80

80

47

28

2. Cirsi
sp.

580

140

575

28

3. Arlu

400

370

506

4. Iris
sp.

480

580

640

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

▲ SITE LOCATIONS
(Not all shown due
to closeness)

WINNEMUCCA DISTRICT

Map of the County of
the State of New York
showing the location of
the Town of

WILKES BARRE TOWNSHIP

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)						S- 30 30	1- 30 30	6- 30 30	7- 30 30	3- 25 30	15- 30 30	D			D					5- 12		
precip. (in)						.55	.3	.07	.36	.56	0	.05			0	.15						
S.T. °C Maximum Minimum						10	13	16	19	17	21	25	26		27	27				26		
						7	3	4	7	7	7	13	16		19	19				14		
WINNEMUCCA 2-2																						
SHRUBS:																						
Atco						D	LG	TG		1B	FB	BO	LY			LD						
Arsp						LG	TG	BV	FB		BO					SD, LD						
Grsp						LG		TG	1B	FB	BO	SR										
						D	BV	TG	1B		FB	BO	LY									
GRASSES:																						
Sihy						GS 1/2			FS	FS	DS	DS	SD, BD							GS		
Posa						GS 1/2		FS	HO	HO	An		BD									
Brte						GS			FS	HO	DS		HS									
FORBS:																						
Lepe						GS		FS	FB	FB, BD	SR		DS									

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)			S- 30	S- 30 30	2- 30 2- 30 30 4- 30 9- 30	10- 30	D	4- 27 D 4- 28		S- 4	
Precip. (in)				.8	.51 1.22 0 .04	0	.98 0	1.02		.85	
S.T.-°C Maximum Minimum					16 7 18 16	18	33 18				
WINNEMUCCA 02-3-1											
SHRUBS:											
Artr			D		TG		BV			SR	
Arar			D		TG		BV	1B		SD	
Tegl			D	LG	TG BV		* LY LD			SR	
Chna			D	LG	TG						
GRASSES:											
Agsp			GS		1/2 V FS	An	SD, BD	PD			
Sihy			GS		1/2 V FS	DS	SD, PD				
Posa			GS		HO FS	DS	SD, PD				
Brte			GS		FS	DS				GS	
Stth			GS		1/2 V	DS	BD	PD			
FORBS:											
Phho			GS		FS 1B FB	BO	PD				
Crac			D	GS	FS	FB	PD				
Casti sp.			GS		FS FB	BO	DS, PD				
Luca			GS		FS FB	SR	PD				
Astra sp.			GS		FS FB	SR	DS, PD				

BATTLE
MOUNTAIN TN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY			JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)						S- 50	S- 30	S- 30	4- 30	2- 30	8- 30	22- 30	D 0	D 0	2- 13	D	1- 15			S- 12			
precip. (in)						.59	.4	.09	.69	.51	1.29	.02	0	0	.8	0	1.34			.38			
S.T.-°C						14	14	16	17	17	22	29	29	26	28	28	27			24			
Maximum						2	2	4	4	6	---	13	13	18	20	23	16			13			
Minimum																							
WINNEMUCCA 2-3-2																							
SHRUBS:																							
Atco						D				LG, TG		1B	FB	BO	LY					LD			
Arsp						LG	TG		1B	FB		BO		LD									
Artr						D				LG, TG				BV	LY								
Tegl						D					TG	BV		FB, SR, SD	LD								
Chvi						D				TG				BV	FB, LY		FB, LD						
GRASSES:																							
Posa						GS	1/2 V		FS	HO		DS	HS										
Sihy						GS	1/2 V			FS		An	DS							GS			
Brte						GS				FS		An	BD	PD									
FORBS:																							
Phho						GS	1B		FB			BO	SR	DS									
Ruan						FS	BO		SR	DS		gr.											

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE		JULY		AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)						1- 30	0- 30	3- 30	3- 30	1- 30	S- 30	S- 6	
Precip. (in)												0	
S.T.-°C													
WINNEMUCCA 02-6													
SHRUBS:													
Salix sp. ♀						TG, BO			LY				
♂						TG, SD			LY				
GRASSES:													
Pobu						HO	An	DS, BD	SD	PD		PD	
Hobr						IV		DS	SD, BD			SD, BD	
Carex sp.						FS	An	DS	HS	SD			
Juncu sp.						HO	An	DS	HS	SD		BD	
FORBS:													
Taof						FB	SR		PD			DS, PD	
Iris sp.						GS	FS	SH		DS			
Acla						GS	FS	FB	DS, BD	PD			
Cirsi sp.						FS		FB	SR, DS	BD		PD	

M U D

BATTLE
ACQUITTANT

CARROLL
SUMMIT

CARSON CITY
(NORTH)

SYMBOL, 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)					S- 7- 30 30	9- 30		2- D 25		3- 6	
Precip. (in)								.94 0		1.07	
S.T.-°C					16 17	15		25 23		14	
WINNEMUCCA 02-7											
SHRUBS:											
Amal					LG, TG, BV FB	BO	SR	LY		LD	
Hodi					LG BV	1B	1B	BO LY		LD	
Sylo					TG BV		SR	SD		LD	
Arar					LG TG		BV	1B		SD	
GRASSES:											
Agsp					1/2 V	FS	An	SD BD		PD	
Elci					1/2 V	FS	An	HS, SD, SD BD		PD	
Posa					FS An	DS	HS SD	SD, SD, BD PD		PD	
Sihy					1/2 V FS		DS	SD, BD BD			
FORBS:											
Phho					FB BO		DS, BD	PD			
Luca					FS 1B		BO, BD	PD			
Pesi					1B FB	SR		DS BD			
Haplo sp.					GS 1B	FB	SR, DS	PD			

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

Station	Time	Wind	Temp	Humidity	Pressure	Clouds	Sea	Remarks
1	0800	10	25	75	1015	10	1	
2	0900	12	26	76	1014	10	1	
3	1000	15	27	77	1013	10	1	
4	1100	18	28	78	1012	10	1	
5	1200	20	29	79	1011	10	1	
6	1300	22	30	80	1010	10	1	
7	1400	25	31	81	1009	10	1	
8	1500	28	32	82	1008	10	1	
9	1600	30	33	83	1007	10	1	
10	1700	32	34	84	1006	10	1	
11	1800	35	35	85	1005	10	1	
12	1900	38	36	86	1004	10	1	
13	2000	40	37	87	1003	10	1	
14	2100	42	38	88	1002	10	1	
15	2200	45	39	89	1001	10	1	
16	2300	48	40	90	1000	10	1	
17	0000	50	41	91	999	10	1	
18	0100	52	42	92	998	10	1	
19	0200	55	43	93	997	10	1	
20	0300	58	44	94	996	10	1	
21	0400	60	45	95	995	10	1	
22	0500	62	46	96	994	10	1	
23	0600	65	47	97	993	10	1	
24	0700	68	48	98	992	10	1	
25	0800	70	49	99	991	10	1	
26	0900	72	50	100	990	10	1	
27	1000	75	51	101	989	10	1	
28	1100	78	52	102	988	10	1	
29	1200	80	53	103	987	10	1	
30	1300	82	54	104	986	10	1	
31	1400	85	55	105	985	10	1	
32	1500	88	56	106	984	10	1	
33	1600	90	57	107	983	10	1	
34	1700	92	58	108	982	10	1	
35	1800	95	59	109	981	10	1	
36	1900	98	60	110	980	10	1	
37	2000	100	61	111	979	10	1	
38	2100	102	62	112	978	10	1	
39	2200	105	63	113	977	10	1	
40	2300	108	64	114	976	10	1	
41	0000	110	65	115	975	10	1	
42	0100	112	66	116	974	10	1	
43	0200	115	67	117	973	10	1	
44	0300	118	68	118	972	10	1	
45	0400	120	69	119	971	10	1	
46	0500	122	70	120	970	10	1	
47	0600	125	71	121	969	10	1	
48	0700	128	72	122	968	10	1	
49	0800	130	73	123	967	10	1	
50	0900	132	74	124	966	10	1	
51	1000	135	75	125	965	10	1	
52	1100	138	76	126	964	10	1	
53	1200	140	77	127	963	10	1	
54	1300	142	78	128	962	10	1	
55	1400	145	79	129	961	10	1	
56	1500	148	80	130	960	10	1	
57	1600	150	81	131	959	10	1	
58	1700	152	82	132	958	10	1	
59	1800	155	83	133	957	10	1	
60	1900	158	84	134	956	10	1	
61	2000	160	85	135	955	10	1	
62	2100	162	86	136	954	10	1	
63	2200	165	87	137	953	10	1	
64	2300	168	88	138	952	10	1	
65	0000	170	89	139	951	10	1	
66	0100	172	90	140	950	10	1	
67	0200	175	91	141	949	10	1	
68	0300	178	92	142	948	10	1	
69	0400	180	93	143	947	10	1	
70	0500	182	94	144	946	10	1	
71	0600	185	95	145	945	10	1	
72	0700	188	96	146	944	10	1	
73	0800	190	97	147	943	10	1	
74	0900	192	98	148	942	10	1	
75	1000	195	99	149	941	10	1	
76	1100	198	100	150	940	10	1	
77	1200	200	101	151	939	10	1	
78	1300	202	102	152	938	10	1	
79	1400	205	103	153	937	10	1	
80	1500	208	104	154	936	10	1	
81	1600	210	105	155	935	10	1	
82	1700	212	106	156	934	10	1	
83	1800	215	107	157	933	10	1	
84	1900	218	108	158	932	10	1	
85	2000	220	109	159	931	10	1	
86	2100	222	110	160	930	10	1	
87	2200	225	111	161	929	10	1	
88	2300	228	112	162	928	10	1	
89	0000	230	113	163	927	10	1	
90	0100	232	114	164	926	10	1	
91	0200	235	115	165	925	10	1	
92	0300	238	116	166	924	10	1	
93	0400	240	117	167	923	10	1	
94	0500	242	118	168	922	10	1	
95	0600	245	119	169	921	10	1	
96	0700	248	120	170	920	10	1	
97	0800	250	121	171	919	10	1	
98	0900	252	122	172	918	10	1	
99	1000	255	123	173	917	10	1	
100	1100	258	124	174	916	10	1	

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)							S- 30 30	S- 30 30		S- 30 30	2- 30 30	7- 30 30	4- 30 30	2- 30 30	7- 30 30	7- 30 30	20- 30 30				2- 24 24	D		1- 29 29									
precip. (in)								.85	.19				.59	1.3	.04	0	0				.90	0		1.38									
S.T.-°C Maximum							5	2		13			17	21	22	24	27				27	28		28									
Minimum										2			6	6	15	12	16				17	21		5									
WINNEMUCCA 02-11																																	
SHRUBS:																																	
Salix sp.							D			BV			FB	TG, SD BO							BV	LY							LD				
							D			BV			TG, FB LB		BO	SD						LY							LD				
Prvi							D			LG			TG		FB	BO	SR												LD				
Chna							D						TG																SR				
Chvi							D			LG			TG									FB							SR				
Artr							D						LG, TG				BV												SR				
Potr							D						TG	BV		SR	SD					LY											
Riau							D						TG, FB	LB		SR						LY											
Rowo							D			LG			TG		BV	FB	FB				BO								LD				
GRASSES:																																	
Posa							GS			½V			HO	FS	An	DS	SD, PD				PD												
Sihy							GS							½V	FS	HO	DS				PD												
Elci							GS							½V		FS	DS				SD, BD			BD					PD				
Pobu							GS			½V			FS		HO	DS	DS				SD	PD											

BATTLE
SUMMIT
CARROLL
CARSON CITY
(NORTH)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total	Average	Remarks
1900															
1901															
1902															
1903															
1904															
1905															
1906															
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2063															

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)											
Precip. (in)											
S.T. - °C											
Winnemucca 02-11 con't											
Grasses:											
Brte			GS		1/4 V FS An	DS SD, PD	PD				
Carex sp.			GS	1/4 V	FS HO An	DS DS	SD, BD			PD	
FORBS:											
Erci			GS	FS	BO SR DS	1B PD	SR, DS			GS	
Cirsi sp.			GS		FS	1B FB	DS DS			GS	
Clema sp.			D	GS			SR, DS, PD			PD	
Arlu			D			FS	BO, DS, SR, DS, BD	FB BD			
Iris sp.			GS		FS 1B	FB SR	SR, DS, BD				

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

CARSON CITY

In this fourth year of data, big sagebrush (Artemisia tridentata) shows twig growth to be about average with previous years (Figure 1), as does the height growth for Indian ricegrass (Oryzopsis hymenoides; Figure 2).

Desert globemallow (Sphaeralcea ambigua; Figure 3) bloomed five weeks earlier in 1978 and 1979, but in 1979 it quickly dried and was completely dry six to ten weeks before other years. Although not shown on this graph, the soil seemed to dry in 1979 about the time the plant dried.

Indian ricegrass started its phenophases slightly earlier in 1979, but quickly finished and dried before other years (Figure 4). Squirreltail grass (Sitanion hystrix; Figure 5), appears to strike a medium in 1979 between the previous years.

The bar charts on Figures six through eight seem to show that 1979 mostly averaged in with the three previous years for selected phenophases. Twigs on low sagebrush (Artemesia arbuscula; Figure 6) grew for only five weeks, whereas in previous years twig growth lasted up to five months. Indian ricegrass (Figure 7) began to dry in early July of 1979, three to seven weeks earlier than previous years. This was probably a reflection of soil moisture dropping quicker than in other years.

An excellent array of plant height for grasses and forbs, and twig growth for shrubs is portrayed in Table 1. Considerable variation is shown for most species over the four years. This gives the manager a good idea on what kind of variation might be expected from year to year.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 — — — —
1977 —————
1978 + + + + +
1979

Fig. 1. Leader growth (mm) of *Artemisia tridentata* compared with soil moisture depth (inches); pinyon-juniper vegetation type (site 03-5-4), Carson City District.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 - - - - -
 1977 —————
 1978 + + + + +
 1979

Fig. 2. Height growth (mm) of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on northern desert shrub vegetation type (site 03-3-1), Carson City District.

Fig. 3. Phenology of Sphaeralcea ambigua on salt desert shrub vegetation type (site 03-2-1), Carson City District.

PLANTS BEGIN
TO DRY
 $\frac{1}{2}$ VEGETATIVE
GROWTH
REGROWTH
PLANT DRY
PLANT BEGINS
TO DRY
DISSEMINATION
HARD SEED
DOUGH SEED SET
ANTHESIS
HEADS OUT
FULLY
FLOWER STALKS
 $\frac{1}{2}$ VEGETATIVE
GROWTH
GROWTH STARTS
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ————
1977 ————
1978 ————
1979 ······

Fig. 4. Phenology of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 03-2-1), Carson City District.

Fig. 5. Phenology of Sitanion hystrix on northern desert shrub vegetation type (site 03-3-1), Carson City District.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

03-5-1
Arar

1976

1977

1978

1979

03-3-2
Putr

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

LEAF GROWTH

TWIG GROWTH

Fig. 6. Occurrence of leaf and twig growth of selected shrubs, Carson City District.

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

03-5-4
Popr

1976

1977

1978

1979

03-2-1
Orhy

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

VEGETATIVE
GROWTH

FLOWER STALKS
FIRST APPEAR

SEED
DISSEMINATION

PLANTS DRY

Fig. 7. Occurrence of various phenophases of selected grasses, Carson City District.

03-3-1
Basa

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

GROWTH STARTS

FULL BLOOM

PLANTS DRY

Fig. 8. Occurrence of various phenophases of *Balsamorhiza sagittata*, Carson City District.

Table 1. Leader (Shrubs) and Height
(Grasses) Growth in the
Carson City District for
1976, 1977, 1978, and 1979.

Millimeters								
	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 03-2-1</u>								
<u>SHRUBS</u>								
1. Cela	70		80		125		70	
2. Artr	90		120		160		125	
3. Atca	118		70		85		80	
4. Tegl	120				90		55	
5. Chvi	71		100		105		75	
6. Atco	32		70		105		55	
7. Epne	240		80		0		110	
8. Chna	55		120		160		140	
9. Arsp			10		30		30	
10. Grsp			30		90		125	
<u>GRASSES</u>								
1. Orhy	190	150	290		310		300	
2. Sihy	250	100	270		215		225	
3. Stipa sp.					290		430	
<u>FORBS</u>								
1. Astra sp.	85		110		not found		35	
2. Spam	100		275		230		160	
<u>Site 03-3-1</u>								
<u>SHRUBS</u>								
1. Grsp	40		160		180		100	

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

Table 1. Growth of *Salix* spp. in 1977
 (Growth in height and diameter)
 (Mean ± SE)

1977 measurements 1977 diameter 1977 height

Site 02-1-1

SHRUBS

1. Ceta	70	80	108
2. Aler	90	130	125
3. Alce	118	90	90
4. Tegi	150	90	75
5. Chv	71	100	75
6. Alce	52	90	55
7. Kpne	240	80	110
8. Chm	52	100	75
9. Ksep	10	90	70
10. Gsep	30	90	125

GRASSES

1. Orvy	150	150	200
2. Sily	150	150	210
3. Stipe	sp.	200	230

FORBS

1. Asta	82	100	75
2. Spas	100	100	100

Site 02-1-1

SHRUBS

1. Gsep	40	100	100
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Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

03-3-1 Con't.

2. Pran	120	50	120	30
3. Artr	80	190	210	80
4. Chvi	50	145	145	95
5. Chna	35	140	150	130
6. Epvi	110	75	90	35
7. Lepu	80		180	200
8. Teca		100	140	120
9. Saca		110	70	65

GRASSES

1. Orhy	250	450	310	300
2. Brte	120	140	140	120
3. Sihy	130	250	245	220
4. Stco		180	290	260

FORBS

1. Basa	200	250	250	310
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Site 03-3-2

SHRUBS

1. Artr	115	160	180	80
2. Epne	100	115	100	40
3. Putr	30	120	130	40
4. Pran	35	70	90	50

GRASSES

1. Stth			230	200
2. Sihy	90	195	210	180

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 September 1 - 1976 September 10

1976-77-1 Con't

1. Prawn	120	120	120
2. Arty	80	100	100
3. Chry	80	120	120
4. Chna	70	120	120
5. Ecol	110	70	70
6. Japu	80	120	120
7. Tera	100	120	120
8. Saca	120	70	70

GRASSES

1. Ory	220	120	120
2. Hry	120	120	120
3. Siny	220	120	120
4. Sica	120	120	120

FORES

1. Bass	200	220	220
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1976-77-2

SHRUBS

1. Arty	120	120	120
2. Ecol	120	120	120
3. Puci	20	120	120
4. Prawn	70	120	120

GRASSES

1. Seta	120	120	120
2. Siny	80	120	120

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth
03-3-2 Con't.

3. Orhy	170	185	140	150
4. Stco		140	140	180

Site 03-5-1

SHRUBS

1. Arno-Arar	15	105	140	30
2. Tegl	75		55	35
3. Chna		145	140	100
4. Grsp			90	65

GRASSES

1. Brte	90	90	100	80
2. Sihy	109	160	240	180
3. Stipa sp.		100	175	180
4. Posa			80	

FORBS

1. Erci		100	150	30
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Site 03-5-2

SHRUBS

1. Artr	220	220	280	200
2. Pran	16	45	150	0
3. Putr	25	70	170	50
4. Chna	120	115	150	200
5. Ribes sp.	100		50	0
6. Symp sp.	70	100	90	110
7. Tegl		100	140	150

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976

1976 Department 1976 Department 1976 Department

03-2-3 Con. 1

2. 000	170	100	100
4. 000	100	100	100

Site 03-2-1

Summary

1. 000	100	100	100
2. 000	100	100	100
3. 000	100	100	100
4. 000	100	100	100

Summary

1. 000	100	100	100
2. 000	100	100	100
3. 000	100	100	100
4. 000	100	100	100

Summary

1. 000	100	100	100
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Site 03-2-2

Summary

1. 000	100	100	100
2. 000	100	100	100
3. 000	100	100	100
4. 000	100	100	100
5. 000	100	100	100
6. 000	100	100	100
7. 000	100	100	100

Millimeters

03-5-2 Con't.

GRASSES

1. Elci	850	335	680	800	150
2. Posa	32	70	160	150	155
3. Sihy	290	85	320	270	250
4. Stth				310	---

FORBS

1. Senec sp.		150	180	280
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Site 03-5-4

SHRUBS

1. Artr	300	280	230	200
2. Chna	120	170	150	140
3. Ribes sp.	15	105	80	20
4. Rowo	130	160	65	80

GRASSES

1. Popr	690	495	300	360
2. Juncu sp.	610	500	550	320
3. Carex sp.	370	175	160	150
4. Agrop sp.		520	670	600
5. Pobu		250	260	160
6. Agcr		440	600	400

FORBS

1. Poten sp.			380	300
2. Taof	205	140	120	65
3. Veth	640	1020	750	900

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

97-8-2 Cont.

GRASSES

1. Ely	850	302	600	500	150
2. Poa	32	70	100	150	150
3. Sib	200	85	200	200	250
4. Sec				210	---

FORBES

1. Sph			150	150	250
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Site 07-2-4

SHRUBS

1. Acer	300	150	150	250	200
2. Cera	120	170	150	150	150
3. Hib	15	102	80	80	20
4. Querc	120	150	65	65	60

GRASSES

1. Pop	650	455	200	200	200
2. Junc	610	200	250	250	250
3. Carex	270	175	150	150	150
4. Vulp		210	670	670	600
5. Poda		200	200	200	150
6. Agr		550	550	550	450

FORBES

1. P. sp.			150	150	250
2. Tof	200	140	120	120	60
3. Ver	650	1050	750	750	600

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

03-5-4 Con't.

4. Acmi 380 550 340

Site 03-7-1

1. Potr 260 250 55 190

2. Ribes_{sp.} 100 125 60 60

3. Syal 500 140 80 150

4. Artr 300 220 170 220

GRASSES

1. Posa 70 100 185 130(grazed) 180

2. Brte 170 160 grazed 180

3. Brca. 375 200(grazed) 400

FORBS

1. Alliu_{sp.} 180 175(grazed) 220

Site 03-7-3

SHRUBS

1. Artr 290 340 300 200

2. Pran 32 160 180 110

3. Ribes_{sp.} 14 170 90 60

4. Teca 130 150

5. Putr 75 135 140 110

6. Chna 250 160 140 150

7. Epvi 100 260 100 150

GRASSES

1. Agcr 485 165 500 450 500

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

1976 February 1977 February 1978 February 1979 February

01-2-4-6-8-10-12

4. Acorn

01-2-4-6-8-10-12

1. Pot

2. Ridge

3. Spat

4. Arter

GRASS

1. Pot

2. Ridge

3. Spat

GRASS

1. Arter

01-2-4-6-8-10-12

GRASS

1. Arter

2. Ridge

3. Spat

4. Arter

5. Pot

6. Ridge

7. Spat

GRASS

1. Arter

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth
03-7-3 Con't.

2. Sihy	300	110	315	220	300
3. Orhy	400	106	425	400	350
4. Agtr	671		600	400	600
5. Brte	265	80	210	100	140

FORBS

1. Circi sp.		450	600	600
2. Lysp		305	200	300

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

▲ CITY LOCATIONS
 (NOT ALL CITY LOCATIONS
 TO BE SHOWN)

CARSON CITY DISTRICT

BATTLE
MOUNTAIN
CARROLL
SUMMIT
CARSON CITY
(NORTH)

▲ SITE LOCATION
(Not all sites shown due
to closeness)

CARSON CITY DISTRICT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
SMD (From-To in cm)								S+ 2- 15				7- 30	7- 30	4- 30	6- 30	10- 30	10- 30	16- 30	20- 30	10- 30	24- 30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)											
Precip. (in)											
S.T. - °C											
Carson City Con't											
03-2-1 Con't											
GRASSES:											
Stipa sp.											
FORBS:											
Spam											
Astra sp.											

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)			S+ 3-15 S- 3	4-30 7-30	2-30 5-30 12-30	18-30 18-30 18-30	18-30 18-30 18-30	D			
Precip. (in)			Sn .02 .48	0	.13 .11 .06	0	0	.74			
S.T.-°C			6	14	14 13 18 21	22	22 21	25			
CARSON CITY											
03-3-1											
SHRUBS:											
Chvi			LG	TG, BV	TG			BV			
Grsp			LG	1B	FB BO	SR SD	SD	LD			
Epvi			LG	1B	FB	FB	SD	LD			
Artr			D	BV		BO	SR				
Chna			LG	TG	1B	FB	SD				
Teca			LG	BV	1B	BO	SD				
Pran			LG	TG	1B	BO	SD				
Lepu			D	BV	TG, BO	SR SD		SD			
Saca			LG	1B	FB	BO		LY			
GRASSES:			LG	TG		BO		LY			
Sihy			GS	1/2 V	FS	HO, DS	SD, BD	BD			
Orhy			GS	1/2 V	FS	HO	SD				
Brte			GS	1/2 V	FS	HO	SD				

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MAINTAIN

♀ ♂

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SYMBOL 1979											
SMD (From-To in cm)											
Precip. (mm)											
S.T. - °C											
Carson City											
03-3-1 Con't											
GRASSES:											
Stco			GS	1V 1/2	FS	HO	DS	HS	SD	SD	BD
FORBS:											
Basa			D	GS	1B	FB	SR	DS	BD	PD	

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE				JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)								S+ 2-15	1-30	6-30	4-30	6-30	1-30	8-30	11-30	20-30	21-30	3-30	17-30															
Precip. (in)								.05	.20	0	0	.26	.07	.01	0	0	0	.47	0		0		0											
S.T.-°C								5	10	7	15	13	15	14	22	22	25	24	20	20	21	25	23											
CARSON CITY																																		
03-3-2																																		
SHRUBS:																																		
Artr								LG			TG																							
Epne								D																										
Pran								D																										
Putr								LG																										
GRASSES:																																		
Orhy								GS			1/2																							
Sihy								GS			1/2																							
Stth								GS			1/2																							
Stco								GS			1/2																							
Brte								D			1/2																							

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)						S+ 3-30 0	7-30 1-30 0	8-30 4-30 0	9-30 10-30 0	10-30 11-30 0	11-30 12-30 0	12-30 13-30 0	13-30 14-30 0	14-30 15-30 0	15-30 16-30 0	16-30 17-30 0	17-30 18-30 0	18-30 19-30 0	19-30 20-30 0	20-30 21-30 0	21-30 22-30 0	22-30 23-30 0
Precip. (in)							0	.13	.20	.12	.04	0	0	0	.02	0	0	.38	0	0	0	0
S.T. - °C						6	11	13	11	14	12	19	21	24	22	20	24	26	24	24	24	24
CARSON CITY																						
O3-5-1																						
SHRUBS:																						
Arno						LG																
Chna						D	LG															
Tegl						LG																
Grsp						LG																
Chv1						LG																
GRASSES:						GS																
Sihy						GS																
Brte						GS																
Stipa sp.						GS																
Posa						GS																
FORBS:																						
Erci						GS																

♀ ♂

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MAINTAIN

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
Precip. (in)																																	
S.T.-°C																																	
CARSON CITY																																	
03-5-4																																	
SHRUBS:																																	
Rowo																																	
Chna																																	
Artr																																	
Ribes sp.																																	
GRASSES:																																	
Popr																																	
Agrop sp.																																	
Pobu																																	
Juncu sp.																																	
Agcr																																	
Carex sp.																																	
FORBS:																																	
Veth																																	
Poten sp.																																	
Acmi																																	
Taof																																	

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
Precip. (in)																																	
S.T.-°C																																	
CARSON CITY																																	
03-7-01																																	
SHRUBS:																																	
Ribes sp.																																	
Artr																																	
Potr																																	
Syal																																	
GRASSES:																																	
Brte																																	
Posa																																	
Brca																																	
FORBS:																																	
Alliu sp.																																	

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
Precip. (in.)																																	
S.T. °C																																	
CARSON CITY																																	
O3-7-3																																	
SHRUBS:																																	
Artr																																	
Chna																																	
Epsi																																	
Ribes sp.																																	
Pran																																	
Teca																																	
Putr																																	
GRASSES:																																	
Agcr																																	
Brte																																	
Agtr																																	
Orhy																																	
Sihy																																	
FORBS:																																	
Cirsi sp.																																	
Lysp																																	

CARSON CITY
(NORTH)

CARROLL
SUMMIT

BATTLE
MOUNTAIN

BATTLE
MOUNTAIN

CARROLL
SUMMIT

CARSON CITY
(NORTH)

CARSON CITY (NORTH OF RENO)

This data set is most notable for the similarity among the three years 1977, 1978, and 1979. No data was obtained in 1976. The data for bitterbrush (Purshia tridentata; Figure 1), Indian ricegrass (Oryzopsis hymenoides; Figure 2), and Needle-and-thread (Stipa comata; Figure 3) show curves that are very similar. Leader growth data for bitterbrush shows that 1979 was intermediate in growth rate when compared with 1978, a good growth year, and 1977, a poor growth year (Figure 5). Height growth of Indian ricegrass was very similar in 1978, but 1977 was a year where growth came later and exceeded both 1978 and 1979 (Figure 6).

Seed dissemination occurred about one week later for squirreltail grass (Sitanion hystrix) in 1978 when compared with 1977 and 1979 (Figure 7) and several weeks earlier in 1979 for lupine (Lupinus caudatus; Figure 9). Twig growth of bitterbrush was much later in 1977 than either 1978 or 1979 (Figure 8). Shrub leader growth was somewhat less in 1979, when compared with 1977 and 1978 (Table 1), indicating a poorer growth year. For grasses, the culm height growth was comparable in each year.

On a couple of sites, winterfat (Ceratoides lanata) and peachbrush (Prunus andersonii) did not develop twig growth; rabbitbrush (Chrysothamnus nauseosus) developed almost no seed heads in 1979.

NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1977 ---
1978 +++
1979 —

Fig. 1. Phenology of *Purshia tridentata* in mountain brush vegetation type for Carson City north of Reno (Site 03A-7-2) for 1977, 1978, and 1979.

REGROWTH
PLANT DRY
PLANT BEGINS
TO DRY
DISSEMINATION
HARD SEED
DOUGH SEED SET
ANTHESIS
HEADS OUT
FULLY
FLOWER STALKS
 $\frac{1}{2}$ VEGETATIVE
GROWTH
GROWTH STARTS
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1977 —————
1978 |||||
1979 —————

Fig. 2. Phenology of *Oryzopsis hymenoides* in northern desert shrub vegetation for Carson City north of Reno (Site 03A-3) for 1977, 1978, and 1979.

RESEARCH

PLANT

PLANT

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BATTLE
MOUNTAIN

CARROLL
SUMMIT

1977 - - - - -
1978 |||||
1979 _____

Fig. 3. Phenology of *Stipa comata* in northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977, 1978, and 1979.

RESEARCH

PLANT DAY

PLANT SCIENCE

TO DAY

PRESENTATION

WARD ROOM

ROOM 200

WATER

HEAD OUT

WATER

WATER STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

STATION

BATTLE
MOUNTAIN

CARROLL
SUMMIT

1977 - - - - -
 1978 | | | | |
 1979 —————

Fig. 4. Phenology of *Sitanion hystrix* compared with soil moisture depth (inches) on northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977, 1978, and 1979.

500+

500

450

400

350

300

250

200

150

100

50

0

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

1977

1978

|||||

1979

Fig. 5. Leader growth(mm) of Purshia tridentata compared with soil moisture depth (inches) on mountain brush vegetation type for Carson City north of Reno (Site 03A-7-1) for 1977, 1978 and 1979.

1977 ---
1978 |||||
1979 ———

Fig.6. Height growth(mm) of Oryzopsis hymenoides compared with soil moisture depth (inches) on northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977, 1978, and 1979.

03A-3
Sihy
1977

1978

1979

03A-5
Sihy

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

$\frac{1}{2}$ VEGETATIVE
GROWTH

FLOWER STALKS
FIRST APPEAR

SEED
DISSEMINATION

PLANTS DRY

Fig. 7. Occurrence of various phenophases of Sitanion hystrix for Carson City north of Reno (Sites 03A-3 and 03A-5) for 1977, 1978 and 1979.

LEAF GROWTH

TWIG GROWTH

Fig. 8. Occurrence of various phenophases of Purshia tridentata on Carson City north of Reno (Site 03A-7-1) in 1977, 1978 and 1979.

GROWTH STARTS

FULL BLOOM

PLANTS DRY

Fig. 9. Occurrence of various phenophases of Lupinus caudatus for Carson City north of Reno (Site 03A-3) in 1977, 1978 and 1979.

Table 1. Leader (Shrubs) and Height
(Grasses) Growth in Carson City District
(North of Reno) in 1977 and 1978.

		Millimeters			
1977	Regrowth	1978	Regrowth	1979	Regrowth

Site 03A-2
Estab. 1978

SHRUBS

1. Grsp		152		85
2. Atco		175		50
3. Artr		190		65
4. Save		160		65
5. Arsp		78		30
6. Atca		120		50
7. Cela		180		83

GRASSES

1. Orhy		490		400
2. Sihy		340		360
3. Stth		505		440
4. Brte		315		180

Site 03A-3

SHRUBS

1. Artr	170		175		65
2. Chvi	150		180		80
3. Pran	80		150		0
4. Tegl	160		160		55
5. Ribes sp.			270		50
6. Grsp	120		110		73

GRASSES

1. Stco	750		560		335
2. Brte	250	220	225		150
3. Orhy	310		260		265

BATTLE
MOUNTAIN

CARROLL
SUMMIT

BATTLE
MOUNTAIN

CARROLL
SUMMIT

	Millimeters					
	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 03A-3</u> <u>con't</u>						
<u>GRASSES</u>						
1.Sihy	230		320		280	
<u>FORBS</u>						
1.Luca	180		470		160	
<u>Site 03A-4</u>						
<u>SHRUBS</u>						
1. Tegl	--		230		35	
2. Atca	135		130		65	
3. Chvi	--		110		59	
<u>GRASSES</u>						
1. Agcr	70		920		870	
2. Elci	875		1300		1030	
3. Agin	500		890		660	
4. Sihy	280		500		530	
5. Sece	900		1200		650	
6. Brte	260		280		120	
<u>FORBS</u>						
1. Mesa	860		600		700	
<u>Site 03A-7-1</u>						
<u>SHRUBS</u>						
1. Artr	150		170		65	
2. Putr	35		100		47	
3. Chvi	180		160		75	
4. Ribes sp.	60		155		15	
5. Tegl	175		245		45	

Site 02A-2

GRASSES

1. Siny	120	120	120
2. Luce	120	120	120

Site 02A-4

GRASSES

1. Tedj	120	120	120
2. Aice	120	120	120
3. Chyl	120	120	120

GRASSES

1. Agor	120	120	120
2. Eict	120	120	120
3. Agin	120	120	120
4. Siny	120	120	120
5. Sice	120	120	120
6. Bity	120	120	120

GRASSES

1. Meas	120	120	120
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Site 02A-7-1

GRASSES

1. Artn	120	120	120
2. Pwt	120	120	120
3. Chyl	120	120	120
4. Bity	120	120	120
5. Tedj	120	120	120

Millimeters

1977 Regrowth 1978 Regrowth 1979 RegrowthSite 03A-7-1
con'tGRASSES

1.Orhy	480	380	340
2.Stth	490	380	275
3.Brte	280	130	140
4.Sihy	400	390	330
5.Feme	22	45	45
6.Agcr	500	690	380 (grazed)

FORBS

1.Wyeth sp.	560	480	390
2.Luca	220	340	250

Site 03A-7-2SHRUBS

1.Cela	125	40	0
2.Artr	165	200	70
3.Ceve	140	135	39
4.Ribes sp.	105	180	45
5.Chvi	130	120	80
6.Putr	100	110	0
7.Teca	190	180	35
8.Chna		180	--

GRASSES

1.Mebu	300	315	245
2.Posa	90	300	180
3.Sihy	460	285	280
4.Stth	470	340	330
5.Brte		225	210

Site 02A-7-1
Unit C

GRASSES

1. Orby	480	520	360
2. Scch	480	380	270
3. Brce	380	170	140
4. Siny	400	380	230
5. Fene	22	42	40
6. Agor	500	680	580 (grazed)

FORBS

1. Wyeth sp.	320	480	280
2. Luch	220	210	120

Site 02A-7-2

SHRUBS

1. Orla	120	40	0
2. Actr	160	800	70
3. Cava	140	130	20
4. Ribes sp.	100	160	40
5. Chyl	130	160	40
6. Pust	100	110	0
7. Tech	190	180	15
8. Crna	160	160	—

GRASSES

1. Mebu	300	510	240
2. Rose	90	700	100
3. Siny	460	220	220
4. Scch	470	260	270
5. Brce	—	240	210

BATTLE
MOUNTAINCARROLL
SUMMIT

Millimeters

	1977	Regrowth	1978	Regrowth	1979	Regrowth
--	------	----------	------	----------	------	----------

Site 03A--7-2 con't

FORBS

1.Luca	250		320		300	
2.Wyeth sp.	530		490		520	

Site 03A-5

SHRUBS

1.Grsp	45		150		75	
2.Artr	135		200		70	
3.Chvi	120		195		75	
4.Ribes sp.	55		100		0	

GRASSES

1.Brte	230		210		135	
2.Stco	490		450		315	
3.Orhy	310		400		285	
4.Sihy	280		430		350	

FORBS

1.Basa	280		450		330	
--------	-----	--	-----	--	-----	--

CARSON CITY DISTRICT

FORMS

1. Luce	250	250	250
2. Wyeck sp.	250	250	250

155 OSA-8

SHRUBS

1. Grep	45	150	15
2. Arce	150	100	75
3. Chai	150	150	15
4. R. R. sp.	75	150	0

GRASSES

1. Brye	750	210	135
1. Arce	450	450	275
2. Gray	170	450	250
4. Silv	350	450	150

FORMS

1. B. sp.	250	450	250
-----------	-----	-----	-----

CARSON CITY DISTRICT

▲ SITE LOCATIONS
 (Not all sites shown due
 to closeness)

CARSON CITY DISTRICT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
Precip. (in)																																	
S.T.-°C																																	
CARSON CITY NO.																																	
03A-2																																	
SHRUBS:																																	
Grsp																																	
Artr																																	
Save																																	
Arsp																																	
Atca																																	
Chvi																																	
Cela																																	
Tegl																																	
GRASSES:																																	
Orhy																																	
Sihy																																	
Brte																																	
Stth																																	
Stco																																	

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	JAN			FEB			MARCH		APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
							2- 15	S- 15	1- 15	3- 15	2- 15	S- 15	3- 15	6- 15	7- 15	8- 15	19	26	28	15	D	D	2	D	10	14						
SMD (From-To in cm)																																
Precip. (in)							0	.05	.16	.16	.10	.129	0	.5	0	0	0	0	0	.75	0	0	1.4	1.0	0	0						
S.T.-°C							5	5	4	6	12	10	10	17	14	18	19	24	26	21	20	23	21	20	17	20						
CARSON CITY NO. 03A-3																																
SHRUBS:																																
Artr							LG					TG																				
Chvi							D	LG					TG																			
Pran							D	LG					BV	1B	FB	BO																
Tegl							LG																									
Grsp							LG						TG, FG																			
							LG						TG, FG																			
							LG						BV																			
Ribes sp.							LG						FB																			
GRASSES:																																
Stco							D	GS																								
Brte							GS																									
Orhy							D	GS																								
Sihy							GS																									
FORBS:																																
Luca							D																									

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BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)																						
Precip. (in)																						
S.T.-°C																						
CARSON CITY NO.																						
03A-4																						
SHRUBS:																						
Atca																						
Chvi																						
Tegl																						
GRASSES:																						
Agcr																						
Elci																						
Agin																						
Sihiy																						
Sece																						
Brte																						
FORBS:																						
Mesa																						
Onobr sp.																						

BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL, 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)							S-15	S-15	S-15	S-15	4-15	8-15	5-15	3-15	8-15	12-15	20	24	27	17	D	D	2	27		7	12	16					
Precip. (in)							0	.06	.19	.24	.02	.03	.57	0	.5	0	0	0	0	.8	0	0	.4	0		1.5	0	0					
S.T.-°C							4	7	4	5	12	12	8	17	16	20	26	25	20	18	24	21		20		22	18	19					
CARSON CITY NO.																																	
03A-5																																	
SHRUBS:																																	
Grsp							LG	LG	LG	LG	LG	BV	FG	FG	1B	FB	FB	FB	BO	BO	SR	SD, LY	LY	LY	FG								
Artr							LG	LG	LG	LG	LG	TG	TG								BV	BV	FG	FG									
Chvi							LG	LG	LG	LG	LG	FB			BO		SR, SD, LY		LD														
Ribes sp.							LG	LG	LG	LG	1B						An	DS, HS, BD	SD, PD														
GRASSES:							GS	GS	GS	GS		1/2	1/2	1/2	1/2		DS, HS, BD	SD, PD							GS								
Brte							GS	GS	GS	GS		1/2	1/2	1/2	1/2		HO	An	DS, HS, BD	SD, PD					GS								
Stco							GS	GS	GS	GS		1/2	1/2	1/2	1/2		HO	An	DS, HS, BD	SD, PD					GS								
Orhy							GS	GS	GS	GS		1/2	1/2	1/2	1/2		HO	An	DS, HS, BD	SD, PD					GS								
Sihy							GS	GS	GS	GS		1/2	1/2	1/2	1/2		HO	An	DS, HS, BD	SD, PD					GS								
Stth							GS	GS	GS	GS		1/2	1/2	1/2	1/2		HO	An	DS, HS, BD	SD, PD					GS								
FORBS																																	
Basa																																	

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)							S-15 15	S-15 15	S-15 15	1-15 15	2-15 15	3-15 15	5-15 15	5-15 15	25	25	29	15	D	D	1	3	3	4	15	18							
Precip. (in)							0	.16	.22	.25	.25	0	.46	0	.70	0	0	.75	0	0	.50	0	.65	2.0	0	0	0	0	0	0	0		
S.T.-°C							5	6	4	5	8	9	9	15	18	17	18	25	25	22	20	22	21	27	21	20	19						
CARSON CITY NO. 03A-7-1																																	
SHRUBS:																																	
Artr							LG							TG																			
Putr							LG								BV	FB	BO																
Chvi							LG																										
Ribes sp.							LG																										
Tegl																																	
GRASSES:																																	
Orhy																																	
Stth																																	
Brte																																	
Sihy																																	
Feme																																	
Agcr																																	
FORBS:																																	
Wyeth sp.																																	
Luca																																	

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)						S- 15	S- 15	S- 15	S- 15	1- 15	S- 15	2- 15	2- 15	4- 15	4- 30		21	22	14	25	D	1	24	30	3	9	12						
Precip. (in)						0	.6	.41	.55	.08	.12	.6	0	.7	0	0	0	0	1.0	0	0	.85	0	.6	2.5	0	0						
S.T.-°C							4	2	3	7	10	12	11	10	19	19	20	19	16	20	20		20	19	16	18							
CARSON CITY NO. 03A-7-2																																	
SHRUBS:																																	
Ceve						LG									TG																		
Artr							LG																										
Chvi						D																											
Teca						D				LG																							
Cela						D																											
Putr						LG																											
Ribes sp.						LG																											
GRASSES:																																	
Stth						D																											
Sihiy						GS																											
Posa						GS																											
Brte						GS																											
Mebu						GS																											
Elci						D																											
FORBS:																																	
Luca						D																											
Wyeth sp.						D																											

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MOUNTAIN

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The phenology of bluestem wheatgrass (Agropyron smithii) in the northern desert shrub type in Steptoe Valley shows a relatively concise developmental pattern after 4 years and no surprises (Figure 1). The same thing can be said for crested wheatgrass (Agropyron cristatum; Figure 2).

The height growth of bluestem wheatgrass varied considerably among years, but does not seem to be strongly regulated by soil moisture, at least as it was recorded in this study (Figure 3). Possibly a more quantitative analysis of soil moisture would reveal a stronger relationship. Leader growth is also likely regulated to some extent by temperatures in May and June. The leader growth of green rabbitbrush (Chrysothamnus viscidiflorus) was much less variable (Figure 4).

The growth and development of bluestem and crested wheatgrass plus Indian ricegrass (Oryzopsis hymenoides) was quite uniform over the four years of the study (Figure 5 and Figure 8). The greatest variation occurs with the onset of drying at the end of the growing season.

Development of bitterbrush (Purshia tridentata) in the pinyon-juniper woodland also exhibits no surprises as departure from the general phenological pattern recorded over the four years of the study (Figure 6). Conversely, the initiation of leaf and twig growth of bitterbrush, shadscale (Atriplex confertifolia), and gooseberry (Ribes sp.) is characterized by great annual differences (Figure 7).

Examination of the phenological data for all grasses

The phenology of *Pinus strobus* (L.) in the northern limit of its range is characterized by certain distinctive features. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season.

The height growth of *Pinus strobus* is characterized by a distinct seasonal pattern. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season.

The growth and development of *Pinus strobus* is characterized by a distinct seasonal pattern. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season.

Development of *Pinus strobus* is characterized by a distinct seasonal pattern. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season. The tree is a deciduous conifer, and its growth is regulated by the length of the growing season.

Examination of the phenological data for all years.

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MOUNTAIN

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indicates that cool-season grasses such as squirreltail grass (Sitanion hystrix) reach $\frac{1}{2}$ vegetative growth by mid-April (04-2), while a warm-season grass such as Indian ricegrass growing on the same site reaches the same stage a month later (by mid-May). Numerous other observations can be made concerning this data, each of which sheds further light on vegetation management.

Fig. 1. Phenology of
Sitanion hystrix in the
northern desert shrub type
late 04-2, 04-3, 04-4, 04-5, 04-6, 04-7, 04-8, 04-9, 04-10, 04-11, 04-12, 05-1, 05-2, 05-3, 05-4, 05-5, 05-6, 05-7, 05-8, 05-9, 05-10, 05-11, 05-12, 06-1, 06-2, 06-3, 06-4, 06-5, 06-6, 06-7, 06-8, 06-9, 06-10, 06-11, 06-12, 07-1, 07-2, 07-3, 07-4, 07-5, 07-6, 07-7, 07-8, 07-9, 07-10, 07-11, 07-12, 08-1, 08-2, 08-3, 08-4, 08-5, 08-6, 08-7, 08-8, 08-9, 08-10, 08-11, 08-12, 09-1, 09-2, 09-3, 09-4, 09-5, 09-6, 09-7, 09-8, 09-9, 09-10, 09-11, 09-12, 10-1, 10-2, 10-3, 10-4, 10-5, 10-6, 10-7, 10-8, 10-9, 10-10, 10-11, 10-12, 11-1, 11-2, 11-3, 11-4, 11-5, 11-6, 11-7, 11-8, 11-9, 11-10, 11-11, 11-12, 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-10, 12-11, 12-12, 13-1, 13-2, 13-3, 13-4, 13-5, 13-6, 13-7, 13-8, 13-9, 13-10, 13-11, 13-12, 14-1, 14-2, 14-3, 14-4, 14-5, 14-6, 14-7, 14-8, 14-9, 14-10, 14-11, 14-12, 15-1, 15-2, 15-3, 15-4, 15-5, 15-6, 15-7, 15-8, 15-9, 15-10, 15-11, 15-12, 16-1, 16-2, 16-3, 16-4, 16-5, 16-6, 16-7, 16-8, 16-9, 16-10, 16-11, 16-12, 17-1, 17-2, 17-3, 17-4, 17-5, 17-6, 17-7, 17-8, 17-9, 17-10, 17-11, 17-12, 18-1, 18-2, 18-3, 18-4, 18-5, 18-6, 18-7, 18-8, 18-9, 18-10, 18-11, 18-12, 19-1, 19-2, 19-3, 19-4, 19-5, 19-6, 19-7, 19-8, 19-9, 19-10, 19-11, 19-12, 20-1, 20-2, 20-3, 20-4, 20-5, 20-6, 20-7, 20-8, 20-9, 20-10, 20-11, 20-12, 21-1, 21-2, 21-3, 21-4, 21-5, 21-6, 21-7, 21-8, 21-9, 21-10, 21-11, 21-12, 22-1, 22-2, 22-3, 22-4, 22-5, 22-6, 22-7, 22-8, 22-9, 22-10, 22-11, 22-12, 23-1, 23-2, 23-3, 23-4, 23-5, 23-6, 23-7, 23-8, 23-9, 23-10, 23-11, 23-12, 24-1, 24-2, 24-3, 24-4, 24-5, 24-6, 24-7, 24-8, 24-9, 24-10, 24-11, 24-12, 25-1, 25-2, 25-3, 25-4, 25-5, 25-6, 25-7, 25-8, 25-9, 25-10, 25-11, 25-12, 26-1, 26-2, 26-3, 26-4, 26-5, 26-6, 26-7, 26-8, 26-9, 26-10, 26-11, 26-12, 27-1, 27-2, 27-3, 27-4, 27-5, 27-6, 27-7, 27-8, 27-9, 27-10, 27-11, 27-12, 28-1, 28-2, 28-3, 28-4, 28-5, 28-6, 28-7, 28-8, 28-9, 28-10, 28-11, 28-12, 29-1, 29-2, 29-3, 29-4, 29-5, 29-6, 29-7, 29-8, 29-9, 29-10, 29-11, 29-12, 30-1, 30-2, 30-3, 30-4, 30-5, 30-6, 30-7, 30-8, 30-9, 30-10, 30-11, 30-12, 31-1, 31-2, 31-3, 31-4, 31-5, 31-6, 31-7, 31-8, 31-9, 31-10, 31-11, 31-12, 32-1, 32-2, 32-3, 32-4, 32-5, 32-6, 32-7, 32-8, 32-9, 32-10, 32-11, 32-12, 33-1, 33-2, 33-3, 33-4, 33-5, 33-6, 33-7, 33-8, 33-9, 33-10, 33-11, 33-12, 34-1, 34-2, 34-3, 34-4, 34-5, 34-6, 34-7, 34-8, 34-9, 34-10, 34-11, 34-12, 35-1, 35-2, 35-3, 35-4, 35-5, 35-6, 35-7, 35-8, 35-9, 35-10, 35-11, 35-12, 36-1, 36-2, 36-3, 36-4, 36-5, 36-6, 36-7, 36-8, 36-9, 36-10, 36-11, 36-12, 37-1, 37-2, 37-3, 37-4, 37-5, 37-6, 37-7, 37-8, 37-9, 37-10, 37-11, 37-12, 38-1, 38-2, 38-3, 38-4, 38-5, 38-6, 38-7, 38-8, 38-9, 38-10, 38-11, 38-12, 39-1, 39-2, 39-3, 39-4, 39-5, 39-6, 39-7, 39-8, 39-9, 39-10, 39-11, 39-12, 40-1, 40-2, 40-3, 40-4, 40-5, 40-6, 40-7, 40-8, 40-9, 40-10, 40-11, 40-12, 41-1, 41-2, 41-3, 41-4, 41-5, 41-6, 41-7, 41-8, 41-9, 41-10, 41-11, 41-12, 42-1, 42-2, 42-3, 42-4, 42-5, 42-6, 42-7, 42-8, 42-9, 42-10, 42-11, 42-12, 43-1, 43-2, 43-3, 43-4, 43-5, 43-6, 43-7, 43-8, 43-9, 43-10, 43-11, 43-12, 44-1, 44-2, 44-3, 44-4, 44-5, 44-6, 44-7, 44-8, 44-9, 44-10, 44-11, 44-12, 45-1, 45-2, 45-3, 45-4, 45-5, 45-6, 45-7, 45-8, 45-9, 45-10, 45-11, 45-12, 46-1, 46-2, 46-3, 46-4, 46-5, 46-6, 46-7, 46-8, 46-9, 46-10, 46-11, 46-12, 47-1, 47-2, 47-3, 47-4, 47-5, 47-6, 47-7, 47-8, 47-9, 47-10, 47-11, 47-12, 48-1, 48-2, 48-3, 48-4, 48-5, 48-6, 48-7, 48-8, 48-9, 48-10, 48-11, 48-12, 49-1, 49-2, 49-3, 49-4, 49-5, 49-6, 49-7, 49-8, 49-9, 49-10, 49-11, 49-12, 50-1, 50-2, 50-3, 50-4, 50-5, 50-6, 50-7, 50-8, 50-9, 50-10, 50-11, 50-12, 51-1, 51-2, 51-3, 51-4, 51-5, 51-6, 51-7, 51-8, 51-9, 51-10, 51-11, 51-12, 52-1, 52-2, 52-3, 52-4, 52-5, 52-6, 52-7, 52-8, 52-9, 52-10, 52-11, 52-12, 53-1, 53-2, 53-3, 53-4, 53-5, 53-6, 53-7, 53-8, 53-9, 53-10, 53-11, 53-12, 54-1, 54-2, 54-3, 54-4, 54-5, 54-6, 54-7, 54-8, 54-9, 54-10, 54-11, 54-12, 55-1, 55-2, 55-3, 55-4, 55-5, 55-6, 55-7, 55-8, 55-9, 55-10, 55-11, 55-12, 56-1, 56-2, 56-3, 56-4, 56-5, 56-6, 56-7, 56-8, 56-9, 56-10, 56-11, 56-12, 57-1, 57-2, 57-3, 57-4, 57-5, 57-6, 57-7, 57-8, 57-9, 57-10, 57-11, 57-12, 58-1, 58-2, 58-3, 58-4, 58-5, 58-6, 58-7, 58-8, 58-9, 58-10, 58-11, 58-12, 59-1, 59-2, 59-3, 59-4, 59-5, 59-6, 59-7, 59-8, 59-9, 59-10, 59-11, 59-12, 60-1, 60-2, 60-3, 60-4, 60-5, 60-6, 60-7, 60-8, 60-9, 60-10, 60-11, 60-12, 61-1, 61-2, 61-3, 61-4, 61-5, 61-6, 61-7, 61-8, 61-9, 61-10, 61-11, 61-12, 62-1, 62-2, 62-3, 62-4, 62-5, 62-6, 62-7, 62-8, 62-9, 62-10, 62-11, 62-12, 63-1, 63-2, 63-3, 63-4, 63-5, 63-6, 63-7, 63-8, 63-9, 63-10, 63-11, 63-12, 64-1, 64-2, 64-3, 64-4, 64-5, 64-6, 64-7, 64-8, 64-9, 64-10, 64-11, 64-12, 65-1, 65-2, 65-3, 65-4, 65-5, 65-6, 65-7, 65-8, 65-9, 65-10, 65-11, 65-12, 66-1, 66-2, 66-3, 66-4, 66-5, 66-6, 66-7, 66-8, 66-9, 66-10, 66-11, 66-12, 67-1, 67-2, 67-3, 67-4, 67-5, 67-6, 67-7, 67-8, 67-9, 67-10, 67-11, 67-12, 68-1, 68-2, 68-3, 68-4, 68-5, 68-6, 68-7, 68-8, 68-9, 68-10, 68-11, 68-12, 69-1, 69-2, 69-3, 69-4, 69-5, 69-6, 69-7, 69-8, 69-9, 69-10, 69-11, 69-12, 70-1, 70-2, 70-3, 70-4, 70-5, 70-6, 70-7, 70-8, 70-9, 70-10, 70-11, 70-12, 71-1, 71-2, 71-3, 71-4, 71-5, 71-6, 71-7, 71-8, 71-9, 71-10, 71-11, 71-12, 72-1, 72-2, 72-3, 72-4, 72-5, 72-6, 72-7, 72-8, 72-9, 72-10, 72-11, 72-12, 73-1, 73-2, 73-3, 73-4, 73-5, 73-6, 73-7, 73-8, 73-9, 73-10, 73-11, 73-12, 74-1, 74-2, 74-3, 74-4, 74-5, 74-6, 74-7, 74-8, 74-9, 74-10, 74-11, 74-12, 75-1, 75-2, 75-3, 75-4, 75-5, 75-6, 75-7, 75-8, 75-9, 75-10, 75-11, 75-12, 76-1, 76-2, 76-3, 76-4, 76-5, 76-6, 76-7, 76-8, 76-9, 76-10, 76-11, 76-12, 77-1, 77-2, 77-3, 77-4, 77-5, 77-6, 77-7, 77-8, 77-9, 77-10, 77-11, 77-12, 78-1, 78-2, 78-3, 78-4, 78-5, 78-6, 78-7, 78-8, 78-9, 78-10, 78-11, 78-12, 79-1, 79-2, 79-3, 79-4, 79-5, 79-6, 79-7, 79-8, 79-9, 79-10, 79-11, 79-12, 80-1, 80-2, 80-3, 80-4, 80-5, 80-6, 80-7, 80-8, 80-9, 80-10, 80-11, 80-12, 81-1, 81-2, 81-3, 81-4, 81-5, 81-6, 81-7, 81-8, 81-9, 81-10, 81-11, 81-12, 82-1, 82-2, 82-3, 82-4, 82-5, 82-6, 82-7, 82-8, 82-9, 82-10, 82-11, 82-12, 83-1, 83-2, 83-3, 83-4, 83-5, 83-6, 83-7, 83-8, 83-9, 83-10, 83-11, 83-12, 84-1, 84-2, 84-3, 84-4, 84-5, 84-6, 84-7, 84-8, 84-9, 84-10, 84-11, 84-12, 85-1, 85-2, 85-3, 85-4, 85-5, 85-6, 85-7, 85-8, 85-9, 85-10, 85-11, 85-12, 86-1, 86-2, 86-3, 86-4, 86-5, 86-6, 86-7, 86-8, 86-9, 86-10, 86-11, 86-12, 87-1, 87-2, 87-3, 87-4, 87-5, 87-6, 87-7, 87-8, 87-9, 87-10, 87-11, 87-12, 88-1, 88-2, 88-3, 88-4, 88-5, 88-6, 88-7, 88-8, 88-9, 88-10, 88-11, 88-12, 89-1, 89-2, 89-3, 89-4, 89-5, 89-6, 89-7, 89-8, 89-9, 89-10, 89-11, 89-12, 90-1, 90-2, 90-3, 90-4, 90-5, 90-6, 90-7, 90-8, 90-9, 90-10, 90-11, 90-12, 91-1, 91-2, 91-3, 91-4, 91-5, 91-6, 91-7, 91-8, 91-9, 91-10, 91-11, 91-12, 92-1, 92-2, 92-3, 92-4, 92-5, 92-6, 92-7, 92-8, 92-9, 92-10, 92-11, 92-12, 93-1, 93-2, 93-3, 93-4, 93-5, 93-6, 93-7, 93-8, 93-9, 93-10, 93-11, 93-12, 94-1, 94-2, 94-3, 94-4, 94-5, 94-6, 94-7, 94-8, 94-9, 94-10, 94-11, 94-12, 95-1, 95-2, 95-3, 95-4, 95-5, 95-6, 95-7, 95-8, 95-9, 95-10, 95-11, 95-12, 96-1, 96-2, 96-3, 96-4, 96-5, 96-6, 96-7, 96-8, 96-9, 96-10, 96-11, 96-12, 97-1, 97-2, 97-3, 97-4, 97-5, 97-6, 97-7, 97-8, 97-9, 97-10, 97-11, 97-12, 98-1, 98-2, 98-3, 98-4, 98-5, 98-6, 98-7, 98-8, 98-9, 98-10, 98-11, 98-12, 99-1, 99-2, 99-3, 99-4, 99-5, 99-6, 99-7, 99-8, 99-9, 99-10, 99-11, 99-12, 100-1, 100-2, 100-3, 100-4, 100-5, 100-6, 100-7, 100-8, 100-9, 100-10, 100-11, 100-12, 101-1, 101-2, 101-3, 101-4, 101-5, 101-6, 101-7, 101-8, 101-9, 101-10, 101-11, 101-12, 102-1, 102-2, 102-3, 102-4, 102-5, 102-6, 102-7, 102-8, 102-9, 102-10, 102-11, 102-12, 103-1, 103-2, 103-3, 103-4, 103-5, 103-6, 103-7, 103-8, 103-9, 103-10, 103-11, 103-12, 104-1, 104-2, 104-3, 104-4, 104-5, 104-6, 104-7, 104-8, 104-9, 104-10, 104-11, 104-12, 105-1, 105-2, 105-3, 105-4, 105-5, 105-6, 105-7, 105-8, 105-9, 105-10, 105-11, 105-12, 106-1, 106-2, 106-3, 106-4, 106-5, 106-6, 106-7, 106-8, 106-9, 106-10, 106-11, 106-12, 107-1, 107-2, 107-3, 107-4, 107-5, 107-6, 107-7, 107-8, 107-9, 107-10, 107-11, 107-12, 108-1, 108-2, 108-3, 108-4, 108-5, 108-6, 108-7, 108-8, 108-9, 108-10, 108-11, 108-12, 109-1, 109-2, 109-3, 109-4, 109-5, 109-6, 109-7, 109-8, 109-9, 109-10, 109-11, 109-12, 110-1, 110-2, 110-3, 110-4, 110-5, 110-6, 110-7, 110-8, 110-9, 110-10, 110-11, 110-12, 111-1, 111-2, 111-3, 111-4, 111-5, 111-6, 111-7, 111-8, 111-9, 111-10, 111-11, 111-12, 112-1, 112-2, 112-3, 112-4, 112-5, 112-6, 112-7, 112-8, 112-9, 112-10, 112-11, 112-12, 113-1, 113-2, 113-3, 113-4, 113-5, 113-6, 113-7, 113-8, 113-9, 113-10, 113-11, 113-12, 114-1, 114-2, 114-3, 114-4, 114-5, 114-6, 114-7, 114-8, 114-9, 114-10, 114-11, 114-12, 115-1, 115-2, 115-3, 115-4, 115-5, 115-6, 115-7, 115-8, 115-9, 115-10, 115-11, 115-12, 116-1, 116-2, 116-3, 116-4, 116-5, 116-6, 116-7, 116-8, 116-9, 116-10, 116-11, 116-12, 117-1, 117-2, 117-3, 117-4, 117-5, 117-6, 117-7, 117-8, 117-9, 117-10, 117-11, 117-12, 118-1, 118-2, 118-3, 118-4, 118-5, 118-6, 118-7, 118-8, 118-9, 118-10, 118-11, 118-12, 119-1, 119-2, 119-3, 119-4, 119-5, 119-6, 119-7, 119-8, 119-9, 119-10, 119-11, 119-12, 120-1, 120-2, 120-3, 120-4, 120-5, 120-6, 120-7, 120-8, 120-9, 120-10, 120-11, 120-12, 121-1, 121-2, 121-3, 121-4, 121-5, 121-6, 121-7, 121-8, 121-9, 121-10, 121-11, 121-12, 122-1, 122-2, 122-3, 122-4, 122-5, 122-6, 122-7, 122-8, 122-9, 122-10, 122-11, 122-12, 123-1, 123-2, 123-3, 123-4, 123-5, 123-6, 123-7, 123-8, 123-9, 123-10, 123-11, 123-12, 124-1, 124-2, 124-3, 124-4, 124-5, 124-6, 124-7, 124-8, 124-9, 124-10, 124-11, 124-12, 125-1, 125-2, 125-3, 125-4, 125-5, 125-6, 125-7, 125-8, 125-9, 125-10, 125-11, 125-12, 126-1, 126-2, 126-3, 126-4, 126-5, 126-6, 126-7, 126-8, 126-9, 126-10, 126-11, 126-12, 127-1, 127-2, 127-3, 127-4, 127-5, 127-6, 127-7, 127-8, 127-9, 127-10, 127-11, 127-12, 128-1, 128-2, 128-3, 128-4, 128-5, 128-6, 128-7, 128-8, 128-9, 128-10, 128-11, 128-12, 129-1, 129-2, 129-3, 129-4, 129-5, 129-6, 129-7, 129-8, 129-9, 129-10, 129-11, 129-12, 130-1, 130-2, 130-3, 130-4, 130-5, 130-6, 130-7, 130-8, 130-9, 130-10, 130-11, 130-12, 131-1, 131-2, 131-3, 131-4, 131-5, 131-6, 131-7, 131-8, 131-9, 131-10, 131-11, 131-12, 132-1, 132-2, 132-3, 132-4, 132-5, 132-6, 132-7, 132-8, 132-9, 132-10, 132-11, 132-12, 133-1, 133-2, 133-3, 133-4, 133-5, 133-6, 133-7, 133-8, 133-9, 133-10, 133-11, 133-12, 134-1, 134-2, 134-3, 134-4, 134-5, 134-6, 134-7, 134-8, 134-9, 134-10, 134-11, 134-12, 135-1, 135-2, 135-3, 135-4, 135-5, 135-6, 135-7, 135-8, 135-9, 135-10, 135-11, 135-12, 136-1, 136-2, 136-3, 136-4, 136-5, 136-6, 136-7, 136-8, 136-9, 136-10, 136-11, 136-12, 137-1, 137-2, 137-3, 137-4, 137-5, 137-6, 137-7, 137-8, 137-9, 137-10, 137-11, 137-12, 138-1, 138-2, 138-3, 138-4, 138-5, 138-6, 138-7, 138-8, 138-9, 138-10, 138-11, 138-12, 139-1, 139-2, 139-3, 139-4, 139-5, 139-6, 139-7, 139-8, 139-9, 139-10, 139-11, 139-12, 140-1, 140-2, 140-3, 140-4, 140-5, 140-6, 140-7, 140-8, 140-9, 140-10, 140-11, 140-12, 141-1, 141-2, 141-3, 141-4, 141-5, 141-6, 141-7, 141-8, 141-9, 141-10, 141-11, 141-12, 142-1, 142-2, 142-3, 142-4, 142-5, 142-6, 142-7, 142-8, 142-9, 142-10, 142-11, 142-12, 143-1, 143-2, 143-3, 143-4, 143-5, 143-6, 143-7, 143-8, 143-9, 143-10, 143-11, 143-12, 144-1, 144-2, 144-3, 144-4, 144-5, 144-6, 144-7, 144-8, 144-9, 144-10, 144-11, 144-12, 145-1, 145-2, 145-3, 145-4, 145-5, 145-6, 145-7, 145-8, 145-9, 145-10, 145-11, 145-12, 146-1, 146-2, 146-3, 146-4, 146-5, 146-6, 146-7, 146-8, 146-9, 146-10, 146-11, 146-12, 147-1, 147-2, 147-3, 147-4, 147-5, 147-6, 147-7, 147-8, 147-9, 147-10, 147-11, 147-12, 148-1, 148-2, 148-3, 148-4, 148-5, 148-6, 148-7, 148-8, 148-9, 148-10, 148-11, 148-12, 149-1, 149-2, 149-3, 149-4, 149-5, 149-6, 149-7, 149-8, 149-9, 149-10, 149-11, 149-12, 150-1, 150-2, 150-3, 150-4, 150-5, 150-6, 150-7, 150-8, 150-9, 150-10, 150-11, 150-12, 151-1, 151-2, 151-3, 151-4, 151-5, 151-6, 151-7, 151-8, 151-9, 151-10, 151-11, 151-12, 152-1, 152-2, 152-3, 152-4, 152-5, 152-6, 152-7, 152-8, 152-9, 152-10, 152-11, 152-12, 153-1, 153-2, 153-3, 153-4, 153-5, 153-6, 153-7, 153-8, 153-9, 153-10, 153-11, 153-12, 154-1, 154-2, 154-3, 154-4, 154-5, 154-6, 154-7, 154-8, 154-9, 154-10, 154-11, 154-12, 155-1, 155-2, 155-3, 155-4, 155-5, 155-6, 155-7, 155-8, 155-9, 155-10, 155-11, 155-12, 156-1, 156-2, 156-3, 156-4, 156-5, 156-6, 156-7, 156-8, 15

indicates that cool-season grasses such as *Andropogon* (1-2)
(*Andropogon furcata*) reach a vegetative growth by April (1-2).
While a warm-season grass such as *Andropogon furcata* growing on the
same site reaches the same stage a month later (1-2). This
shows other observations can be made concerning the stage of growth
of which sheds further light on vegetation development.

1976 - - - - -
 1977 —————
 1978 // // // //
 1979 • • • • •

Fig. 1 . Phenology of *Agropyron smithii* in the northern desert shrub type (site 04-3), Ely District.

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CARROLL
SUMMIT

1976 ————
 1977 ————
 1978 |||||
 1979 ●●●●●

Fig. 2 . Phenology of *Agropyron cristatum* in the northern desert shrub vegetation type (site 04-3), Ely District.

1976

1977

1978

1979

Fig. 3. Height growth (mm) of Agropyron smithii compared with soil moisture depth (inches) in a coniferous forest (site 04-8), Ely District.

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500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ---
1977 ———
1978 + + + + +
1979

Fig. 4. Leader length (mm) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) on a northern desert shrub vegetation type (site 04-3), Ely District.

Fig. 5. Occurrence of various phenophases for selected grasses, Ely District.

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NEW LEAVES TURN
YELLOW
NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 — — — —
1977 — — — —
1978 + + + + +
1979

Fig. 6 . Phenology of
Purshia tridentata in the
Pinyon-juniper type (site
04-5), Ely District.

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LEAF GROWTH

TWIG GROWTH

Fig. 7. Periods of leaf and twig growth for selected shrubs, Ely District.

1976 - - - - -
1977 - - - - -
1978 + + + + +
1979

Fig. 8. Phenology of *Oryzopsis hymenoides* compared to soil moisture depth (inches) on northern desert shrub vegetation type (site 04-3), Ely District.

17. 5. Theology of
 Christ's death and
 resurrection (as
 taught in the New
 Testament and
 the early Church)
 18. 6. Theology of
 Christ's resurrection
 and ascension (as
 taught in the New
 Testament and
 the early Church)

1975
 1976
 1977
 1978
 1979

Table 1. Table of Leader (Shrubs) and Height (Grasses and Forbs) Growth in Ely District for 1976, 1977, 1978, and 1979.

Millimeters								
	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 04-2</u>								
<u>SHRUBS</u>								
1. Artr	60		100		90		57	
2. Arsp	26		20		50		25	
3. Atco	50		105		90		44	
4. Cela	50		160		150		77	
5. Save	58		63		60		54	
<u>GRASSES</u>								
1. Orhy	240		190	165	200		249	
2. Sihy	255		210	100	280		172	
<u>Site 04-3</u>								
<u>SHRUBS</u>								
1. Artr	52		98		100		100	
2. Chvi	55		100		70		67	
<u>GRASSES</u>								
1. Agcr	310		455	150	330		287	
2. Orhy	300	75	375	160	400		360	
3. Agsm	270		450	75	170		150	
<u>FORBS</u>								
1. Astra								
sp.	55		75		75		46	19
2. Phho	51		25		20		23	
<u>Site 04-5</u>								
<u>SHRUBS</u>								
1. Arno	25		125		35		32	
2. Putr	105		60		75		74	

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Table 1. Table of Logarithmic and
Height, Diameter and Volume
Listed for 1974, 1975,
and 1976.

1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
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2081				
2082				
2083				
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2087				
2088				
2089				
2090				
2091				
2092				
2093				
2094				
2095				
2096				
2097				
2098				
2099				
2100				

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 04-5 Con't.

GRASSES

1. Posa 210 25 150 50 310 127

FORBS

1. Pepa 250 340 530 495

Site 04-6

SHRUBS

1. Salix
sp. 70 4 70

GRASSES

1. Popr 300 500 260 226

2. Carex
sp. 170 320 210 371

3. Juba 270 380 400 454

4. Agal 800 450 559

FORBS

1. Popa 95 200 90 170 40

2. Acla 300 550 90 195 16

3. Taof 150 150 75 71 15

4. Viad 75 90 70 101 30

5. Thmo 450 310 410

Site 04-7

SHRUBS

1. Cele 20 10 10 25

2. Ribes
sp. 52 20 7 31

3. Amal 155 30 20 45

4. Sylo 150 185 80 47

5. Bere 20 75 100 80 LG*

6. Artr 50 150 100 115

* Leaf Growth

1976 Redwood 1977 Redwood 1978 Redwood 1979 Redwood

Site 04-5 cont.

SHRUBS

1. Lora

210

25

150

25

150

150

FORBS

1. Pops

250

250

250

250

Site 04-6

SHRUBS

1. Salix

sp.

70

5

70

GRASSES

1. Pops

200

200

200

200

2. Carex

sp.

170

220

210

270

3. Lora

270

250

200

450

4. Agai

200

450

220

FORBS

1. Pops

25

200

60

150

2. Aloa

200

250

60

120

3. Toef

150

120

75

75

4. Vind

75

30

75

100

5. Thmo

450

210

410

Site 04-7

SHRUBS

1. Cels

20

10

10

25

2. Ribes

sp.

25

20

7

21

3. Arai

150

20

20

45

4. Syin

150

150

80

47

5. Bete

20

75

100

100

6. Acer

20

150

100

212

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 04-7 Con't.

GRASSES

1. Agsm	210	425	75	140	145
2. Pone	360	310		300	---
3. Orhy	305	380	150	300	320
4. Stco		600	75	170	407 160
5. Agsp		500	75	200	275

FORBS

1. Meob	178	150		150	115
2. Delph sp.	210	355		125	100
3. Lupin sp.		255		150	193
4. Casti sp.		355		150	260
5. Lomat sp.	76	60		30	42 20

Site 04-8

SHRUBS

1. Sylo	105	110		30	69
2. Artr	50	80		50	47
3. Amal	15	28		30	23
4. Bere	30	77		30	111 TG*

GRASSES

1. Agsm	155	400		150 75	96
2. Pone	305	300		75 150	68

FORBS

1. Meob	180	110		90	146
2. Peki	250	400		100	136

* Twig Growth

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1976 Harvest 1977 Harvest 1978 Harvest 1979 Harvest

1976 Harvest 1977 Harvest 1978 Harvest 1979 Harvest

GRAPE

1. Adam	210	422	75	140
2. Bone	300	270		
3. Gray	300	300	100	100
4. Stone		200	75	200
5. Apple		200	75	200

GRAPE

1. Apple	175	100	120	110
2. Apple	210	125	125	100
3. Apple		125	100	100
4. Apple		175	100	200
5. Apple	70	20	20	20

GRAPE

1. Apple	100	110	20	20
2. Apple	20	80	20	20
3. Apple	15	25	20	20
4. Apple	20	75	20	20

GRAPE

1. Apple	125	400	120	20
2. Apple	200	300	75	20
3. Apple				
4. Apple	150	170	20	140
5. Apple	150	400	100	140

* Two Growth

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 04-0 Con't.

GRASSES

1. Carex sp.	230	250	240	347
2. Juba	330	350	400	441
3. Dist	70	140	150	55

FORBS

1. Plma	210	170	220	248	101
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BATTLE
SUMMIT

CARROLL
SUMMIT

ELY DISTRICT

SITE LOCATIONS
(Not all shown due
to closeness)

ELY DISTRICT

▲ SITE LOCATIONS
(Not all shown due
to closeness)

ELY DISTRICT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			
SMD (From-To in cm)									2- 30	S- 30	7- 30	3- 30	S- 30	S- 30	6- 30	6- 30																		
Precip. (in)										.43	.12				.09	.02	.27	0	0	.10	0	0	0	0	.91									
S.T.-°C									0	0	8	11	7	9	17	16	20	22	19	28	20	30	25	28	20	19	18	24	12	15	16	12	10	
ELY 04-2																																		
SHRUBS:																																		
Artr									D		TG						LY			BV, FG, LY	1B													
Cela									D		LG						BV FG																	
Arsp									LG		BV						BO SR LY																	
Save									D		LG																							
Atco									D		LG						BV	1B	FB	BO SR	1B	FB	SR	SD										
GRASSES:																																		
Orhy									D		GS							HO		HS	SD, BD													
Sihy									GS								HO		DS	HS	SD, BD													

♀ ♂

BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	
Precip. (in)																																	
S.T.-°C																																	
ELY 04-3																																	
SHRUBS:																																	
Artr																																	
Chvi																																	
GRASSES:																																	
Agcr																																	
Orhy																																	
Agsm																																	
FORBS:																																	
Phho																																	
Astra sp.																																	

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER				
SMD (From-To in cm)									S- 30 30	4- 30 30	S- 30 30	7- 30 30	2- 30 30	13- 30 30	22+ 2+ 30	16+ 30	D	D	D	D	8	15+	S+	S+ 10+	D			D		D	D	D	5+		1.8
Precip. (in)										0	.33	.21	.25	0	0	.38	0	0	0	0	0	.94	0	.65	0	0			.22	0	0	2.			
S.T.-°C									0	4	6	7	3	11	12	19	20	16	20	18	28	22	20	22	14	16	19	14	13	13	10	10			
ELY 04-5																																			
SHRUBS:																																			
Arno									D	TG									BV	LY	FG, LY									BO, LY	SD, LD				
Putr									LG												SD														
GRASSES:																																			
Posa									D	GS											BD														
FORBS:																																			
Pepa									D	GS											DS, BD BD														

BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)				S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S- 30
Precip. (in)											
S.T.-°C				6	7	9	12	12	12	12	10
ELY 04-6											
SHRUBS:											
Salix sp.				D	D	D	D	D	D	D	D
Riar				D	D	D	D	D	D	D	D
GRASSES:											
Carex sp.											
Juba											
Agal											
Popr											
FORBS:											
Acla											
Taof											
Thmo											
Viad											
Popa											

BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)																																	Sn
Precip. (in)																																	
S.T.-°C																																	
ELY 04-7																																	
Cele																																	
Ribes sp.																																	
Artr																																	
Sylo																																	
Amal																																	
Bere																																	
GRASSES:																																	
Orhy																																	
Pone																																	
Agsp																																	
Stco																																	
Agsm																																	
FORBS:																																	
Lupin sp.																																	
Casti sp.																																	

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)											
Precip. (in)											
S.T.-°C											
ELY											
04-7 Cont'd											
FORBS:											
Meob											
Delph sp.											
Lomat sp.											

BATTLE
MOUNTAIN

CARROLL
SUMMIT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)															1- 30	5+	S+	4+	17+	26+	S- 9.	S+	3+	4+	20+	D		D	D	S+			
Precip. (in)																			0	0	.10	1.5	0	1.26	0	0		0	0	0	1.87		
S.T.-°C															11	18	10	20	15	23	18	18	12	13	11	16	10	12	11	6			
ELY 04-8																																	
SHRUBS:																																	
Artr															TG				BV	FG													
Sylo															TG				SR		SD												
Amal															TG		BV	1B	BO	SR												SD, LY	
Bere															TG									LY									
GRASSES:																																	
Agsm															1/2																		
Pone															1/2																		
FORBS:																																	
Meob															FB		BO	SR	DS, BD	PD													
Pek1															GS			FS	1B		BO, SR			DS	BD								

BATTLE
SUMMIT

CARROLL
SUMMIT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER		
SMD (From-To in cm)									S- 30	S- 30	S- 30	S- 30	S- 30	S- 30	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Precip. (in)									.19	.36	.14	.19	.53		.95		1.3		.2	0	0	0	0	0	0	0	0	0	0	0			
S.T.-°C									0	0	7	13	14	18	18	18	20	16	18	20	19	20	18	16	15	13	13	11	10	8			
ELY 04-9																																	
SHRUBS:																																	
GRASSES:																																	
Juba									GS					FS	HO			DS	HS	SD													
Dist									GS				FS	HO		An	DS	DS	HS		SD		SD	SD, BD							PD		
Carex sp.									D		GS		HO	An	DS	HS	SD	SD					BD										
FORBS:																																	
Plma									D		GS		FS	1B		FB	BO	SR		FS, DS			FS, BD	BD, BD							PD		
Iris sp.													FS			FB	BO	SR		BD													

BATTLE
SUMMIT
CARROLL

BATTLE
MOUNTAIN

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SUMMIT

LAS VEGAS

The final year of phenology data further establishes a general description of species development. Results from 1979 offered no surprises. For spiny hopsage (Grayia spinosa), the 1979 data fits well within the pattern described the previous three years (Figure 1). Big galleta (Hilaria rigida) developed much slower the first year of the study (Figure 2), while the following three years showed a close phenological development. This is a good example of the problem inherent in relying on a single year of phenological data.

Galleta (Hilaria jamesii) showed similar phenology among the four years except for drying and regrowth. This species is a warm season grass and varies considerably in its maturation and regrowth depending on late summer rains and associated warm weather (Figure 3).

Even though development to $\frac{1}{2}$ vegetative growth and the appearance of flower stalks varies up to several weeks depending upon year and species, the period of seed dissemination is remarkably consistent in the desert grasses: Indian ricegrass (Oryzopsis hymenoides), galleta, and big galleta (Figure 4). This may well be an important consideration in setting grazing use for these species.

Indian ricegrass seems to indicate that late season growth was dependent upon soil moisture within a few inches of the surface of the soil (Figure 5). Height growth of this species is strongly regulated by the availability of soil moisture (Figure 6).

Leader growth of the desert shrub bur-sage (Ambrosia dumosa) is influenced by the adequate early season (April) soil moisture (Figure 7). The initiation of growth, full bloom and the time when the plants are dry varies considerably from year to year in the forb desert globemallow (Sphaeralcea ambigua; Figure 8). For this species the 1977 growing season was earlier than the other three years of the study.

The onset and duration of leaf and twig growth in the desert shrubs cliffrose (Cowania stansburiana), big sagebrush (Artemesia tridentata) and littleleaf krameria (Krameria parvifolia) show great variability among years (Figure 9). Of particular interest is the length of time of leaf growth prior to the onset of twig growth. Leaf growth of littleleaf krameria lasts up to 8 weeks before the start of twig growth, while for big sagebrush this period is very short, usually lasting only one week. Cliffrose appears to be intermediate in this regard.

Leader and height growth for the various species on these Lincoln County sites shows reasonable consistency from year to year (Table 1). There are no strong trends.

leader growth of the heart shrub *Lycium* sp.
(*neesii*) is influenced by the calendar only season (April) and
moisture (Figure 1). The initiation of growth, leaf fall and
the time when the plant are dry varies considerably from year
to year in the low desert *Lycium* *neesii* *neesii*.
Figure 2). For this species the 1957 growing season was earlier
than the other three years of the study.
The onset and duration of leaf and twig growth in the desert
shrub *Lycium* *neesii* (Figure 3), *Lycium* *neesii* (Figure 4)
tridentata and *Lycium* *neesii* (Figure 5). Of particular interest
is the length of time of leaf growth prior to the onset of twig
growth. Leaf growth of *Lycium* *neesii* lasts up to 8 weeks
before the start of twig growth, while the leaf growth of this
period is very short, usually lasting only one week. *Lycium*
appears to be intermediate in this regard.
Leader and twig growth for the various species on these
Lincoln County sites show considerable consistency from year to
year (Table 1). There are no strong trends.

NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 —————
1977 - - - - -
1978 // // // // //
1979 • • • • •

Fig. 1 . Phenology of Grayia spinosa on salt desert shrub vegetation type (site 05-2), Las Vegas District.

NEW YORK
CHICAGO
LOS ANGELES
SAN FRANCISCO

LEAVES FOR
YELLOW
RED
GREEN

SHADES OF
GREEN

SHADES OF
RED

SHADES OF
BLUE

SHADES OF
PURPLE

SHADES OF
ORANGE

SHADES OF
BROWN

SHADES OF
BLACK

SHADES OF
WHITE

SHADES OF
GRAY

SHADES OF
PINK

BATTLE
MOUNTAIN

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1976 —————
 1977 - - - - -
 1978 + + + + +
 1979

Fig. 2 . Phenology of *Hilaria rigida* in the southern desert shrub vegetation type (site 05-1-1), Las Vegas District.

1976 —————
1977 - - - - -
1978 + + + + +
1979

Fig. 3 . Phenology of *Hilaria jamesii* in the salt desert shrub vegetation type (site 05-2), Las Vegas District.

05-2

Orhy

1976

1977

1978

1979

05-2

Hija

1976

1977

1978

1979

05-1-2

Hiri

1976

1977

1978

1979

05-1-1

Hiri

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

VEGETATIVE
GROWTH

FLOWER STALKS
FIRST APPEAR

SEED
DISSEMINATION

PLANTS DRY

DROPPED

Fig. 4. Occurrence of various phenophases for selected grasses in the Las Vegas District.

BATTLE
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1976 —————
 1977 - - - - -
 1978 |||||
 1979

Fig. 5. Phenology of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 05-2), Las Vegas District.

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 —————
1977 - - - - -
1978 + + + + +
1979 • • • • •

Fig. 6. Height (mm) of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 05-2), Las Vegas District.

BATTLE
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500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 —————
1977 - - - - -
1978 + + + + +
1979 • • • • •

Fig. 7. Leader length (mm) of *Ambrosia dumosa* compared with soil moisture depth (inches) on southern desert shrub vegetation type (site 05-1-1), Las Vegas District.

BATTLE
MOUNTAIN

CARROLL
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Fig. 8. Occurrence of various phenophases for *Sphaeralcea ambigua*, Las Vegas District.

LEAF GROWTH

TWIG GROWTH

Fig. 9. Occurrence of leaf and twig growth for selected shrubs in the Las Vegas District.

Fig. 2. Growth of the
and leaf growth for selected
stages in the life cycle
of the plant.

Leaf growth

Stem growth

Table 1. Table of Leader (Shrubs) and Height (Grasses and Forbs) Growth in the Las Vegas District for 1976, 1977, 1978, and 1979.

Millimeters								
	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 05-1-1</u>								
<u>SHRUBS</u>								
1. Amdu	101		60		143		55	
2. Ladi	50		101		44		65	
3. Dafr	101		140		205		90	
4. Grsp	152		32		140		150	
<u>GRASSES</u>								
1. Hiri	355	304	461	350	409		300	
<u>FORBS</u>								
1. Spam	508		182	85	485		370	
<u>Site 5-1-2</u>								
<u>SHRUBS</u>								
1. Cora	50		59		64	LG*	100	
2. Krpa	25		193		105	60	100	
3. Epne	76		63		190		35	
			140		205			
<u>GRASSES</u>								
1. Hiri	304		420		120	75	---	
<u>Site 05-2</u>								
<u>SHRUBS</u>								
1. Arsp	76		35		75		50	
2. Grsp	76		91		70		88	LG*
			141		80			
3. Cela	76		121		200		120	

Site 05-2

SHRUBS

1. Arsp	76		35		75		50	
2. Grsp	76		91		70		88	LG*
			141		80			
3. Cela	76		121		200		120	

* LG - Leaf Growth

BATTLE
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CARROLL
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Table 1. Height of trees and shrubs in the study area in 1970, 1971, 1972, and 1973.

Site 02-1-1				
Shrubs				
1. And	101	60	142	22
2. Ladi	50	101	44	42
3. Dali	101	140	202	90
4. Grop	122	22	140	120
Trees				
1. Hili	202	204	441	200
Site 2-1-2				
Shrubs				
1. Gora	20	20	24	100
2. Kpa	22	122	100	100
3. Gine	24	42	120	24
Trees				
1. Hili	204	420	120	24
Site 02-2				
Shrubs				
1. Grop	20	24	22	20
2. Grop	20	40	20	20
3. Gila	24	121	200	120

LD - Last Growth

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 05-2 Con't.

GRASSES

1. Hija	304	307	200	160	100	210	110
2. Orhy	330	363	190	420	100	285	140
3. Sihy	228	284	180	355	70	250	

FORBS

1. Spam	406	505	330	470	90	390	50
---------	-----	-----	-----	-----	----	-----	----

Site 05-3

SHRUBS

1. Artr	101	223	233	75
2. Chvi		149	204	80

GRASSES

1. Orhy	203	302	260	300	130	320	150
2. Hija	177	421	275	160	195	310	110
3. Sihy	228	308	250	305	110	290	50

Site 05-7

SHRUBS

1. Cost	50	87	101	65
2. Epvi	76	♀ 35 ♂ 48	165	30
3. Artr	76	170	202	90

GRASSES

1. Hiri	203	245	330	200	135	210	120
2. Bogr	203	169	225	84	93	115	100
3. Sihy	254	247	146	236	70	285	210

FORBS

1. Spam	254	281	202	235	50	150	100
---------	-----	-----	-----	-----	----	-----	-----

BATTLE
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SUMMIT

1970 Newborn 1971 Newborn 1972 Newborn 1973 Newborn

Site 02-2 Cont.

GRASSES

1. Htja	204	207	200	180	210	110
2. Orby	230	203	200	180	200	180
3. Stby	238	204	180	200	200	

FORBS

1. Spem	404	202	210	200	200	
---------	-----	-----	-----	-----	-----	--

Site 02-3

GRASSES

1. Arfr	101	203	200	200	200	20
2. Chet		200	200	200	200	20

GRASSES

1. Orby	200	200	200	200	200	200
2. Htja	177	200	200	200	200	200
3. Stby	200	200	200	200	200	200

Site 02-7

GRASSES

1. Cost	20	20	20	20	20	20
2. Evst	70	20	20	20	20	20
3. Arfr	20	20	20	20	20	20

GRASSES

1. Htja	202	202	200	200	210	120
2. Boqr	202	202	200	200	210	100
3. Stby	204	202	200	200	210	210

FORBS

1. Spem	224	201	202	222	20	100
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LAS VEGAS DISTRICT

THE WESTERN DISTRICT

SYMBOL 1979	DECEMBER		JAN 11th	FEB 7th	MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)	2- 25	2- 30	5- 25	S- 30	4- 20	S- 30	5- 18	4- 30	5- 30	S- 25	5- 20	15- 30	D	20- 30	10- 30	D						
Precip. (in)	.25	.30	0	.45	.1	.25	.75	.65	0	.35	.2	0	0	0	1.25	0	0					
S.T.-°C	0	0	0	0	20	9	0	21	20	17	14	30	29	30	38	32	40	34				
<u>LAS VEGAS</u>																						
<u>5-5-1</u>																						
<u>SHRUBS</u>																						
Amdu	D				LG				BV	FG	LB, TG	BO	SR	SD	LY							
Ladi	D								LG, TG	BV	FG	LB	FB	BO, SR	LY							
Dafr	D								TG	BV	FG	LB	BO	SR	LY							
Grsp	D				LG	TG	BV		FG, LB		FB	BO	SD		LY							
<u>GRASSES</u>																						
Hiri	D						GS		1/2 V	FS	HO	An	DS	HS	SD							
<u>FORBS</u>																						
Spam	D				GS			FS			FB	BO	SR		PD							

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	DECEMBER		JAN 11th	FEB 7th	MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
	2-30	1-25	5-20	5-30	2-25	2-25	2-15	2-7	10-20	8-20	D	15-30	D	D	10+20+	D						
SMD (From-To in cm)		1-25																				
Precip. (in.)		.35	.20	.90	.2	.15	.90	.05	.2	.3	0	0	0	0	1.15	0						
S.T.-°C	0	6	0	0	16	10	14	23	26	20	22	35	36	40	30	32						
LAS VEGAS																						
5-1-2																						
SHRUBS																						
Cora	D							LG	TG, BV	1B	FB	BO	SR	LY								
Krpa	LD	D								TG				FG								
Epne	D							TG	BV					1B								

BATTLE
SUMMIT
CARROLL

SYMBOL 1979	DECEMBER		JAN	FEB	MARCH		APRIL		MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER					
	4-25	5-30	11th	7th	2-20	S-30	1-20	7-30	13-30	7-20	3-29	8-28	D	20-30	D	D	D	9+11-15+														
SMD (From-To in cm)																																
Precip. (in)	.35	.40	.20	.60	.20	.20	Sn	.06	.2	.1	.85	0	.1	0	0	0	0	0	0	0												
S.T.-°C	0	0	0	0	15	10	0	8	16	20	19	19	20	30	3	20	39	30	22	24	24	26	24									
LAS VEGAS																																
5-2																																
SHRUBS																																
Arsp	D				LG	TG		BV	FG	1B	FB	BO	SR		LY	LD																
Grsp	D				LG		FG, BV		FG	1B	FB	BO	SR	SD	LY				LD			LG										
	D				LG		FG, BV		FG	1B	FB	BO	SR		SD	LY			LD			LG										
Cela	LD		D		LG			TG	BV		FG	1B	FB		SR																	
GRASSES																																
Hi ja	D								GS	1/2 V	FS	HO, An	DS		SD	BD						GS										
Orhy	D									FS	HO, An	An	HS		BD							PD, GS										
Si hy	D								FS		HO, An	An	DS		HS				PD													
FORBS																																
Spam	D										1B	FB			SR	BD						GS										

BATTLE
SUMMIT

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SUMMIT

SYMBOL 1979	DECEMBER		JAN	FEB	MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
	S-30	S-30	11th	7th	1-25	5-30	S-30	2-30	6-30	S-30	2-30	9-25	15-28	D	D	6+	10+	5+				
SMD (From-To in cm)																						
Precip. (in)	.55	.60	.25	.65	.70	.20	Sn	3.2	.1	0	0	.1	0	0	0	2.25	0	.35				
S.T.-°C	0	0	0	0	4	8	Sn	5	12	21				22	22	22	28	20				
LAS VEGAS 5-3																						
SHRUBS																						
Artr	SD, LY			D								LG, TG		FG			1B					
Chvi	SD, LY			D		LG								FG	BV							
GRASSES																						
HiJa	D																					
Orhy	D																					
SiHy	D																					

BATTLE
MOUNTAIN

CARROLL
SUMMIT

SYMBOL 1979	DECEMBER		JAN 11th	FEB 7th	MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)	1- 30	5- 30 25		5- 30	2- 30 30	Sn 30	3- 25 30	3- 30 30	5- 30 30	8- 30 30	S- 30 25	2- 30 20	6- 20 20	12- 20 20	10- 28	D	D	D	6+ 10+12+			
Precip. (in)	.45	.60.3		.9	1.0 2.5	Sn 3.	.04	0	.2	.25	.6	0	0	0	0	.2	0	0	1.75	0	0	
S.T.-°C	0	0	0	0	10	8	Sn 2	17	20	18	10	10	20	20	24	--	18	22	24	24	23	
LAS VEGAS 5-7																						
SHRUBS																						
Cost	LD			D				LG					TG, BV		FG							
Epvi	LD			D				LG					TG			BV FG				LY		
Artr	LD	LD, SD		D									LG TG			BV FG						
GRASSES																						
Hiri	PD	D											1/2			DS BD			1/2	FS		
Bogr	D	FS			BD		GS		1/2							BD			1/2			
Sihy	PD		D			GS		1/2					FS HO	An	DS	SD		BD	1/2			
FORBS																						
Spam	PD	D																	GS			

BATTLE
SUMMIT
CARROLL

BATTLE
MOUNTAIN

CARROLL
SUMMIT

BATTLE MOUNTAIN

Figure 1 shows the annual halogeton (Halogeton glomeratus) to have quite variable phenophases from year to year, while desert globemallow (Sphaeralcea ambigua) is somewhat variable, and arrowleaf balsamroot (Balsamorhiza sagittata) is very similar from year to year.

Bitterbrush (Purshia tridentata) and Mormon tea (Ephedra nevadensis) exhibit considerable variation in leaf and twig growth from year to year (Figure 2). Leaf growth seems to occur over a period of a month or less, while twigs grow from five weeks to over five months in some years.

The three perennial grasses squirreltail grass (Sitanion hystrix), bluebunch wheatgrass (Agropyron spicatum), and Indian ricegrass (Oryzopsis hymenoides) appear to maintain a fairly consistent phenotypic pattern from year to year irrespective of precipitation (Figure 3). Figure 4 bears out the same consistent pattern over the four year period.

Over the four years, bud sagebrush (Artemesia spinescens) varies throughout its growing season from four to seven weeks (Figure 5). Apparently, it is influenced fairly heavily by differences in climatic condtions. This certainly has implications for this important shrub if climatic phenomena can be directly related to a following season's growth.

Indian ricegrass has a very similar phenotypic pattern for all years except 1977 (Figure 6).

Squirreltail grass showed considerable more growth in 1979 than in the other years, and was also quite variable from year

Figure 1 shows the annual precipitation (in inches) for the years 1950-1959. It has been determined that the annual precipitation for the years 1950-1959 is approximately 40 inches. The annual precipitation for the years 1950-1959 is approximately 40 inches. The annual precipitation for the years 1950-1959 is approximately 40 inches.

Figure 2 shows the annual precipitation (in inches) for the years 1960-1969. It has been determined that the annual precipitation for the years 1960-1969 is approximately 45 inches. The annual precipitation for the years 1960-1969 is approximately 45 inches. The annual precipitation for the years 1960-1969 is approximately 45 inches.

Figure 3 shows the annual precipitation (in inches) for the years 1970-1979. It has been determined that the annual precipitation for the years 1970-1979 is approximately 50 inches. The annual precipitation for the years 1970-1979 is approximately 50 inches. The annual precipitation for the years 1970-1979 is approximately 50 inches.

Figure 4 shows the annual precipitation (in inches) for the years 1980-1989. It has been determined that the annual precipitation for the years 1980-1989 is approximately 55 inches. The annual precipitation for the years 1980-1989 is approximately 55 inches. The annual precipitation for the years 1980-1989 is approximately 55 inches.

to year (Figure 7). It appears that soil moisture was available for a considerably longer time period in 1979, particularly as opposed to 1976 where soil moisture dropped quickly along with height of the plant.

Leader growth in rabbitbrush was about average for 1979 among the previous three years (Figure 8).

Overall leader growth for shrubs and height growth for forbs and grasses in 1979 appears greater than for any of the three previous years (Table 1).

to year (Figure 7). It appears that both nations are able for a consistently higher time period in 1979, particularly as opposed to 1978 where the nations display a slightly lower

rich history of the 1970s. Leader growth in 1979 was 1.1% compared to 1.0% in 1978. Among the previous three years (1976-78).

Overall leader growth for each and every year for 1978 and 1979 in 1979 appears higher than for any of the three previous years (Table 1).

GROWTH STARTS

FULL BLOOM

PLANTS DRY

Fig. 1. Occurrence of various phenophases of selected forbs, Battle Mountain District.

06-7

Putr

1976

1977

1978

1979

06-2-2

Epne

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

LEAF GROWTH

TWIG GROWTH

Fig. 2. Occurrence of leaf and twig growth for selected shrubs, Battle Mountain District.

Fig. 3. Occurrence of various phenophases of selected grasses, Battle Mountain District.

$\frac{1}{2}$ VEGETATIVE GROWTH
 REGROWTH
 PLANT DRY
 PLANT BEGINS TO DRY
 DISSEMINATION
 HARD SEED
 DOUGH SEED SET
 ANTHESIS
 HEADS OUT FULLY
 FLOWER STALKS
 $\frac{1}{2}$ VEGETATIVE GROWTH
 GROWTH STARTS
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ———
 1977 ———
 1978 / / / / /
 1979 ● ● ● ● ●

Fig. 4. Phenology of
Agropyron spicatum on
 northern desert shrub veg-
 etation type (site 06-3),
 Battle Mountain District.

TWIG GROWTH
 NEW LEAF
 GROWTH
 LEAVES DRY
 AND DROP
 LEAVES TURN
 YELLOW
 SEED
 DISSEMINATION
 SEED RIPE
 BLOOM OVER
 FULL BLOOM
 FIRST BLOOM
 LEAVES FULL
 GROWN
 FLOWER BUDS
 FIRST VISIBLE
 TWIG GROWTH
 LEAF GROWTH
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ———
 1977 ———
 1978 ———
 1979 ●●●●

Fig. 5. Phenology of *Artemisia spinescens* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 06-2-2), Battle Mountain District.

1976 — — — — —
 1977 — — — — —
 1978 + + + + +
 1979 • • • • •

Fig. 6. Phenology of *Oryzopsis hymenoides* on salt desert shrub vegetation type (site 06-2-3), Battle Mountain District.

1976 — — — — —
 1977 — — — — —
 1978 + + + + +
 1979 • • • • •

Fig. 7. Height growth (mm) of Sitanion hystrix compared with soil moisture depth (inches) on salt desert shrub vegetation (site 06-2-2), Battle Mountain District.

CARROLL
SUMMIT

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 — — — — —
1977 — — — — —
1978 + + + + +
1979 • • • • •

Fig. 8. Leader growth (mm) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) on mountain brush vegetation (site 06-7), Battle Mountain District.

Table 1. Leader (Shrubs) and Height
(Grasses) Growth in the
Battle Mountain District for
1976, 1977, 1978 and 1979.

Millimeters								
	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 06-2-1</u>								
<u>SHRUBS</u>								
1. Tegl	64		66		105		140	
2. Chna	283		130		185		380	
3. Save	127		70		122		165	
4. Atco	120		75	♀	125		160	
				♂	110			
<u>GRASSES</u>								
1. Elci	584		1100		765		1000	
2. Spai	416		500		270	15	260	
<u>Site 06-2-2</u>								
1. Arsp	36	42	19		50		30	
2. Atco	48		50	♀	160		110	
				♂	154			
3. Epne	204		120		180		150	
4. Grsp	33		90		165		160	
<u>GRASSES</u>								
1. Brte	145		140		100	70	220	
2. Sihy	113	73	185		170	105	235	75
3. Posa	145	81	160		62	50	300	
<u>FORBS</u>								
1. Sphae sp.	130	103	175		102	40	140	45
2. Lomat sp.					60		200	

Table 1. Land Use (Agriculture and Forest)
(Ganges) District in the
Himalayan Region for
1975, 1977, 1979 and 1981

Milligrams

1975 1977 1979 1981

Table 1-1

Grasses

1. Grass	64	66	105	110
2. Grass	282	110	183	280
3. Grass	127	70	123	160
4. Grass	130	75	123	160

Grasses

1. Grass	686	1100	765	1000
2. Grass	415	600	570	560

Table 1-2

1. Grass	35	43	60	30
2. Grass	48	50	120	110
3. Grass	204	110	180	170
4. Grass	32	60	182	170

Grasses

1. Grass	142	100	100	120
2. Grass	113	75	110	120
3. Grass	145	61	62	200

Grasses

1. Grass	150	103	103	140
2. Grass	150	175	103	140

Millimeters

Site 06-2-3 1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

SHRUBS

1. Cela	70			215		190
2. Atco	65			155		60
3. Grsp	25	20		♀ 168 ♂ 160		75
4. Arsp	20	12		52		60

GRASSES

1. Sihy	178			170	70	130	60
2. Orhy	150			360	170	350	330
3. Brte	145	55		130	50	170	

FORBS

1. Sphae sp.	200			80		90	50
2. Hagl	155			175		115	

Site 06-3

SHRUBS

1. Arar	62		30	188		200
2. Eriog sp.	65		46	100		200
3. Chvi	86		75	158		130
4. Pran	97		25	110		120

GRASSES

1. Posa	205		65	94	80	210
2. Sihy	279		185	215	105	250
3. Agsp	437		500	375	200	550
4. Brte	90		56	100	105	190

FORBS

1. Crac	90		85	125		145
2. Zigad sp.	381		240	255		300

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1970 Reprint 1971 Reprint 1972 Reprint

Site 00-2-2

SHRUBS

1. Cels	70	212	100
2. Acc	65	185	80
3. Grap	35	115	75
4. Asp	20	25	80

GRASSES

1. Silv	178	150	50	20	60
2. Orny	150	300	170	200	200
3. Brs	145	130	50	130	

FORES

1. Sphax	200	200	50	10	10
2. Hagi	155	175	115		

Site 00-3

SHRUBS

1. Arar	65	155	100
2. Eriog	65	100	200
3. Oliv	65	155	150
4. Fran	55	110	150

GRASSES

1. Poas	205	65	80	210
2. Silv	270	175	150	250
3. Asp	475	200	300	250
4. Brs	80	65	100-100	100

FORES

1. Cras	90	65	115	145
2. Elgud	261	240	275	200

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth
Site 6-3 Con't.

FORBS

3. Phlox sp.	13	15	52	16	70
4. Lomat sp.	90		75		140
5. Astra sp.	25	68	150		---
6. Eriog sp.		4	55		55
7. Alliu sp.			100		140

Site 06-7

SHRUBS

1. Putr	76	40	185		170
2. Chvi	92	165	138		150
3. Eriog sp.	89	40	110		100
4. Artr	154	65	255		220
5. Pran	74	65	145		185

GRASSES

1. Agsp	383	310	313	165	600
2. Posa	175	200	100	90	280
3. Sihy	251	225	210	135	270
4. Brte	125	60	108	50	140

FORBS

1. Phlox sp.	50	30	40	15	40	10
2. Basa	305	400	365		300	
3. Eriog sp.	152	---	70		150	

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1975 Research 1975 Research 1975 Research

Site 6-3 cont.

FOSSILS

1. *Wink*

sp.

2. *Lomax*

sp.

3. *Asira*

sp.

4. *Erlog*

sp.

5. *Alia*

sp.

Site 6-3

SHRUBS

1. *Pur*

sp.

2. *Ch*

sp.

3. *Erlog*

sp.

4. *Alia*

sp.

5. *Plan*

sp.

6. *Erlog*

sp.

7. *Adap*

sp.

8. *Erlog*

sp.

9. *Alia*

sp.

10. *Erlog*

sp.

FOSSILS

1. *Erlog*

sp.

2. *Erlog*

sp.

3. *Erlog*

sp.

CARROLL
SUMMIT

BATTLE MOUNTAIN DISTRICT

BATTLE MOUNTAIN DISTRICT

▲ SITE LOCATIONS

CARROLL
SUMMIT

Township

Section 20

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER						
SMD (From-To in cm)									S- 43	S- 43	3- 46	S- 60	6- 55	3- 50	S- 56	4- 60	2- 60	2- 60	2- 60	3- 60	4- 60	5- 60	2- 50	3- 35	0- 35	4- 50	5- 35	9- 35	9- 36		S-10- 40	30	6- 40	8- 40	5- 40	7- 30	
Precip. (in)										.2	.10	.5	.17		.36	.17	.38	.38	.42	.42	.42	.3	0	0		.08	.02	.14	.14		.16	0	.04	.16	.24		
S.T.-°C							1	2	-2	1	1	3		3	6	8	7	10	8	10	4	7	10	7	4	4	6	2		10	16	10	10	7	40	0	
BATTLE MOUNTAIN																																					
06-2-1																																					
Chna							D	LG												FG	BO	SD	LY	LD	1B	FB										LD	
Tegl							D	LG												BO	SD	LY															
Save							D		LG					TG						FB	BO																
							D		LG					TG						FB	BO																
Atco							D													BO																	LD
GRASSES							D													BO																	LD
Eici							D	GS												DS	HS															PD	
Spai							D													HO	An															PD	

♀ ♂ ♀ ♂

CARROLL
SUMMIT

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)			S- 1- 38 40 32 60 42 45	3- 3 33	17- 48	20-20- 48 48	17-20- 40 40	14-9- 30 30	8-12- 35 30	17-15- 30 30	3- 30
Precip. (in)			2.61.4 .2 .02	.43	.20	.10.10	.2 .2			.1 .3	.05
S.T.- °C			2 1 1 3 5	6	12	12 12	11 12	0 9 7 8	2 22	13 9 6	3
BATTLE MOUNTAIN											
O6-2-2											
SHRUBS											
Arsp			LG	BV	FG	LY LD	BO		SD		
Atco			LG	BV	FG	1B FB	BO				
Epne			D			TG	BO		LD		
Grsp				TG		BO	SR				
GRASSES											
Brte			GS		DS	BD	PD				
Posa			GS	FS	DS	BD	PD				
Slhy			GS			DS SD	BD	GS			
FORBS											
Sphae sp.			D	GS	1B	BD	PD	GS			
Hagl			D	FS		GS	FS 1B FB		SR	DS PD	

CARROLL
SUMMIT

SYMBOL 1979	JAN			FEB			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY		JUNE		JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER				
SMD (From-To in cm)						S- 30 30	S- 30 30	S- 60 35	S- 1- 35	S- 30		10- 37 35	7- 35 30	9- 30 30	11- 30 30	2- 30 35	13- 35 35	21- 35 35	22- 35 30	S- 30 30	2- 30 30	S- 35 35	13- 35 35	3-3- 15- 30 30	20- 30 30	17- 30 30	14- 30 30	S- 30 30	4- 30 30
Precip. (in)							.17	.4	.35	.05	.9	.05	.3	0	0				.5	.5	.15	0	.06	0	.08	.2	.5	Fr.	
S.T.-°C						0	0	1	1	2	4	8	8	10	14	10	10	15	10	4	8	10	8	4	16	10	10	4	0
<u>BATTLE MOUNTAIN</u>																													
<u>06-7</u>																													
<u>SHRUBS</u>																													
Eriog sp.						D		LG		TG		BV		FG	FB	FB		BO								SR	LY	LD	SD
Artr						D		LG		TG			SR	BV	FG	SD													
Putr												BO	SR			SD													
Pran						D		LG		TG		BO	SR				SD												
Chvi								LG		TG			SR			FG	1B	BO	SD										
Saca													FG	FB	BO	SR	LY												
<u>GRASSES</u>																													
Brte						GS				$\frac{1}{2}$ V		DS		SD	BD	PD													
Agsp						GS				$\frac{1}{2}$ V		HO		An	DS	SD	BD											GS	
Posa						GS			$\frac{1}{2}$ V	FS		HS		BD		PD												GS	
Sihiy						GS			$\frac{1}{2}$ V			HO	An	HS	SD	BD	PD												
<u>FORBS</u>																													
Eriog sp.						D		GS				FS	FB		DS	BD	PD	SR	DS	BD								PD	
Phlox sp.						D		GS				BO				PD													
Basa						D			GS			SR	BD		PD														

CARROLL
SUMMIT

TONOPAH

A review of four years data including 1979 shows no radical departures from the patterns established during the first three years of the study. Indian ricegrass (Oryzopsis hymenoides) began its growth early and most other phenophases occurred earlier in 1979 (Figure 1).

However, the opposite is shown in the description of phenophases for squirreltail grass (Sitanion hystrix) and desert globemallow (Sphaeralcea ambigua), where these two species began growth later in 1979 than for the previous three years (Figures 2 and 3).

Bud sagebrush (Artemisia spinescens) completed its life cycle a few weeks earlier in 1979 (Figure 4) than in 1976 and 1978. However, almost all of its phenophases occurred earliest in 1977. Figure 5 suggests that, relative to leaf and twig growth of shrubs, 1978 and 1979 were both earlier years than were 1976 and 1977. A similar relationship is found with grasses, since seed dissimination of Indian ricegrass and Galleta (Hilaria jamesii) occurred somewhat earlier, especially in 1979 (Figure 6). Total height growth of Indian ricegrass was least in 1979, a possible result of relatively dry soil at the end of April (Figure 7).

Shrub leader growth and regrowth revealed no surprises when the data were compared (Table 1). This last year (1979) seems to be about average relative to leader growth.

Winter fat (Ceratoides lanata) seemed to have very poor seed production this year.

A review of last year's production and the factors influencing it, and the factors influencing the production of the present year, are given in the following paragraphs. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

However, the production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

But the production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

However, the production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

in 1977, a possible reason for the increase in production is the increase in the area of the field. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

Winter for the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed. The production of the present year is compared with the production of the previous year and the factors influencing the production of the present year are discussed.

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 1 . Phenology of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

The following table shows the results of the experiments conducted during the year 1938. The data is presented in a tabular form, with the first column representing the date of the experiment, the second column representing the time of day, and the third column representing the results. The results are given in terms of the number of plants that survived, the number of plants that died, and the number of plants that were lost. The data is presented in a tabular form, with the first column representing the date of the experiment, the second column representing the time of day, and the third column representing the results. The results are given in terms of the number of plants that survived, the number of plants that died, and the number of plants that were lost.

1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612	1611	1610	1609	1608	1607	1606	1605	1604	1603	1602	1601	1600	1599	1598	1597	1596	1595	1594	1593	1592	1591	1590	1589	1588	1587	1586	1585	1584	1583	1582	1581	1580	1579	1578	1577	1576	1575	1574	1573	1572	1571	1570	1569	1568	1567	1566	1565	1564	1563	1562	1561	1560	1559	1558	1557	1556	1555	1554	1553	1552	1551	1550	1549	1548	1547	1546	1545	1544	1543	1542	1541	1540	1539	1538	1537	1536	1535	1534	1533	1532	1531	1530	1529	1528	1527	1526	1525	1524	1523	1522	1521	1520	1519	1518	1517	1516	1515	1514	1513	1512	1511	1510	1509	1508	1507	1506	1505	1504	1503	1502	1501	1500	1499	1498	1497	1496	1495	1494	1493	1492	1491	1490	1489	1488	1487	1486	1485	1484	1483	1482	1481	1480	1479	1478	1477	1476	1475	1474	1473	1472	1471	1470	1469	1468	1467	1466	1465	1464	1463	1462	1461	1460	1459	1458	1457	1456	1455	1454	1453	1452	1451	1450	1449	1448	1447	1446	1445	1444	1443	1442	1441	1440	1439	1438	1437	1436	1435	1434	1433	1432	1431	1430	1429	1428	1427	1426	1425	1424	1423	1422	1421	1420	1419	1418	1417	1416	1415	1414	1413	1412	1411	1410	1409	1408	1407	1406	1405	1404	1403	1402	1401	1400	1399	1398	1397	1396	1395	1394	1393	1392	1391	1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	1377	1376	1375	1374	1373	1372	1371	1370	1369	1368	1367	1366	1365	1364	1363	1362	1361	1360	1359	1358	1357	1356	1355	1354	1353	1352	1351	1350	1349	1348	1347	1346	1345	1344	1343	1342	1341	1340	1339	1338	1337	1336	1335	1334	1333	1332	1331	1330	1329	1328	1327	1326	1325	1324	1323	1322	1321	1320	1319	1318	1317	1316	1315	1314	1313	1312	1311	1310	1309	1308	1307	1306	1305	1304	1303	1302	1301	1300	1299	1298	1297	1296	1295	1294	1293	1292	1291	1290	1289	1288	1287	1286	1285	1284	1283	1282	1281	1280	1279	1278	1277	1276	1275	1274	1273	1272	1271	1270	1269	1268	1267	1266	1265	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951	950	949	948	947	946	945	944	943	942	941	940	939	938	937	936	935	934	933	932	931	930	929	928	927	926	925	924	9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CARROLL
SUMMIT

REGROWTH
PLANT DRY
PLANT BEGINS
TO DRY
DISSEMINATION
HARD SEED
DOUGH SEED SET
ANTHESIS
HEADS OUT
FULLY
FLOWER STALKS
 $\frac{1}{2}$ VEGETATIVE
GROWTH
GROWTH STARTS
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 ---
1977 ———
1978 —+—+—+—
1979
1

Fig. 2 . Phenology of
Sitanion hystrix on a salt
desert shrub vegetation
type (site 06A-2-1),
Tonopah District.

BEGINS TO DRY

FULL BLOOM

FIRST BLOOM

REGROWTH

PLANTS DRY

PLANTS BEGIN
TO DRY

DISSEMINATION
STARTS

SEEDS RIPE

BLOOM OVER

FULL BLOOM

FIRST BLOOM

FLOWER STALKS
APPEAR

GROWTH STARTS

DORMANT

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

1976 - - - - -

1977 —————

1978 + + + + +

1979

Fig. 3 . Phenology of
Sphaeralcea ambigua on
salt desert shrub
vegetation type (site
06A-2-2), Tonopah District.

LEAVES DRY
AND DROP
NEW LEAF
GROWTH
LEAVES DRY
AND DROP
LEAVES TURN
YELLOW
SEED
DISSEMINATION
SEED RIPE
BLOOM OVER
FULL BLOOM
FIRST BLOOM
LEAVES FULL
GROWN
FLOWER BUDS
FIRST VISIBLE
TWIG GROWTH
LEAF GROWTH
DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 4 . Phenology of *Artemisia Spinescens* on salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

The first thing I noticed when I stepped
 out of the plane was the cold. It was
 a sharp contrast to the warm, humid
 air of the tropics. I shivered as I
 walked down the stairs, my hands
 tucked into my pockets. The ground
 was hard and uneven, and I stumbled
 a few times. I looked up at the
 sky, where a few clouds were visible
 against the pale blue. The sun was
 low in the sky, casting a soft glow
 over the landscape. I took a deep
 breath, feeling the crisp air fill my
 lungs. It was a strange feeling, like
 I had been transported to a different
 world. I looked around, trying to
 get my bearings. The landscape was
 flat and open, with a few small trees
 scattered here and there. In the
 distance, I could see a line of trees
 that marked the edge of a forest. I
 walked towards them, feeling a sense
 of adventure. The air was so clean,
 so different from what I was used to.
 I felt like I had discovered a new
 world.

Date		Time		Location	
1970	10/10	10:00	10:15	10:30	10:45
1971	10/11	10:00	10:15	10:30	10:45
1972	10/12	10:00	10:15	10:30	10:45
1973	10/13	10:00	10:15	10:30	10:45
1974	10/14	10:00	10:15	10:30	10:45
1975	10/15	10:00	10:15	10:30	10:45
1976	10/16	10:00	10:15	10:30	10:45
1977	10/17	10:00	10:15	10:30	10:45
1978	10/18	10:00	10:15	10:30	10:45
1979	10/19	10:00	10:15	10:30	10:45
1980	10/20	10:00	10:15	10:30	10:45
1981	10/21	10:00	10:15	10:30	10:45
1982	10/22	10:00	10:15	10:30	10:45
1983	10/23	10:00	10:15	10:30	10:45
1984	10/24	10:00	10:15	10:30	10:45
1985	10/25	10:00	10:15	10:30	10:45
1986	10/26	10:00	10:15	10:30	10:45
1987	10/27	10:00	10:15	10:30	10:45
1988	10/28	10:00	10:15	10:30	10:45
1989	10/29	10:00	10:15	10:30	10:45
1990	10/30	10:00	10:15	10:30	10:45

06A 2-1
Arno

1976

1977

1978

1979

06A 2-1
Epne

1976

1977

1978

Dropped
1979

06A 2-2
Atco

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

LEAF GROWTH

TWIG GROWTH

Fig. 5 . Occurrence of leaf and twig growth of selected shrubs, Tonopah District.

Fig. 3. Occurrence of head and tail growth of selected anodes, Tropic District.

06A-2-1
Orhy

1976

1977

1978

1979

06A-2-1
Hija

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

$\frac{1}{2}$ VEGETATIVE
GROWTH

FLOWER STALKS
FIRST APPEAR

SEED
DISSEMINATION

PLANTS DRY

Fig. 6 . Occurrence of
various phenophases of se-
lected grasses, Tonopah
District.

1976	-----
1977	—————
1978	+ + + + +
1979	• • • • •

Fig. 7 . Height growth (mm) of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

Table 1. Leader (Shrubs) and Height
(Grasses) Growth in the Tonapah
District for 1976, 1977, 1978,
and 1979.

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 06A-2-1

SHRUBS

1. Arno	230	200	220	140	
2. Arsp	30	20	23	16	
3. Atco	60	60	87	70	
4. Cela	170	45	23	dropped	
5. Epne	250	105	135	dropped	
6. Grsp	110	60	70	35	LG*

GRASSES

1. Hija	340	330	105	52	70
2. Orhy	324	280	310	97	255
3. Sihy	400	290	400	140	330

FORBS

1. Sphae sp.	450	340	110	440	30	320
-----------------	-----	-----	-----	-----	----	-----

Site 06A-2-2

SHRUBS

1. Atco	70	70	155	35 °	18 °
2. Arsp	40	20	2	43	LG* 35°
3. Cela	235	180	180	235	

GRASSES

1. Orhy	314	260	367	145	325
---------	-----	-----	-----	-----	-----

*LG=leaf growth

CARROLL
SUMMIT

Yield I, (Landed (Landed) and higher
 (Landed) (Landed) in the (Landed)
 District for 1977, 1978, 1979
 and 1980

Milligrams

1976 Reunited 1977 Reunited 1978 Reunited 1979 Reunited

1976 OEA-2-1

1976	1977	1978	1979
1. 1976	1977	1978	1979
2. 1976	1977	1978	1979
3. 1976	1977	1978	1979
4. 1976	1977	1978	1979
5. 1976	1977	1978	1979
6. 1976	1977	1978	1979

1976 OEA-2-2

1976	1977	1978	1979
1. 1976	1977	1978	1979
2. 1976	1977	1978	1979
3. 1976	1977	1978	1979
4. 1976	1977	1978	1979
5. 1976	1977	1978	1979
6. 1976	1977	1978	1979

1976 OEA-2-3

1976	1977	1978	1979
1. 1976	1977	1978	1979
2. 1976	1977	1978	1979
3. 1976	1977	1978	1979
4. 1976	1977	1978	1979
5. 1976	1977	1978	1979
6. 1976	1977	1978	1979

1976 OEA-2-4

Millimeters

1976 Regrowth 1977 Regrowth 1978 Regrowth 1979 Regrowth

Site 06A-2-2

Con't

FORBS

1. Spam	500	310	310	440	GS*	400
---------	-----	-----	-----	-----	-----	-----

Site 06A-3

SHRUBS

1. Artr	220	125		180		152
2. Come	120	75		90		52
3. Grsp						37
4. Atca						42
5. Epne						80
6. Pran						18

*GS=growth starts

CARROLL
SUMMIT

1970-1971 Regional Survey

Page 100-101

Notes

1. Span

100-101

Notes

1. Area

2. Core

3. Gap

4. Area

5. Line

6. Point

100-101

BATTLE MOUNTAIN DISTRICT

CARROLL
SUMMIT

CARROLL
SUMMIT

▲ SITE LOCATION

BATTLE MOUNTAIN DISTRICT

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)			1- S- 60 60	3- 6- 60 60	9- 25- 60 60	18-28- 60 51	28-30- 51 50	3- 3- 38 60	5- 3- 60 60	8- 60	
Precip. (in) NONE											
S.T.-°C			10 4 7 4	12 12 12 14	16 16 22 22	22 24 26 26	26 26 27 25	30 25 25	22	12	
TONOPAH 06A-2-1											
SHRUBS:											
Arno			LG	TG BV	1B FB BO	BV	LY LD	FG	1B	SD	
Arsp			D LG	TG		1B	FB BO			SR	
Atco			D LG	TG		1B	FB BO	LY			
Grsp			D LG		TG BV	1B BO	LY LG				
GRASSES:											
Hija			D		1/2 V		SD	1/2 V		1/2 V	
Orhy			GS	1/2 V	FS An	DS	HS SD	GS			
Sihy			GS	1/2 V	HO An	DS SD	BD	1/2 V			
FORBS:											
Sphae sp.			D		FS	1B FB BO	BD		1B	DS	

CARROLL
SUMMIT

CARROLL
SUMMIT

CARROLL SUMMIT

Squirreltail grass (Sitanion hystrix) seems to confine its phenologic development to no more than a three week spread for each phenotype during the past four years (Figure 1), irrespective of soil moisture depth.

Height growth on crested wheatgrass (Agropyron cristatum) seems to follow very closely all four years until early July, when it either stops growing or spurts quickly, as it did in 1978 to 500 millimeters (Figure 2).

Phenologic stages for Kentucky bluegrass (Poa pratensis) are remarkably similar over the four years (Figure 3). These four years of data would appear to be adequate for determining when this grass arrives at its key stages. Snowberry (Symphoricarpos longiflorus) shows a similar pattern over the four years except for seed ripe in 1978, which occurred a month later (Figure 4).

On the other hand, Sandberg's bluegrass (Poa sandbergii) shows much more variation, with up to seven weeks difference for occurrence of one phenotype (Figure 5).

Leader growth of bitterbrush (Purshia tridentata) grew less than one-fourth in 1979 than it did in 1976, while the other two years were in between (Figure 6). In 1976, soil moisture appears to stay relatively close to the surface while it does drop down somewhat in the other years.

While key phenological events for bitterbrush and snowberry are quite similar over the four years, they are very different for desert globemallow (Sphaeralcea ambigua), phlox (Phlox sp.),

Thurber's needlegrass (Stipa thurberiana), and crested wheat-grass (Figures 7-9).

Leader growth for shrubs and height growth for forbs and grasses are quite variable over the four years, but show no specific, discernable pattern (Table 1).

Further a number of large specimens and a small specimen

Grass (Figure 7-5)

Leaves grown for analysis and having given the same

and grasses are also available from the 1st series, but they

are specific, distinguishable patterns (Figure 7)

REGROWTH
 PLANT DRY
 PLANT BEGINS
 TO DRY
 DISSEMINATION
 HARD SEED
 DOUGH SEED SET
 ANTHESIS
 HEADS OUT
 FULLY
 FLOWER STALKS
 1/2 VEGETATIVE
 GROWTH
 GROWTH STARTS
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 — — — —
 1977 — — — —
 1978 + + + +
 1979

Fig. 1. Occurrence of phenophases of *Sitanion hystrix* as compared to soil moisture depth (inches) in northern desert shrub vegetation (Site 07-3), Carroll Summit.

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 — — — —
1977 — — — —
1978 + + + + +
1979

Fig. 2. Height growth (mm) of *Agropyron cristatum* compared with soil moisture depth (inches) on northern desert shrub vegetation (site 07-3), Carroll Summit.

REGROWTH DRY
 REGROWTH
 PLANT DRY
 PLANT BEGINS TO DRY
 DISSEMINATION
 HARD SEED
 DOUGH SEED SET
 ANTHESIS
 HEADS OUT FULLY
 FLOWER STALKS
 1/2 VEGETATIVE GROWTH
 GROWTH STARTS
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 -----
 1977 —————
 1978 +++++
 1979

Fig. 3 . Phenology of *Poa pratensis* in mountain meadow vegetation (site 07-6), Carroll Summit.

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<p> [Faint text in the bottom-left corner, possibly a date or reference number.] </p>	<p> [Faint text in the bottom-right corner, possibly a signature or name.] </p>

REGROWTH
 PLANT DRY
 PLANT BEGINS
 TO DRY
 DISSEMINATION
 HARD SEED
 DOUGH SEED SET
 ANTHESIS
 HEADS OUT
 FULLY
 FLOWER STALKS
 $\frac{1}{2}$ VEGETATIVE
 GROWTH
 GROWTH STARTS
 DORMANT

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 -----
 1977 _____
 1978 +++++
 1979

Fig. 5 . Phenology of *Poa sandbergii* in mountain brush vegetation (site 07-7), Carroll Summit.

8 X 8 PER INCH

500+
500
450
400
350
300
250
200
150
100
50
0

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

1976 - - - - -
1977 —————
1978 + + + + +
1979

Fig. 6. Leader growth (mm) of Purshia tridentata compared to soil moisture depth (inches) in mountain brush vegetation (site 07-7), Carroll Summit.

07-7
Putr

1976

1977

1978

1979

07-7
Sylc

1976

1977

1978

1979

JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT

LEAF GROWTH

TWIG GROWTH

Fig. 7. Occurrence of leaf and twig growth of selected shrubs, Carroll Summit.

07-2
Spam

1976

1977

1978

1979

07-5
Phlox sp.

1976

1977

1978

1979

JAN

FEB

MAR

APR

MAY

JUNE

JULY

AUG

SEPT

OCT

GROWTH STARTS

FULL BLOOM

PLANTS DRY

Fig. 8. Occurrence of various phenophases of selected forbs, Carroll Summit.

Fig. 9. Occurrence of various phenophases of selected grasses, Carroll Summit.

Table 1. Leader (Shrubs) and Height (Grasses) Growth at Carroll Summit (Carson City and Battle Mountain Districts) for 1976, 1977, 1978, and 1979.

Millimeters

	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 07-2</u>								
<u>SHRUBS</u>								
1. Saba	50		35		70		70	g.u. ¹
2. Grsp	85		85		150		90	LG ²
3. Arsp	35		25		40		25	
4. Chvi	140		120		130		110	
5. Atco	100		100		180		90	
6. Cela	150		200		250		220	
7. Epne	145		175		220		200	
<u>GRASSES</u>								
1. Brte	200	30	170		250	30	140	
2. Sihy			140		210	60	230	100
3. Orhy			200		345	140	310	70
4. Agcr			500		400	90	270	150
<u>FORBS</u>								
1. Phra	250	3	175		90		220	
2. Hagl	130		185		170		120	
3. Maloc sp.	90				100		---	
4. Spam	200	50	180		350		150	70
<u>Site 07-3</u>								
<u>SHRUBS</u>								
1. Artr	140		170		215		135	
2. Chvi	90		130		160		110	

¹ green-up

² Leaf growth

Table 1. *Summary of the results of the analysis of variance for the years 1975, 1976, 1977, 1978, and 1979.*

1975-1979

1975					1976					1977					1978					1979				
1975					1976					1977					1978					1979				
1975					1976					1977					1978					1979				
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Millimeters

	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
<u>Site 07-3</u>								
<u>Con't.</u>								
3. Chna	180		230		225		210	
4. Epne	100		130		145		140	
<u>GRASSES</u>								
1. Posa	70		200		230	50	300	
2. Brte	130		150		160	35	140	
3. Sihy	210		180		250	110	350	50
4. Agcr	430		380		500	140	400	100
<u>FORBS</u>								
1. Lomat sp.	40		20		80		30	
2. Erci			10		130	50	45	
3. Crac					95		--	
4. Delph sp.					350		100	
<u>Site 07-5</u>								
<u>SHRUBS</u>								
1. Artr	60		150		180		150	
2. Chvi	95		160		110		150	
3. Eriog sp.	25	20	90		100	LG ¹	90	
<u>GRASSES</u>								
1. Brte	150	40	160		120	20	120	
2. Sihy	170	80	180		200	70	185	70
3. Posa	200	50	200		245	40	200	
4. Stth	250	60	170		310	g.u. ²	350	70
<u>FORBS</u>								
1. Phlox sp.	30	4	18		20	1	20	g.u. ²
2. Lupin sp.	130		150		200		200	
3. Aswh	30		25		45		15	
4. Casti sp.							140	

¹ Leaf growth
² green-up

1975 Regional 1975 Regional 1975 Regional 1975 Regional

1975-07-2
Unit

1. China	100	100	100	100
2. France	100	100	100	100
FRANCE				
1. France	100	100	100	100
2. France	100	100	100	100
3. France	100	100	100	100
4. France	100	100	100	100

FRANCE

1. France	100	100	100	100
2. France	100	100	100	100
3. France	100	100	100	100
4. France	100	100	100	100

1975-07-2

FRANCE

1. France	100	100	100	100
2. France	100	100	100	100
3. France	100	100	100	100
4. France	100	100	100	100

FRANCE

1. France	100	100	100	100
2. France	100	100	100	100
3. France	100	100	100	100
4. France	100	100	100	100

FRANCE

1. France	100	100	100	100
2. France	100	100	100	100
3. France	100	100	100	100
4. France	100	100	100	100

1975-07-2
Unit

Millimeters

Site 07-6

GRASSES

	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
1. Carex sp.	120		150		220	30	150	50
2. Sihy	400	80	360		500	60	450	70
3. Popr	450	80	540	170	600	150	750	250
4. Posa			360		450	160	600	25

FORBS

1. Taof	15		70	70	60	20	100	regrowth
2. Vipu	35		45		40	12	40	
3. Senec sp.			80		400		350	
4. Aster sp.			280		310		400	
5. Aggl			140		90		150	
6. Libu			150		250		280	

Site 07-7

SHRUBS

1. Sylo	150		100		160		110	
2. Artr	150		190		170		180	
3. Rive	90		230		105		65	
4. Chvi	110		100		200		115	
5. Putr	150	55	95		90		45	g.u.*

GRASSES

1. Posa	300	60	350		310	80	330	25
2. Stth	250	50	140		160		340	
3. Sihy	180	60	250		330	30	75	

FORBS

1. Vipu	35		20		35	8	23	
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* green-up

1917

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Millimeters

	1976	Regrowth	1977	Regrowth	1978	Regrowth	1979	Regrowth
Site 07-7								
<u>Con't.</u>								
2. Lupin sp.	110		70		130gr.*		210	
3. Liliu sp.			280		100gr.*		240gr.*	
4. Phlox sp.	35		20	3	28		25	
5. Senec sp.	60		50		70		290	
6. Libu	20				--		10	
7. Aggl	150		45		70		100	

* grazed

1972 August 17T August 19T August 20T August 21T August 22T August 23T August 24T August 25T August 26T August 27T August 28T August 29T August 30T

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▲ SITE LOCATIONS
(Not all sites shown due
to closeness)

CARSON CITY DISTRICT

CARSON CITY DISTRICT
SITE LOCATIONS
(Not all sites shown due to closeness)

Symb	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)									D		
Precip. (in)				.39	0 .37	0			.6		
S.T.-°C				12	21 13 26	29 28			16		
CARROLL SUMMIT											
07-2											
SHRUBS											
Saba ♀			D	LG BV	TG	1B FB BO	BD, LY	SD, LD	SD, J.u.		
♂			D	LG BV	TG	BO SR SD	SD, LY	SD, LD	SD, J.u.		
♀			D	TG	BV	1B BO, SD, LY	SD, LD	LD	LG		
♂			D	TG, BV	FG 1B	BO SR, SD, LY	SD, LD	LD	LG		
Arsp			LG	BV	1B FB BO	SD, SD, LY		LD			
Chvi			LG	TG		BV	FG	FB, LY	BO, LY		
Atco ♀			D	TG	BV	FB BO SR	SD, LY				
♂			D	TG			LY				
Cela			D		TG	BV FB BO	BO, LY		SD, LY		
Epne			D		BV	FB BO SR	SD		SD, LY		
GRASSES											
Brte			D	½ V	FS HO	HS, SD, BD PD		PD			
Sihiy			GS	½ V	FS	DS BS, HS, PD	PD		½ V		

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)											
Precip. (in)											
S.T. - °C											
<u>CARROLL SUMMIT</u>											
<u>07-2 Con't.</u>											
Orhy			GS	$\frac{1}{2}$ V	FS	DS HS SD, BD	PD		$\frac{1}{2}$ V		
Agcr			D	$\frac{1}{2}$ V	FS	HO An	DS HS, BD	SD, BD	$\frac{1}{2}$ V		
<u>FORBS</u>											
Phra					1B	BO, SR, BD BD	DS, PD	PD			
Hagl			D		GS				FB		
Spam			D	FS		BO SR DS	DS, BD	GS			

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)			S- 30	S- 30 2- 30 30	4- 30 1- 30 5- 30	14- 30 21- 30 13- 30	D D	S- 30	D		
precip. (in)				.3	0 .64 0	0 0		1.75	0		
S.T.-°C				15	21 20 26	24 24		12	16		
CARROLL SUMMIT											
07-3											
SHRUBS											
Artr			LG		TG		BV	FG	FB		
Chvi			D		TG		BV	FB	BO		
Chna			D	LG					FB		
Epne			D			TG					
GRASSES											
Posa			GS		HO	DS HS, SD, BD PD PD		PD			
Brte			D	GS	HO	DS HS, SD, BD PD PD		PD			
Sihy			GS		FS	An DS BD HS, BD	SD, PD		GS		
Agcr			D	GS	FS	HO An	HS, BD	SD BD	GS		
FORBS											
Lomat sp.			GS	FS 1B FB BO		PD					
Erc1			D	FS 1B	FB	SR, SD, PD BD PD					
Delph sp.			D	FS		PD					

SYMBOL 1979	JAN		FEB		MARCH		APRIL		MAY			JUNE			JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER	
SMD (From-To in cm)						S- 30	S- 30	2- 30	4- 30	5- 30	3- 30	9- 30	18- 30	7- 30	12- 30	D	S- 30	S- 5.						
precip. (in)									0	.94	0	0	0			0	355	75						
S.T.-°C							11		20	16	23	23	22				12	12						
CARROLL SUMMIT																								
07-5																								
SHRUBS																								
Artr						D	LG				TG				BV		FG	FB,						
Chvi						D	LG								BV		FB	BO,						
Eriog sp.						D	LG				TG, BV	1B	FB	SR	SD	SD, LY		SR	SD,					
Eriog sp.						D	LG		IG, BV			FB	BO	SR	SD	SD, LY		J.U.	J.U.					
GHASSES																								
Brte						D	GS		1/2 V	FS		HO	An, BD	DS, BD	HS, PD	SD, PD		PD						
Sihy						GS			1/2 V			FS	HO	An	HS	SD, BD	GS							
Posa						D	GS		1/2 V	FS	HO	An, BD	DS, BD	SD, PD	HS, BD	SD, PD	GS	PD						
Stipa sp.																								
FORBS																								
Phlox sp.						D	GS		FS	1B		BO	SR	BD	BD	PD	J.U.	BD						
Lupin sp.						D		GS			FS	1B	BO	DS, BD			BD	PD						
Aswh						D						BD		PD										
Casti sp.						D			GS		FS	1B	FB		BO, BD		DS, PD	PD						

SYMBOL 1979	JAN	FEB	MARCH	APRIL	MAY	JUNE			JULY		AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
SMD (From-To in cm)					S- 30	S- 30	7- 30	12-4- 30 30 30	7- 30	12- 30	S- 30	S- 5.		
Precip. (in)					.76	0	.25			0	3.			
S.T.-°C					12	15	25 26 22				11	4		
CARROLL SUMMIT														
07-6														
SHRUBS														
GRASSES														
Carex sp.					GS	$\frac{1}{2}$ V	An		HS	HS, BD	SD, BD	$\frac{1}{2}$ V		
Sihy					GS	$\frac{1}{2}$ V	FS		HO	DS	SD, BD	GS		
Popr					GS	$\frac{1}{2}$ V	HO	An	HS	HS, BD	SD, BD	$\frac{1}{2}$ V		
Posa					GS	$\frac{1}{2}$ V	HO	DS	HS	HS, BD	SD, BD	GS		
FORBS														
Taof					GS	FS	FB	SR DS				BO, SR		
Vipu					GS	1B	FB	SR DS				PD		
Senec sp.					GS	1B	FB	BO gr.						
Libu					GS	FS	FB	BO, SR, BD PD	SD, PD	PD				
Aggl					GS		1B	BO, BO, BD BD	SR, PD	DS PD	PD			
Aster sp.					D					FS	FB	BO		

[illegible]

	1975				1976				1977				1978				1979				1980				1981				1982				1983				1984				1985				1986				1987				1988				1989				1990				1991				1992				1993				1994				1995				1996				1997				1998				1999				2000				2001				2002				2003				2004				2005				2006				2007				2008				2009				2010				2011				2012				2013				2014				2015				2016				2017				2018				2019				2020				2021				2022				2023				2024				2025				2026				2027				2028				2029				2030				2031				2032				2033				2034				2035				2036				2037				2038				2039				2040				2041				2042				2043				2044				2045				2046				2047				2048				2049				2050				2051				2052				2053				2054				2055				2056				2057				2058				2059				2060				2061				2062				2063				2064				2065				2066				2067				2068				2069				2070				2071				2072				2073				2074				2075				2076				2077				2078				2079				2080				2081				2082				2083				2084				2085				2086				2087				2088				2089				2090				2091				2092				2093				2094				2095				2096				2097				2098				2099				2100				2101				2102				2103				2104				2105				2106				2107				2108				2109				2110				2111				2112				2113				2114				2115				2116				2117				2118				2119				2120				2121				2122				2123				2124				2125				2126				2127				2128				2129				2130				2131				2132				2133				2134				2135				2136				2137				2138				2139				2140				2141				2142				2143				2144				2145				2146				2147				2148				2149				2150				2151				2152				2153				2154				2155				2156				2157				2158				2159				2160				2161				2162				2163				2164				2165				2166				2167				2168				2169				2170				2171				2172				2173				2174				2175				2176				2177				2178				2179				2180				2181				2182				2183				2184				2185				2186				2187				2188				2189				2190				2191				2192				2193				2194				2195				2196				2197				2198				2199				2200				2201				2202				2203				2204				2205				2206				2207				2208				2209				2210				2211				2212				2213				2214				2215				2216				2217				2218				2219				2220				2221				2222				2223				2224				2225				2226				2227				2228				2229				2230				2231				2232				2233				2234				2235				2236				2237				2238				2239				2240				2241				2242				2243				2244				2245				2246				2247				2248				2249				2250				2251				2252				2253				2254				2255				2256				2257				2258				2259				2260			
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[illegible]

Appendix I. Symbol and scientific name (alphabetically by symbol) of species presented in phenodynamic tables.

<u>SYMBOL</u>	<u>SCIENTIFIC NAME</u>
SHRUBS:	
Amal	<u>Amelanchier alnifolia</u>
Amdu	<u>Ambrosia dumosa</u>
Amut	<u>Amelanchier utahensis</u>
Arar	<u>Artemisia arbuscula</u>
Arno	<u>Artemisia nova</u>
Arpa	<u>Arctostaphylos patula</u>
Arsp	<u>Artemisia spinescens</u>
Artr	<u>Artemisia tridentata</u>
Atca	<u>Atriplex canescens</u>
Atco	<u>Atriplex confertifolia</u>
Atle	<u>Atriplex lentiformis</u>
Bere	<u>Berberis repens</u>
Cegr	<u>Ceanothus greggii</u>
Cela	<u>Ceratoides lanata</u>
Cele	<u>Cercocarpus ledifolius</u>
Cepr	<u>Ceanothus prostratus</u>
Ceve	<u>Ceanothus velutinus</u>
Chna	<u>Chrysothamnus nauseosus</u>
Chvi	<u>Chrysothamnus viscidiflorus</u>
Come	<u>Cowania mexicana</u>
Cora	<u>Coleogyne ramosissima</u>

<u>SYMBOL</u>	<u>SCIENTIFIC NAME</u>
Cost	<u>Cowania stansburiana</u>
Dafr	<u>Dalea fremontii</u>
Epne	<u>Ephedra nevadensis</u>
Epvi	<u>Ephedra viridis</u>
Eriog sp.	<u>Eriogonum</u>
Grsp	<u>Grayia spinosa</u>
Haco	<u>Haplopappus cooperi</u>
Hodi	<u>Holodiscus discolor</u>
Hodu	<u>Holodiscus dumosus</u>
Juos	<u>Juniperus osteosperma</u>
Krpa	<u>Krameria parvifolia</u>
Ladi	<u>Larrea divaricata</u>
Lepu	<u>Leptodactylon pungens</u>
Lysp	<u>Lygodesmia spinosa</u>
Mare	<u>Mahonia repens</u>
Potr	<u>Populus tremuloides</u>
Potr3	<u>Populus trichocarpa</u>
Pran	<u>Prunus andersonii</u>
Prju	<u>Prosopis juliflora</u>
Prvi	<u>Prunus virginiana</u>
Putr	<u>Purshia tridentata</u>
Riau	<u>Ribes aureum</u>
Ribes sp.	<u>Ribes</u>
Rice	<u>Ribes cereum</u>
Rive	<u>Ribes velutinum</u>
Rosa sp.	<u>Rosa</u>

SYMBOLSCIENTIFIC NAME

Rowo	<u>Rosa woodsii</u>
Saal	<u>Salix alba</u>
Saba	<u>Sarcobatus baileyi</u>
Saca	<u>Salix cascadiensis</u>
Salix sp.	<u>Salix</u>
Save	<u>Sarcobatus vermiculatus</u>
Syal	<u>Symphoricarpos albus</u>
Sylo	<u>Symphoricarpos longiflorus</u>
Symph sp.	<u>Symphoricarpos</u>
Syoc	<u>Symphoricarpos occidentalis</u>
Teca	<u>Tetradymia canescens</u>
Tegl	<u>Tetradymia glabrata</u>
Yubr	<u>Yucca brevifolia</u>

GRASSES:

Agal	<u>Agrostis alba</u>
Agcr	<u>Agropyron cristatum</u>
Agda	<u>Agropyron dasystachyum</u>
Agde	<u>Agropyron desertorum</u>
Agin Ag	<u>Agropyron intermedium</u>
Agrop sp.	<u>Agropyron</u>
Agros sp.	<u>Agrostis</u>
Agsm	<u>Agropyron smithii</u>
Agsp	<u>Agropyron spicatum</u>
Agst	<u>Agrostis stolonifera</u>
Agtr	<u>Agropyron trachycaulum</u>

SYMBOL

Bow

Sail

Sail

Sail

Sail sp.

Sail

Sail

Sail

Sail sp.

Sail

Sail

Sail

Sail

GRASS

Ag

Ag

Ag

Ag

Ag

Ag sp.

Ag sp.

Ag

Ag

Ag

Ag

Ag

SYMBOLSCIENTIFIC NAME

Bogr	<u>Bouteloua gracilis</u>
Brca	<u>Bromus carinatus</u>
Brin	<u>Bromus inermis</u>
Brja	<u>Bromus japonicus</u>
Brte	<u>Bromus tectorum</u>
Cane	<u>Calamagrostis neglecta</u>
Carex sp.	<u>Carex</u>
Deca	<u>Deschampsia caespitosa</u>
Disti sp.	<u>Distichlis</u>
Dist	<u>Distichlis stricta</u>
Elci	<u>Elymus cinereus</u>
Eltr	<u>Elymus triticoides</u>
Feid	<u>Festuca idahoensis</u>
Feme	<u>Festuca megalura</u>
Hija	<u>Hilaria jamesii</u>
Hiri	<u>Hilaria rigida</u>
Hobr	<u>Hordeum brachyantherum</u>
Juba	<u>Juncus balticus</u>
Juncu sp.	<u>Juncus</u>
Kocr	<u>Koeleria cristata</u>
Muri	<u>Muhlenbergia richardsonis</u>
Orhy	<u>Oryzopsis hymenoides</u>
Orwe	<u>Oryzopsis webberi</u>
Poam	<u>Poa ampla</u>
Pobu	<u>Poa bulbosa</u>

SYMBOLSCIENTIFIC NAME

Pocu	<u>Poa cusickii</u>
Pofe	<u>Poa fendleriana</u>
Pone	<u>Poa nevadensis</u>
Popr	<u>Poa pratensis</u>
Posa	<u>Poa sandbergii</u>
Pule	<u>Puccinellia lemmoni</u>
Sece	<u>Secale cereale</u>
Sihy	<u>Sitanion hystrix</u>
Spai	<u>Sporobolus airoides</u>
Stco	<u>Stipa comata</u>
Stipa sp.	<u>Stipa</u>
Stth	<u>Stipa thurberiana</u>
Stwe	<u>Stipa webberi</u>
FORBS:	
Acca	<u>Aconitum columbianum</u>
Acla	<u>Achillea lanulosa</u>
Acmi	<u>Achillea millefolium</u>
Aggl	<u>Agoseris glauca</u>
Alliu sp.	<u>Allium</u>
Arabi sp.	<u>Arabis</u>
Argem sp.	<u>Argemone</u>
Arlu	<u>Artemisia ludoviciana</u>
Asle	<u>Astragalus lemmonii</u>
Aster sp.	<u>Aster</u>

SYMBOL

SCIENTIFIC NAME

Poco

Poa annua

Pole

Poa trivialis

Pone

Poa nemoralis

Popi

Poa pratensis

Posa

Poa annua

Pule

Puccinellia maritima

Sera

Setaria verticillata

Siny

Setaria viridis

Spai

Stropharia macrospora

Stco

Stipa caprea

Stipa sp.

Stipa sp.

Stip

Stipa pennata

Stwa

Stipa pennata

THERM:

Toga

Thymus praecox

Tola

Thymus praecox

Toni

Thymus praecox

Togi

Thymus praecox

Tilia sp.

Tilia sp.

Tribi sp.

Tribulus terrestris

Trogen sp.

Trogodon aedon

Trio

Triticum aestivum

Trie

Triticum aestivum

Tater sp.

Taraxacum officinale

<u>SYMBOL</u>	<u>SCIENTIFIC NAME</u>
Astra sp.	<u>Astragalus</u>
Aswh	<u>Astragalus whitneyi</u>
Basa	<u>Balsamorhiza sagittata</u>
Casti sp.	<u>Castilleja</u>
Cirsi sp.	<u>Cirsium</u>
Clema sp.	<u>Clematis</u>
Crac	<u>Crepis acuminata</u>
Delph sp.	<u>Delphinium</u>
Erci	<u>Eriodinium cicutarium</u>
Eriog sp.	<u>Eriogonum</u>
Erca	<u>Eriogonum caespitosum</u>
Erov	<u>Eriogonum ovalifolium</u>
Erth	<u>Eriogonum thomasi</u>
Fraga sp.	<u>Fragaria</u>
Haar	<u>Haplopappus armerioides</u>
Hagl	<u>Halogeton glomeratus</u>
Halog sp.	<u>Halogeton</u>
Haplo sp.	<u>Haplopappus</u>
Hyca	<u>Hydrophyllum capitatum</u>
Iris sp.	<u>Iris</u>
Irm	<u>Iris missouriensis</u>
Lepe	<u>Lepidium perfoliatum</u>
Libu	<u>Lithophragma bulbifera</u>
Liliu sp.	<u>Lilium</u>
Logr	<u>Lomatium grayi</u>

SYMBOLSCIENTIFIC NAME

Lomat sp.	<u>Lomatium</u>
Lone	<u>Lomatium nevadense</u>
Lotr	<u>Lomatium triternatum</u>
Luca	<u>Lupinus caudatus</u>
Lule	<u>Lupinus leucophyllus</u>
Lupin sp.	<u>Lupinus</u>
Lysp	<u>Lygodesmia spinosa</u>
Maca	<u>Machaeranthera canescens</u>
Maloc sp.	<u>Malocathrix</u>
Mear	<u>Mentha arvensis</u>
Meob	<u>Mertensia oblongifolia</u>
Merte sp.	<u>Mertensia</u>
Mesa	<u>Medicago sativa</u>
Migu	<u>Mimulus guttatus</u>
Onobr sp.	<u>Onobrychis</u>
Peki	<u>Penstemon kingii</u>
Penst sp.	<u>Penstemon</u>
Pepa	<u>Penstemon palmeri</u>
Pesi	<u>Pediocactus simpsoni</u>
Phace sp.	<u>Phacelia</u>
Phho	<u>Phlox hoodii</u>
Phlo	<u>Phlox longifolia</u>
Phlox sp.	<u>Phlox</u>
Phmu	<u>Phacelia mustelina</u>
Phra	<u>Phacelia ramosissima</u>
Plma	<u>Plantago major</u>

SYMBOLSCIENTIFIC NAME

Popa	<u>Potentilla pacifica</u>
Poten sp.	<u>Potentilla</u>
Ragl	<u>Ranunculus glaberrimus</u>
Ranun sp.	<u>Ranunculus</u>
Rate	<u>Ranunculus testiculatus</u>
Rumex sp.	<u>Rumex</u>
Saka Salsola	<u>Salsola kali</u>
Senec sp.	<u>Senecio</u>
Sial	<u>Sisymbrium altissimum</u>
Sidel sp.	<u>Sidalcea</u>
Spam	<u>Sphaeralcea ambigua</u>
Sphae sp.	<u>Sphaeralcea</u>
Taof	<u>Taraxacum officinale</u>
Tarax sp.	<u>Taraxacum</u>
Thmo	<u>Thermopsis montana</u>
Trma	<u>Trifolium macilentum</u>
Veca	<u>Veratrum californicum</u>
Veth	<u>Verbascum thapsus</u>
Viad	<u>Viola adunca</u>
Viola sp.	<u>Viola</u>
Vipu	<u>Viola purpurea</u>
Wyeth sp.	<u>Wyethia</u>
Zigad sp.	<u>Zigadenus</u>
Zipa	<u>Zigadenus paniculatus</u>