

# CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9705130418 DOC. DATE: 96/12/31 NOTARIZED: NO DOCKET #  
FACIL: 50-397 WPPSS Nuclear Project, Unit 2, Washington Public Power 05000397  
AUTH. NAME AUTHOR AFFILIATION  
SWANK, D.A. Washington Public Power Supply System  
RECIP. NAME RECIPIENT AFFILIATION

ZELLER, J.J. Washington, State of

SUBJECT: "Operational Ecological Monitoring Program for Nuclear Plant  
2 - 1996 Annual Rept." W/970501 ltr.

DISTRIBUTION CODE: IE25D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 41  
TITLE: Environmental Monitoring Rept (per Tech Specs)

## NOTES:

	RECIPIENT	COPIES		RECIPIENT	COPIES	
	ID CODE/NAME	LTTR	ENCL	ID CODE/NAME	LTTR	ENCL
	PD4-2 LA	1	1	PD4-2 PD	1	1
	COLBURN, T	1	1			
INTERNAL:	ACRS	1	1	FILE CENTER 01	1	1
	NRR/DRPM/PERB	1	1	RGN4 FILE	1	1
EXTERNAL:	NRC PDR	1	1			

## NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE. TO HAVE YOUR NAME OR ORGANIZATION REMOVED FROM DISTRIBUTION LISTS OR REDUCE THE NUMBER OF COPIES RECEIVED BY YOU OR YOUR ORGANIZATION, CONTACT THE DOCUMENT CONTROL DESK (DCD) ON EXTENSION 415-2083

TOTAL NUMBER OF COPIES REQUIRED: LTTR 8 ENCL 8

C  
A  
T  
E  
G  
O  
R  
Y  
  
1  
  
D  
O  
C  
U  
M  
E  
N  
T





WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • Richland, Washington 99352-0968

May 1, 1997  
GO2-97-087

Mr. Jason J. Zeller, Manager  
Energy Facility Site Evaluation Council  
P.O. Box 43172  
Olympia, WA 98501-3172

Dear Mr. Zeller:

Subject: SUPPLY SYSTEM NUCLEAR PLANT NO. 2  
ECOLOGICAL MONITORING PROGRAM ANNUAL REPORT FOR 1996

Enclosed, please find five (5) copies of the subject report which is submitted per Council Resolution No. 266. If you have questions concerning this submittal please contact W.A. Kiel at (509) 377-4490.

Respectfully,

D.A. Swank  
Manager, Regulatory Affairs  
(Mail Drop PE20)

Enclosure

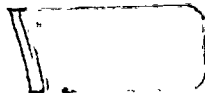
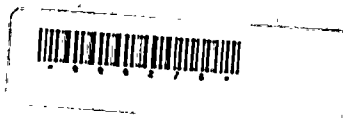
cc (w/encl):

J Bartz (WDOE-Kenn)  
RL Dirkes (PNNL)  
TG Colburn (NRC NRR)  
EW Merschoff (NRC RIV)  
NRC Document Control Desk (Docket No. 50-397)

PE25 1/1

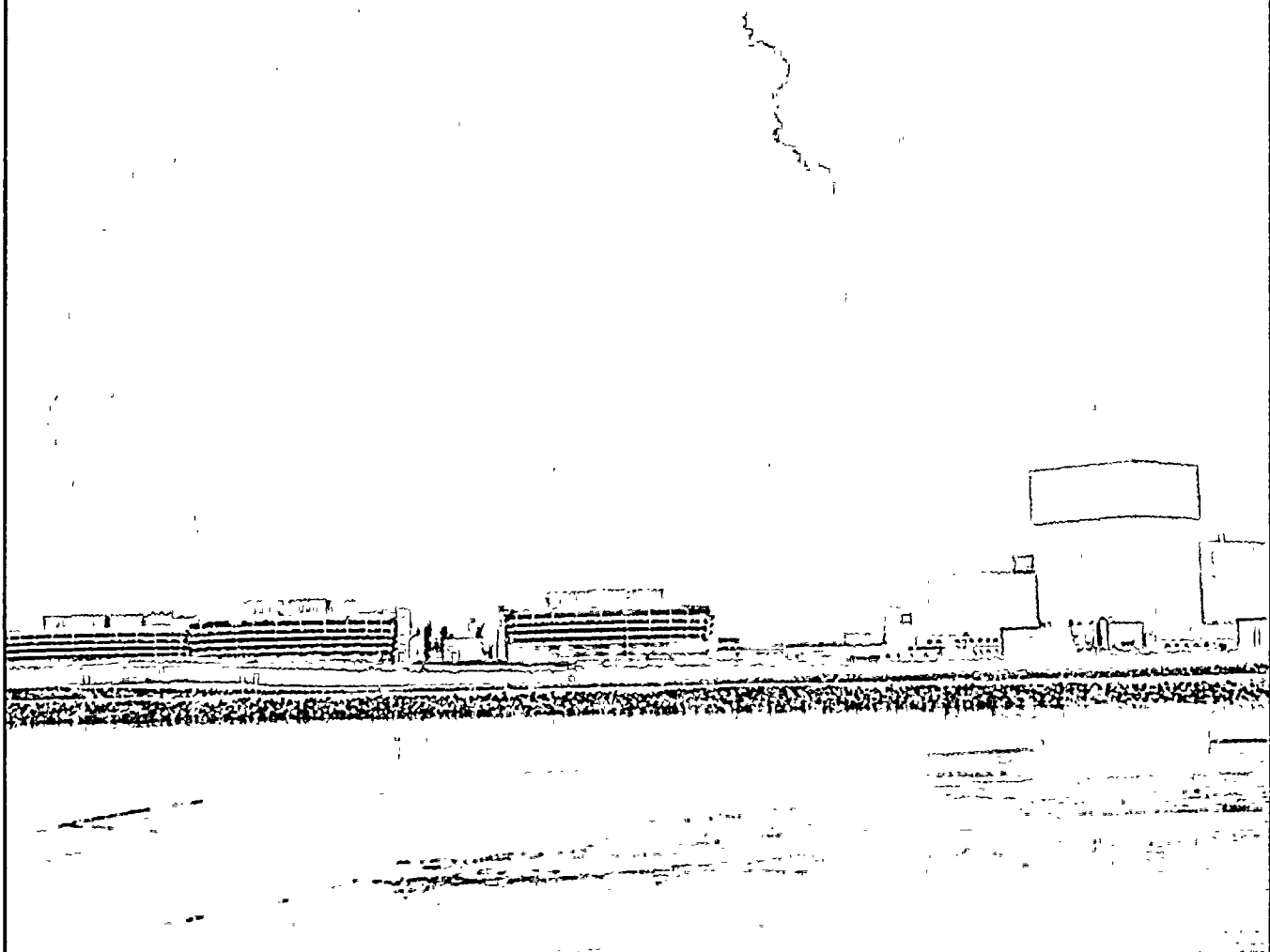
130124

9705130418 961231  
PDR ADDCK 05000397  
R PDR





# OPERATIONAL ECOLOGICAL MONITORING PROGRAM FOR NUCLEAR PLANT 2 WASHINGTON PUBLIC POWER SUPPLY SYSTEM



## 1996 ANNUAL REPORT

PREPARED BY ENVIRONMENTAL SCIENCES DEPARTMENT



WASHINGTON PUBLIC POWER  
SUPPLY SYSTEM

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	i
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	iii
LIST OF FIGURES	iv
BACKGROUND	1
DESCRIPTION AND SAMPLE LOCATIONS	1
MATERIALS AND METHODS	3
Herbaceous Canopy Cover	3
Herbaceous Phytomass	3
Soil Chemistry	3
RESULTS AND DISCUSSION	4
Herbaceous Cover	4
Herbaceous Phytomass	4
Soil Chemistry	4
REFERENCES	6

## EXECUTIVE SUMMARY

The Ecological Monitoring Program was originally established by EFSEC as a comprehensive program to monitor the environmental effects of WNP-2 operation. Since its inception, the program has been modified on several occasions to accommodate technical changes or to delete requirements for completed studies. Terrestrial monitoring is the only currently active program element.

The Terrestrial Monitoring Program was established to determine if cooling tower operation is affecting the surrounding plant communities. The current program is described in EFSEC Resolution No. 266 and is based on measurements of soil chemistry, herbaceous cover, and phytomass at eight grassland and seven shrub sampling sites located within a five miles radius of the towers. Since 1988 aerial photographs have been periodically used to document vegetation patterns in the area. Program results have been annually reported to EFSEC.

No measurable effects of plant cooling tower drift were observed on vegetation cover, phytomass, or soil chemistry. Climatological factors (e.g., precipitation and temperature) and anthropogenic impacts unrelated to cooling tower operation (e.g., range fires) overwhelmingly dominate the productivity of vegetation at the study locations.

## ACKNOWLEDGEMENTS

This report, prepared by the Washington Public Power Supply System, describes the soil and vegetation studies program for WNP-2.

### Project Team

Terry E. Northstrom

Supervisor, Environmental Sciences and Analytical  
Support

Deborah Singleton

Environmental Scientist



## List of Tables

<u>Number</u>		<u>Page</u>
1.	Vascular Plants Observed During 1996	7
2.	Herbaceous Cover for Fifteen Sampling Stations (%)	10
3.	Mean Frequency Values (%) by Species for Each Sampling Station	11
4.	Mean Herbaceous Cover for 1975 through 1996	12
5.	Herbaceous Phytomass for 1996	15
6.	Comparison of Herbaceous Phytomass (g/m <sup>2</sup> ) for 1975 through 1996	16
7.	Summary of Soil Chemistry for 1996	17

## List of Figures

<u>Number</u>		<u>Page</u>
1.	Soil and Vegetation Sampling Location Map	2
2.	Layout of Vegetation and Soil Sampling Plot	3
3.	Mean Herbaceous Cover and Total Precipitation	5

## BACKGROUND

The Site Certification Agreement (SCA) for WNP-2 was approved May 17, 1972, by the State of Washington and the Washington Public Power Supply System (Supply System). The SCA requires that environmental monitoring be conducted during the preoperational and operational phases of site development and use. The objective of the monitoring program is to provide an environmental measurement history for evaluation by the Supply System and the Washington State Energy Facility Site Evaluation Council (EFSEC) and to identify significant effects of plant operation on the environment. Since 1972, several revisions of the monitoring program have been approved by EFSEC in the form of SCA Amendments and EFSEC Resolutions 193, 194, 214, 239, and 266.

Most of the studies, analyses, and reports for the preoperational (1973-1984) environmental program of the SCA were performed by outside laboratories for the Supply System. The terrestrial program was performed and reports were prepared by Battelle from 1974 until 1979 (Rickard 1976, 1977, 1979a, 1979b) and then by Beak from 1980 to 1982 (Beak 1981, 1982a, 1982b).

Since 1983, Supply System scientists have been responsible for the entire operational environmental monitoring program. Using the data acquired during 1984, the first comprehensive operational environmental annual report was prepared by Supply System scientists (Supply System 1985) and has since continued annually (Supply System 1986 through 1995). A few studies and reports were completed by Supply System personnel prior to the annual reports, including animal studies (Schleder 1982, 1983, 1984) and terrestrial monitoring (Northstrom et.al 1984).

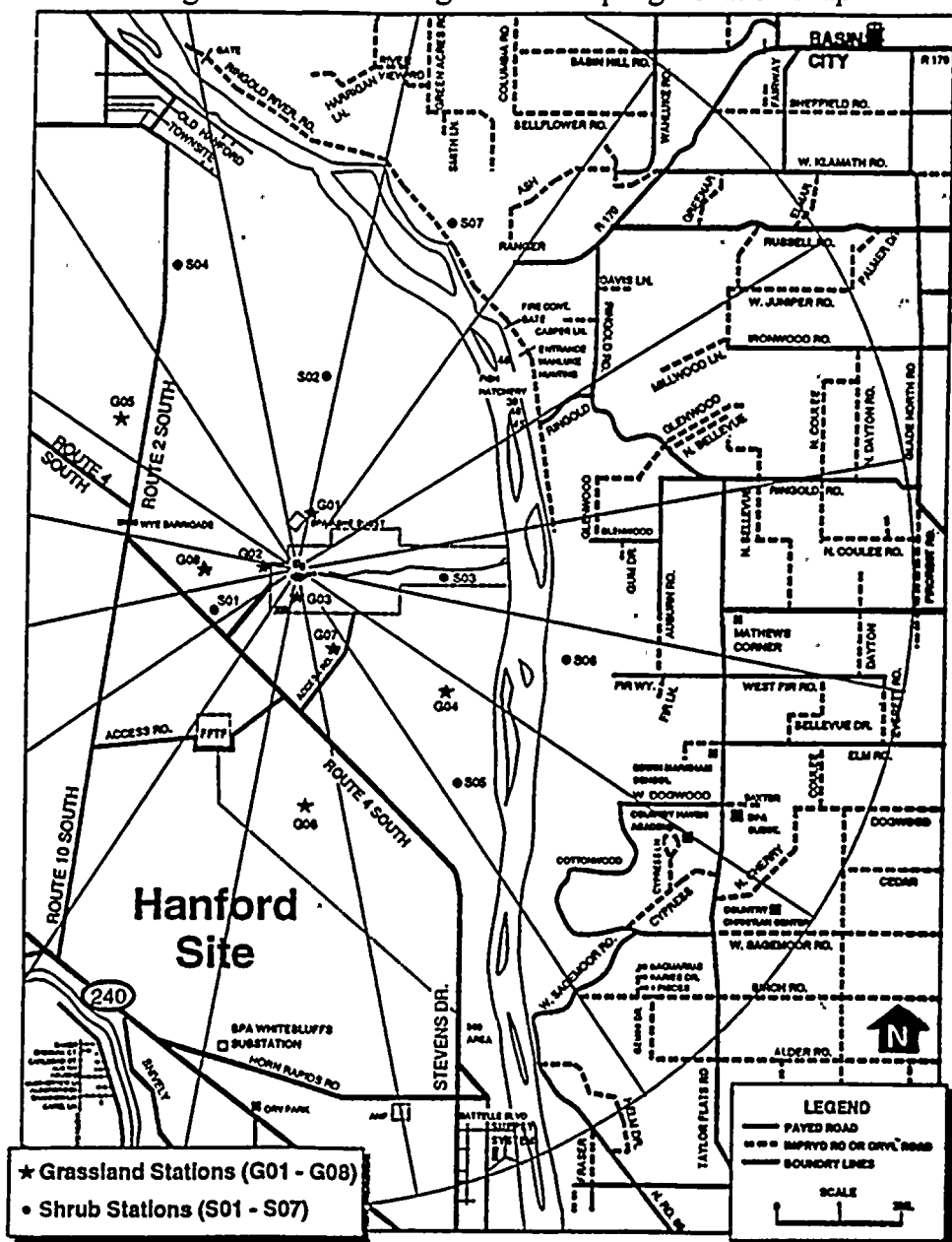
This report presents the results of the Ecological Monitoring Program (in accordance with Resolution No. 266) for the period of January through December 1996. (By letter dated December 12, 1995, EFSEC acknowledged that water quality and bioassay components of the program were superseded by the WNP-2 NPDES Permit issued October 9, 1995.)

## SITE DESCRIPTION AND SAMPLE LOCATION

WNP-2 lies within the boundaries of the Columbia Basin which is located between the Cascade Range and Blue Mountains in Oregon. Approximately 5 km (3.25 miles) to the east, the site is bounded by the Columbia River. The plant communities within the region are described as shrub-steppe communities consisting of various layers of perennial grasses overlaid by a discontinuous layer of shrubs. In general, there is insufficient moisture to support arborescent species except along streambanks. In August 1984, a range fire destroyed much of the shrub cover on the Hanford site and temporarily modified the shrub-steppe associations which were formerly present.

The objective of the soil and vegetation studies is to identify any significant effects or impacts of plant cooling tower operation upon the plant communities surrounding WNP-2. Vegetation and soil sampling was conducted at the peak of the cheatgrass growth cycle known as the purple stage (Klemmedson 1964). Cheatgrass (*Bromus tectorum*) is the predominant species within all fifteen of the sampling plots with a mean frequency >98% and cover often approaching 50%. Cheatgrass fruits turn purple shortly after reaching viability and then brown when mature. The purple stage of development correlates well with the peak productivity of many associated species and serves as a marker for initiation of annual sampling and comparison of phytomass productivity between years. The program includes the measurement of herbaceous canopy cover, herbaceous phytomass and soil chemistry. Soil chemical parameters measured include pH, carbonate, bicarbonate, sulfate, chloride, sodium, copper, zinc and conductivity. Fifteen sampling stations are located within a five-mile radius of the plant. The stations consist of eight grassland (G01-G08) and seven shrub sites (S01-S07). The location of each station is illustrated in Figure 1.

Figure 1. Soil and Vegetation Sampling Location Map

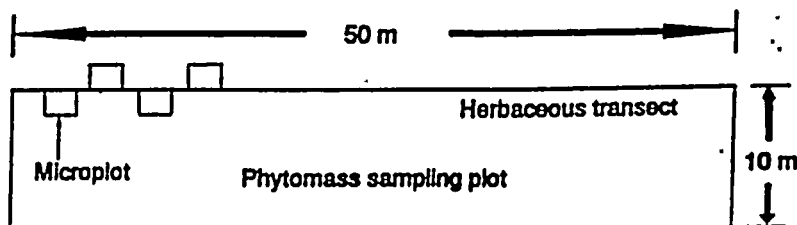


## MATERIALS AND METHODS

### Herbaceous Canopy Cover

At each of the fifteen stations fifty microplots (20 cm x 50 cm) were placed at 1-meter intervals on alternate sides of the herbaceous transect (Figure 2-2). Canopy cover was estimated for each species occurring within a microplot using Daubenmire's (1968) cover classes. Data were recorded on standard data sheets. To assure the quality of the sampling, three randomly selected microplots were sampled twice. The entire transect was resampled if cover estimates for any major species (>50% frequency) differed by more than one cover class.

Figure 2. Layout of Vegetation and Soil Sampling Plot



### Herbaceous Phytomass

Phytomass sampling was conducted concurrently with cover sampling. Phytomass sampling plots were randomly located within an area adjacent to the permanent transects or plots (Figure 2-2). At each station, all live herbaceous vegetation rooted in the designated microplot (20 x 50 cm) was clipped to ground level and placed in paper bags. Each bag was stapled shut and labeled with station code, plot number, date and personnel initials.

Sampling bags were transported to the laboratory, opened, and placed in a drying oven until a consistent weight was obtained. Following drying, the bags were removed singularly from the oven and their contents immediately weighed to the nearest 0.1 g. Laboratory quality assurance consisted of independently reworking 10 percent of the phytomass samples to assess data validity and reliability.

### Soil Chemistry

At each of the fifteen grassland and shrub stations, two soil samples were collected from the top 15 cm of soil with a clean stainless steel trowel. The soil samples were randomly selected and taken from the phytomass sampling plot. The samples were placed in 250 ml sterile plastic cups with lids, labeled and refrigerated at 4°C. Nine parameters were analyzed in each sample, including pH, bicarbonate, carbonate, conductivity, sulfate, chloride, copper, zinc, and sodium. Aliquots of soil for trace metal analyses were microwave digested according to Gilman (1989). Preservation times and conditions, when applicable followed EPA procedures (1991). Laboratory quality control comprised 10-20% of the sample analysis load. Routine quality control samples included internal laboratory check standards, reagent blanks, and prepared EPA or NIST controls.

## RESULTS AND DISCUSSION

During the 1996 season, 62 plant taxa were observed in the study areas. Table 1 lists the vascular plants observed during the 1996 field studies.

### Herbaceous Cover

Total herbaceous cover averaged 84.4% in 1996 which represents a decrease of 8.69% from 1995 (92.39%). Only three stations (G06, S05 and S07) showed an increase from 1995. *Bromus tectorum* continues to be the dominant annual grass with an average cover of 52.4%. Total annual grass cover averaged 52.4%, an increase of 52.1%. Total perennial grass cover was 19.35%, a decrease of 29.9%. The dominant perennial grass was *Poa sandbergii* with an average cover of 15.1%. Total annual forb cover decreased 58.7% from last year. Total cover for each station is shown in Table 2. An overview of herbaceous cover for 1975 through 1996 is shown in Table 4.

Frequency values (%) decreased at eleven of the fifteen stations. The most significant decrease in frequency values was observed at station S06. Three stations (S02, S03 and S04) showed an increase in the number of species per site. Table 3 shows mean frequency values (%) by species for each sampling station.

Growing season (October 95 - April 96) precipitation (20.65 cm) decreased 1.95% from the previous season (21.06 cm). For the calendar year 1996, total precipitation for the year was 30.96 cm, the second wettest year on record, after 1995 which received 31.27 cm. The average growing season temperature was 5.27°C (6.43 °C for 1995). The average temperature for the year was 11.28°C. The wet cool conditions prove to be favorable for the annual grasses (increase 52.1%), with a substantial increase in growth at stations G04, S02, S06, and S07 (>110% increase). A comparison of mean cover and precipitation for 1982 through 1996 is shown in Figure 3.

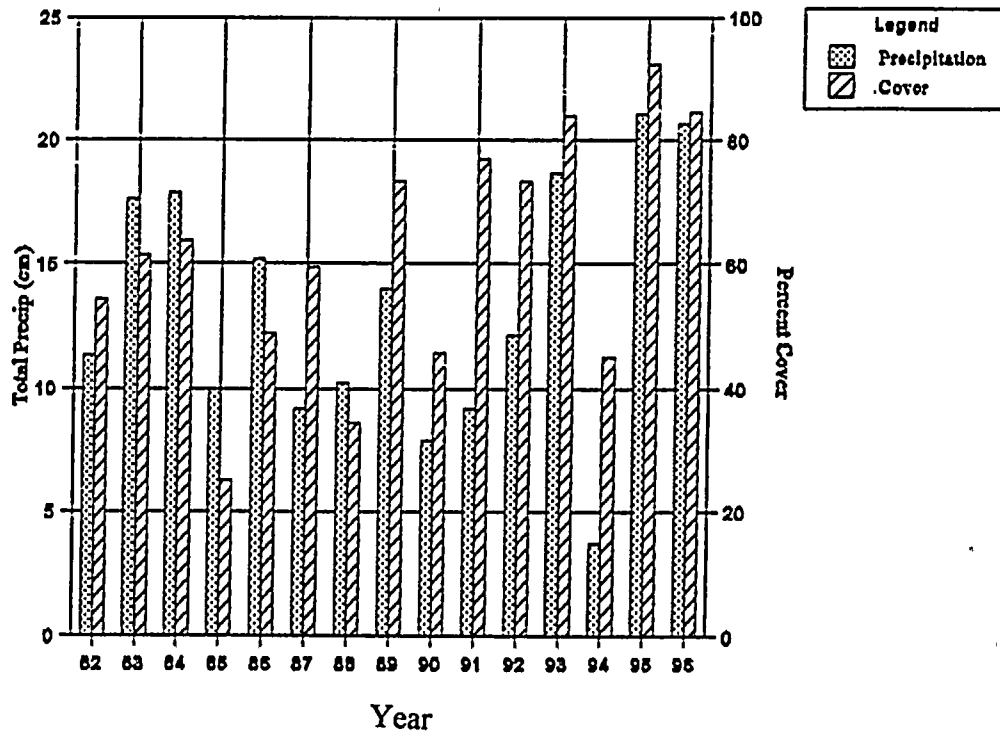
### Herbaceous Phytomass

At grassland and shrub stations the herbaceous phytomass production averaged 154.5g/m<sup>2</sup> and 121.7 g/m<sup>2</sup> respectively. Mean herbaceous phytomass production at grassland and shrub stations is summarized in Table 5. A comparison of herbaceous phytomass (g/m<sup>2</sup>) for 1975 through 1996 is shown in Table 6.

### Soil Chemistry

In comparison to the data for previous years, there has been no significant change in soil chemistry for the fifteen sampling stations. Although concentrations of soil chemistry parameters at station S07 have previously been higher than other stations, the slightly higher increase this year can be attributed to the range fire which occurred during the Spring of 1995. Table 7 is a summation of soil chemistry for 1996.

Figure 3. Mean Herbaceous Cover and Total Precipitation for 1982 through 1996







## REFERENCES

- Beak Consultants, Inc. 1981. Terrestrial monitoring studies near WNP-1, 2 and 4, May through December 1980. Portland, OR.
- Beak Consultants, Inc. 1982a. Terrestrial monitoring studies near WNP-1, 2 and 4, May through December 1981. Portland, OR.
- Beak Consultants, Inc. 1982b. Terrestrial monitoring studies near WNP-1, 2 and 4, May through August 1982. Portland, OR.
- Daubenmire, R. 1968. Plant Communities. Harper and Row, New York, New York.
- Environmental Protection Agency. 1991. Methods for the Determination of Metals in Environmental Samples. EPA/600/4-91-010.
- Gilman, Lee B. 1989. Microwave Sample Preparation. CEM Corporation.
- Klemmedson, J.O. and J.G. Smith. 1964. Cheat Grass (*Bromus tectorum* L.) Bot. Rev. 30; 226-262.
- Northstrom, T.E., J.L. Hickam and T.B. Stables. 1984. Terrestrial monitoring studies for 1983. Washington Public Power Supply System. Richland, WA.
- Rickard, W.H. and K.A. Gano. 1976. Terrestrial ecology studies in the vicinity of Washington Public Power Supply System Nuclear Power Projects 1 and 4. Progress report for the period July 1974 to June 1975. Battelle Pacific Northwest Laboratories. Richland, WA.
- Rickard, W.H. and K.A. Gano. 1977. Terrestrial ecology studies in the vicinity of Washington Public Power Supply System Nuclear Power Projects 1 and 4. Progress report for 1976. Battelle Pacific Northwest Laboratories, Richland, WA.
- Rickard, W.H. and K.A. Gano. 1979a. Terrestrial ecology studies in the vicinity of Washington Public Power Supply System Nuclear Power Projects 1 and 4. Progress report for 1977. Battelle Pacific Northwest Laboratories, Richland, WA.
- Rickard, W.H. and K.A. Gano. 1979b. Terrestrial ecology studies in the vicinity of Washington Public Power Supply System Nuclear Power Projects 1 and 4. Progress reports for 1978. Battelle Pacific Northwest Laboratories, Richland, WA.
- Schleder, L.S. 1982-1984. Preoperational animal studies near WNP-1, 2 and 4. Annual report for 1981. Washington Public Power Supply System, Richland, WA.
- Washington Public Power Supply System. Operational Ecological Monitoring Program for Nuclear Plant 2. Annual Reports for 1985-1995. Richland, WA.

Table 1. Vascular Plants Observed During 1996

<u>Scientific Name</u>	<u>Common Name</u>
<b>APIACEAE</b>	Parsley Family
<i>Cymopterus terebinthinus</i> (Hook.) T.&G. var <i>terebinthinus</i>	Turpentine cymopterus
<b>ASTERACEAE</b>	Aster Family
<i>Achillea millefolium</i> L.	Yarrow
<i>Antennaria dimorpha</i> (Nutt.) T.&G.	Low pussy-toes
<i>Artemisia tridentata</i> Nutt.	Big Sagebrush
<i>Balsamorhiza careyana</i> Gray	Carey's balsamroot
<i>Chrysothamnus nauseosus</i> (Pall.) Britt	Gray rabbitbrush
<i>Chrysothamnus viscidiflorus</i> (Hook.) Nutt	Green rabbitbrush
<i>Crepis atrabarba</i> Heller	Slender hawksbeard
<i>Franseria acanthicarpa</i> Hook.	Bur ragweed
<i>Layia glandulosa</i> (HOOK.) H.&A.	White daisy tidytips
<i>Tragopogon dubius</i> Scop.	Yellow salsify
<i>Aster canescens</i> Pursh	Hoary aster
<b>BORAGINACEAE</b>	Borage Family
<i>Amsinckia lycopoides</i> Lehm.	Tarweed fiddleneck
<i>Cryptantha circumscissa</i> (H&A) Johnst.	Matted cryptantha
<i>Cryptantha leucophaea</i> (Dougl.) Pays	NA
<i>Cryptantha pterocarya</i> (torr.) Greene	Winged cryptantha
<b>BRASSICACEAE</b>	Mustard Family
<i>Descurainia pinnata</i> (Walt.) Britt.	Western tansymustard
<i>Draba verna</i> L.	Spring draba
<i>Erysimum asperum</i> (Nutt.) DC.	Prairie rocket
<i>Sisymbrium altissimum</i> L.	Tumblemustard
<b>CACTACEAE</b>	Cactus Family
<i>Opuntia polycantha</i> Haw.	Starvation cactus
<b>CARYOPHYLLACEAE</b>	Pink Family
<i>Arenaria franklinii</i> Dougl. var <i>franklinii</i>	Franklin's sandwort
<i>Holosteum umbellatum</i> L.	Jagged chickweed
<b>CHENOPODIACEAE</b>	Chenopod Family
<i>Chenopodium leptophyllum</i> (MOQ.) Wats.	Slimleaf goosefoot
<i>Grayia spinosa</i> (Hook.) MOQ.	
<i>Salsola kali</i> L.	Russian thistle

Table 1. Vascular Plants Observed During 1996 (Continued)

<u>Scientific Name</u>	<u>Common Name</u>
<b>FABACEAE</b>	<b>Pea Family</b>
<i>Astragalus purshii</i> Dougl.	Wooly-pod milk-vetch
<i>Astragalus sclerocarpus</i> Gray	Stalked-pod milk-vetch
<i>Psoralea lanceolata</i> Pursh.	Lance-leaf scurf-pea
<b>GERANIACEAE</b>	<b>Geranium Family</b>
<i>Erodium cicutarium</i> (L.) L'Her.	Filaree, storks-bill
<b>HYDROPHYLLACEAE</b>	<b>Waterleaf Family</b>
<i>Phacelia hastata</i> Dougl.	Whiteleaf phacelia
<i>Phacelia linearis</i> (Pursh) Holz.	Threadleaf phacelia
<b>LILIACEAE</b>	<b>Lily Family</b>
<i>Brodiaea douglasii</i> Wats.	Douglas' brodiaea
<i>Calochortus macrocarpus</i> Dougl.	Sego lily
<i>Fritillaria pudica</i> (Pursh) Spreng.	Chocolate lily
<b>LOASACEAE</b>	<b>Blasing-star Family</b>
<i>Mentzelia albicaulis</i> Dougl. Ex Hook.	White-stemmed mentzelia
<b>MALVACEAE</b>	<b>Mallow Family</b>
<i>Sphaeralcea munroana</i> (Dougl.) Spach Ex Gray	White-stemmed globe-mallow
<b>ONAGRACEAE</b>	<b>Evening-primrose Family</b>
<i>Oenothera pallida</i> Lindl. var. <i>pallida</i>	White-stemmed evening primrose
<b>PLANTAGINACEAE</b>	<b>Plantain Family</b>
<i>Plantago patagonica</i> Jacq.	Indian-wheat
<b>POACEAE</b>	<b>Grass Family</b>
<i>Agropyron cristatum</i> (L.) Gaertn.	Crested wheatgrass
<i>Agropyron dasystachyum</i> (Hook.) Scribn.	Thick-spiked wheatgrass
<i>Agropyron spicatum</i> (Pursh.) Scribn. & Smith	Bluebunch wheatgrass
<i>Bromus tectorum</i> L.	Cheatgrass
<i>Festuca octoflora</i> Walt.	Six-weeks fescue
<i>Koeleria cristata</i> Pers.	Prairie Junegrass
<i>Oryzopsis hymenoides</i> (R&S) Ricker	Indian ricegrass
<i>Poa sandbergii</i> Vasey	Sandberg's bluegrass

Table 1. Vascular Plants Observed During 1996 (Continued)

<u>Scientific Name</u>	<u>Common Name</u>
<i>Sitanion hystrix</i> (nut.) Smith	Bottlebrush squirreltail
<i>Stipa comata</i> Trin. & Rupr.	Needle-and-thread
POLEMONIACEAE	Phlox Family
<i>Gilia minutiflora</i> Benth.	Gilia
<i>Gilia sinuata</i> Dougl.	Shy gilia
<i>Leptodactylon pungens</i> (Torr.) Nutt.	Granite gilia
<i>Microsteris gracilis</i> (Hook.) Greene var. <i>humilior</i> (Hook.) Cronq.	Pink microsteris
<i>Phlox longifolia</i> Nutt.	Long-leaf phlox
POLYGONACEAE	Buckwheat Family
<i>Erigeron niveum</i> Dougl.	Snow buckwheat
<i>Rumex venosus</i> Pursh.	Wild begonia
RANUNCULACEAE	Buttercup Family
<i>Delphinium nuttallianum</i> Pritz. ex Walpers	Larkspur
ROSACEAE	Rose Family
<i>Purshia tridentata</i> (pursh.) DC	Antelope Bitterbrush
SANTALACEAE	Sandalwood Family
<i>Comandra umbellata</i> (L.) Nutt.	Bastard toad-flax
SAXIFRAGACEAE	Saxifrage Family
<i>Ribes aureum</i> Pursh.	Golden current
SCROPHULARIACEAE	Figwort Family
<i>Penstemon acuminatus</i> Dougl.	Sand-dune penstemon
VALERIANIACEAE	Valerian Family
<i>Plectritis macrocera</i> T&G	Longhorn plectritis

Table 2. Herbaceous Cover for Fifteen Sampling Stations (%)

	G01	G02	G03	G04	G05	G06	G07	G08	S01	S02	S03	S04	S05	S06	S07 G01-S07	AVG
<b>Annual Grasses</b>																
<i>Bromus tectorum</i>	81.70	82.55	72.35	22.05	23.90	39.95	67.25	71.05	58.0	24.35	52.60	54.35	69.30	15.95	50.80	52.40
<i>Festuca octoflora</i>	0.00	0.00	0.00	0.00	0.25	0.20	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.03
<b>Total Annual Grass Cover</b>	<b>81.70</b>	<b>82.55</b>	<b>72.35</b>	<b>22.05</b>	<b>24.15</b>	<b>40.15</b>	<b>67.25</b>	<b>71.05</b>	<b>58.00</b>	<b>24.35</b>	<b>52.60</b>	<b>54.40</b>	<b>69.30</b>	<b>15.95</b>	<b>50.80</b>	<b>52.43</b>
<b>Perennial Grasses</b>																
<i>Agropyron spicatum</i>	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.04
<i>Oryzopsis hymenoides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.15	0.00	0.00	0.00	3.68	0.00	0.60
<i>Poa sandbergii</i>	13.10	11.60	3.55	17.15	36.90	1.00	9.55	10.25	10.50	21.75	12.15	14.60	0.00	49.85	14.15	15.07
<i>Stipa comata</i>	0.00	0.00	0.00	24.75	0.00	13.85	0.00	0.15	0.00	12.45	0.00	0.00	3.35	0.00	0.00	3.64
<b>Total Perennial Grass Cover</b>	<b>13.10</b>	<b>11.60</b>	<b>3.55</b>	<b>41.90</b>	<b>37.20</b>	<b>14.85</b>	<b>9.55</b>	<b>10.40</b>	<b>10.50</b>	<b>36.35</b>	<b>12.15</b>	<b>14.60</b>	<b>3.65</b>	<b>56.70</b>	<b>14.15</b>	<b>19.35</b>
<b>Annual Forbs</b>																
<i>Amsinckia lycopoides</i>	0.00	0.00	0.10	0.00	1.30	0.05	0.00	0.00	0.15	0.00	0.05	0.00	0.00	0.00	14.35	1.07
<i>Cryptantha cirmumscissa</i>	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05
<i>Descurainia pinnata</i>	0.00	0.00	0.05	0.00	0.05	0.000	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.10	0.15	0.07
<i>Draba verna</i>	1.55	1.05	2.10	0.90	1.65	1.45	1.95	2.10	2.15	0.55	0.65	0.70	1.55	0.05	0.45	1.26
<i>Erodium cicutarium</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
<i>Holosteum umbellatum</i>	5.45	5.80	2.45	5.60	5.45	3.30	3.90	2.80	3.70	2.15	2.25	3.00	2.45	0.00	33.30	5.44
<i>Microsteris gracilis</i>	0.05	0.00	0.10	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.02
<i>Phacelia linearis</i>	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.04
<i>Plantago patagonica</i>	0.55	0.35	0.00	1.7	0.00	0.00	0.00	0.00	0.00	0.05	0.95	0.00	2.10	0.00	0.25	0.40
<i>Salsola kali</i>	0.00	0.20	0.35	0.20	1.65	0.05	0.45	0.15	0.05	0.75	0.25	0.30	0.20	0.00	0.00	0.31
<i>Sisymbrium altissimum</i>	0.00	0.30	0.35	0.00	0.05	0.00	0.00	0.00	0.25	0.15	0.25	3.45	0.05	1.95	23.95	2.05
<b>Total Annual Forb Cover</b>	<b>7.60</b>	<b>7.70</b>	<b>5.85</b>	<b>8.55</b>	<b>10.3</b>	<b>5.15</b>	<b>6.40</b>	<b>5.30</b>	<b>6.50</b>	<b>4.95</b>	<b>4.45</b>	<b>8.25</b>	<b>6.85</b>	<b>2.10</b>	<b>72.45</b>	<b>11.07</b>
<b>Perennial Forbs</b>																
<i>Aster canescens</i>	0.00	0.00	0.90	0.15	0.05	0.10	0.15	0.00	0.00	0.00	0.00	0.10	0.40	0.00	0.00	0.12
<i>Astragalus sclerocarpus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.13
<i>Balsamorhiza careyana</i>	0.00	0.00	0.00	0.00	3.55	0.15	0.00	0.00	0.00	0.00	0.00	4.25	0.75	0.00	0.00	0.58
<i>Crepis atrabarba</i>	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
<i>Cymopterus terebinthinus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.05	0.00	0.00	0.00	0.00	0.00	0.46
<i>Erigeron niveum</i>	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00	0.05	0.00	0.00	0.00	6.75	0.00	0.00	0.55
<i>Oenothera pallida</i>	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.05
<i>Phlox longifolia</i>	0.05	0.00	0.80	0.10	0.40	0.00	0.00	0.05	0.30	0.10	0.35	0.10	0.00	0.00	0.00	0.13
<i>Rumex venosus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.02
<b>Total Perennial Forb Cover</b>	<b>0.05</b>	<b>0.00</b>	<b>1.75</b>	<b>0.25</b>	<b>5.70</b>	<b>0.25</b>	<b>0.15</b>	<b>0.05</b>	<b>0.30</b>	<b>6.80</b>	<b>0.35</b>	<b>6.35</b>	<b>8.20</b>	<b>0.00</b>	<b>0.00</b>	<b>1.51</b>
<b>Total Herbaceous Cover</b>	<b>102.5</b>	<b>101.9</b>	<b>83.50</b>	<b>72.75</b>	<b>77.35</b>	<b>60.40</b>	<b>83.35</b>	<b>86.80</b>	<b>75.30</b>	<b>72.50</b>	<b>69.55</b>	<b>83.60</b>	<b>88.00</b>	<b>74.75</b>	<b>137.4</b>	<b>84.36</b>

Table 3. Mean Frequency Values (%) by Species for each Sampling Station

	G01	G02	G03	G04	G05	G06	G07	G08	S01	S02	S03	S04	S05	S06	S07
<b>Annual Grasses</b>															
<i>Bromus tectorum</i>	100	100	100	98	96	100	100	100	98	80	100	100	100	80	88
<i>Festuca octoflora</i>				10	8							2			
<b>Perennial Grasses</b>															
<i>Agropyron spicatum</i>													2		
<i>Oryzopsis hymenoides</i>										10				26	
<i>Poa sandbergii</i>	64	90	10	88	90	10	56	62	32	50	80	50		86	68
<i>Stipa comata</i>				86		44		6		46			10		
<b>Annual Forbs</b>															
<i>Amsinckia lycopsoides</i>			4		4	2			6		2				70
<i>Cryptantha circumscissa</i>				2					2						
<i>Descurainia pinnata</i>			2		2					2				4	6
<i>Draba verna</i>	62	32	74	26	36	58	68	64	56	12	16	28	62	2	8
<i>Erodium cicutarium</i>													2		
<i>Franseria acanthacarpa</i>			14	2	2	12	4	8	4	2		22	8		
<i>Gilia sinuata</i>					2					4					
<i>Holosteum umbellatum</i>	88	82	78	84	78	82	96	82	68	79	76	54	58		44
<i>Microsteris gracilis</i>	2		4	2					2		2				
<i>Phacelia linearis</i>					6						10				
<i>Plantago patagonica</i>	12	14		48						2	18		44		10
<i>Salsola kali</i>		8	14	8	34	2	18	6	2	10	10	12	8		
<b>Perennial Forbs</b>															
<i>Aster canescens</i>			16	6	2	4	6					4	6		
<i>Astragalus sclerocarpus</i>												10			
<i>Balsamorhiza careyana</i>					4	6					16	2	4		
<i>Brodiaea douglasii</i>					2										
<i>Crepis atrabarba</i>											2				
<i>Cymopterus terebinthinus</i>						32			4	14					
<i>Erigonum niveum</i>				6				8					20		
<i>Oenothera pallida</i>			2						2	6					
<i>Phlox longifolia</i>	2		4	4	6			2	2	4	4	4			
<b>Total Species per Site</b>	<b>7</b>	<b>6</b>	<b>12</b>	<b>13</b>	<b>15</b>	<b>12</b>	<b>8</b>	<b>9</b>	<b>12</b>	<b>15</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>5</b>	<b>7</b>

Table 4. Mean Herbaceous Cover for 1975 through 1996

CLASS	YEAR	S01	S02	S03	S04	S05	X S01-5	S06	S07	XS	Q01	Q02	Q03	Q04	X Q01-4	Q05	Q06	Q07	Q08	XG	XSG	Q01-4, S01-5
AG	1975	49.90	35.30	43.80						43.00	43.90	43.00								43.45	43.18	43.18
PG	1975	0.60	2.00	4.50						2.37	3.70	5.50								4.60	3.26	3.26
AF	1975	14.60	11.70	11.70						12.67	29.50	13.00								21.25	16.10	16.10
PF	1975	4.30	0.90	1.80						2.33	1.50	2.10								1.80	2.12	2.12
ALL	1975	69.40	49.90	61.80						60.37	78.60	63.60								71.10	64.66	64.66
AG	1976	50.70	40.90	34.30						41.97	71.30	51.60								61.40	49.74	49.74
PG	1976	0.40	10.50	10.30						7.07	4.40	3.10								3.75	5.74	5.74
AF	1976	5.50	5.30	7.20						6.00	11.90	8.50								10.20	7.64	7.64
PF	1976	0.00	0.50	0.20						0.23	0.00	0.20								0.10	0.18	0.18
ALL	1976	56.60	57.20	52.00						55.27	87.50	63.40								75.45	63.34	63.34
AG	1977	1.35	0.65	1.90						1.30	5.20	1.45								3.33	2.11	2.11
PG	1977	0.35	11.30	8.28						4.64	3.25	2.90								3.08	5.22	5.22
AF	1977	0.25	0.05	0.90						0.40	2.40	9.35								5.88	2.59	2.59
PF	1977	0.55	0.60	1.42						0.86	0.05	6.50								3.18	1.78	1.78
ALL	1977	2.50	12.60	12.50						9.20	10.90	20.00								13.45	11.70	11.70
AG	1978	51.00	67.00	51.00						56.33	68.00	42.00								55.00	55.80	55.80
PG	1978	3.00	18.00	11.00						10.67	8.00	7.00								7.50	9.40	9.40
AF	1978	38.00	10.00	31.00						27.00	23.00	25.00								24.00	25.80	25.80
PF	1978	8.00	0.00	5.00						4.33	2.00	3.00								2.50	3.60	3.60
ALL	1978	100.00	95.00	100.00						98.33	101.00	77.00								89.00	97.60	94.60
AG	1979	25.00	29.00	9.00						21.00	31.00	10.00								20.50	20.80	20.80
PG	1979	1.00	18.00	11.00						10.00	7.00	5.00								6.00	8.40	8.40
AF	1979	2.00	4.00	10.00						5.33	43.00	33.00								38.00	18.40	18.40
PF	1979	11.00	0.00	3.00						4.67	0.00	7.00								3.50	4.20	4.20
ALL	1979	39.00	51.00	33.00						41.00	81.00	55.00								68.00	51.80	51.80
AG	1980	50.40	51.80	24.30	56.20	56.40	47.82			47.82	64.30	77.80	73.80	12.30	57.05					57.05	51.92	51.92
PG	1980	1.00	7.20	23.30	10.90	0.10	8.50			8.50	28.30	64.00	0.10	26.60	29.75					29.75	17.94	17.94
AF	1980	7.60	4.20	22.50	3.40	14.10	10.36			10.36	7.30	5.00	28.70	4.90	11.48					11.48	10.86	10.86
PF	1980	2.20	2.20	4.70	4.60	1.80	3.10			3.10	0.40	0.00	0.00	4.60	1.25					1.25	2.28	2.28
ALL	1980	61.20	65.40	74.80	75.10	72.40	69.78			69.78	100.30	146.80	102.60	48.40	99.53					99.53	83.00	83.00
AG	1981	74.80	54.60	66.50	49.80	76.20	64.38			64.38	77.40	84.00	88.40	48.90	74.68					74.68	68.96	68.96
PG	1981	0.10	4.70	14.30	5.80	0.00	4.98			4.98	19.60	25.90	0.00	36.70	20.55					20.55	11.90	11.90
AF	1981	5.30	3.50	18.20	1.20	12.50	8.14			8.14	15.90	11.90	17.50	5.90	12.80					12.80	10.21	10.21
PF	1981	0.00	3.20	0.70	4.90	0.50	1.86			1.86	0.20	0.00	0.00	1.90	0.53					0.53	1.27	1.27
ALL	1981	80.20	66.00	99.70	61.70	89.20	79.36			79.36	113.10	121.80	105.90	93.40	108.55					108.55	92.33	92.33
AG	1982	51.50	25.80	36.60	32.70	20.00	33.32			33.32	42.20	45.50	51.00	22.90	40.40					40.40	36.47	36.47
PG	1982	0.40	6.40	17.90	4.30	0.80	5.96			5.96	11.20	11.60	0.10	31.30	13.55					13.55	9.33	9.33
AF	1982	4.60	4.20	7.50	1.60	17.30	7.04			7.04	9.70	4.60	4.60	4.10	5.75					5.75	6.47	6.47
PF	1982	0.20	4.30	0.70	6.20	1.00	2.44			2.44	0.30	0.00	1.30	3.80	1.35					1.35	1.98	1.98
ALL	1982	56.70	40.70	62.70	44.80	39.10	48.80			48.80	63.40	61.70	57.00	62.10	61.05					61.05	54.24	54.24

Table 4. Mean Herbaceous Cover for 1975 through 1996 (continued)

CLASS	YEAR	S01	S02	S03	S04	S05	X S01-5	S06	S07	X5	Q01	Q02	Q03	Q04	X Q01-4	Q05	Q06	Q07	Q08	XQ	XSG	Q01-4, S01-5
AG	1983	53.80	37.60	33.65	36.75	31.85	38.73			38.73	49.50	39.55	62.75	17.55	42.35					42.34	40.33	40.33
PG	1983	2.15	7.70	14.45	6.40	1.29	6.40			6.40	2.10	15.75	0.00	25.50	10.84					10.84	8.37	8.37
AF	1983	8.20	7.85	12.55	3.45	22.35	10.88			10.88	18.70	8.85	8.65	6.65	10.71					10.71	10.81	10.81
PF	1983	0.70	3.10	1.05	4.40	1.95	2.24			2.24	0.65	0.05	2.10	4.00	1.70					1.70	2.00	2.00
ALL	1983	64.85	56.25	61.70	51.00	57.44	58.25			58.25	70.95	64.20	73.50	53.70	65.59					65.59	61.51	61.51
AG	1984	41.50	32.75	39.35	36.30	34.50	37.28			37.28	60.85	71.30	60.85	9.60	50.65					50.65	43.22	43.22
PG	1984	1.85	8.80	11.55	8.55	0.40	6.23			6.23	1.20	4.45		25.00	10.22					10.22	6.87	7.73
AF	1984	12.35	8.10	11.10	4.00	13.40	9.79			9.79	20.65	9.70	19.45	7.95	14.44					14.44	11.86	11.86
PF	1984	0.50	4.00	0.75	6.55	0.65	2.45			2.45	0.70	0.20	1.10	1.25	0.81					0.81	1.72	1.72
ALL	1984	56.00	53.65	62.75	55.40	50.95	55.75			55.75	83.40	85.65	81.40	43.80	73.56					73.56	63.67	63.67
AG	1985	2.10	2.15	14.60	4.95	27.05	10.17			10.17	8.00	8.10	18.30	7.25	10.41					10.41	10.28	10.28
PG	1985	1.05	4.70	17.85	2.40	1.85	5.57			5.57	9.20	17.95	0.00	13.50	10.26					10.26	7.66	7.66
AF	1985	0.70	1.35	9.40	2.30	4.75	3.70			3.70	18.20	8.15	7.55	3.05	9.24					9.24	6.16	6.16
PF	1985	0.00	1.35	1.15	3.00	0.25	1.15			1.15	0.80	0.10	2.35	0.90	1.04					1.04	1.10	1.10
ALL	1985	3.85	9.55	43.00	12.65	33.50	20.59			20.59	36.20	34.30	28.20	25.10	30.95					30.95	25.19	25.19
AG	1986	17.45	1.95	7.20	11.45	13.05	10.22			10.22	9.40	4.45	13.25	7.35	8.66					8.66	9.53	9.53
PG	1986	2.20	10.75	17.25	9.85	1.30	8.27			8.27	19.85	38.45	0.00	26.00	21.13					21.13	13.98	13.98
AF	1986	25.40	16.65	38.10	10.25	16.70	21.42			21.42	27.65	34.15	25.45	8.70	23.99					23.99	22.56	22.56
PF	1986	1.15	5.35	2.30	9.15	1.25	3.84			3.84	1.80	1.95	0.05	2.55	1.59					1.59	2.84	2.84
ALL	1986	46.20	34.70	64.85	40.70	32.30	43.75			43.75	58.70	79.40	38.75	44.60	55.36					55.36	48.91	48.91
AG	1987	28.90	9.95	7.80	19.05	33.40	19.82			19.82	23.85	9.45	51.65	4.65	22.40					22.40	20.97	20.97
PG	1987	3.60	21.90	42.65	19.55	2.30	18.00			18.00	32.45	58.79	0.05	45.95	34.31					34.31	25.25	25.25
AF	1987	12.56	8.50	10.80	6.55	11.40	9.96			9.96	10.30	11.32	14.00	3.25	9.72					9.72	9.85	9.85
PF	1987	5.00	6.00	2.00	10.40	1.75	5.03			5.03	0.90	1.90	0.15	1.55	1.13					1.13	3.29	3.29
ALL	1987	50.06	46.35	63.25	55.55	48.85	52.81			52.81	67.50	81.46	65.85	55.40	67.55					67.55	59.56	59.56
AG	1988	13.80	5.05	8.10	13.80	10.15	10.18	10.40	12.24	10.51	22.95	10.10	16.75	4.80	13.65	11.95	19.20	15.85	10.40	14.00	12.32	11.72
PG	1988	1.75	8.40	11.95	9.40	3.35	6.97	16.85	17.50	9.89	17.85	21.70	0.05	30.20	17.45	9.50	12.05	10.45	14.30	14.51	12.34	11.63
AF	1988	6.08	5.25	3.60	3.10	4.00	4.41	0.00	0.35	3.20	6.30	16.15	7.55	1.80	7.95	1.20	1.45	12.35	6.12	6.61	5.16	5.98
PF	1988	11.55	15.75	2.10	4.85	3.25	7.50	0.10	0.00	5.37	0.20	2.00	0.00	4.40	1.65	15.25	8.70	2.45	4.34	4.34	4.79	4.90
ALL	1988	33.18	34.45	25.75	31.15	20.75	29.06	27.35	30.09	28.96	47.30	49.95	24.35	41.20	40.70	37.90	41.10	32.52	39.47	34.60	34.23	
AG	1989	21.85	12.50	12.45	10.25	32.90	17.99	15.00	47.65	21.80	22.50	13.20	65.85	3.05	26.15	22.35	35.10	34.05	12.05	26.52	24.05	21.62
PG	1989	8.30	29.55	64.00	13.00	1.25	23.22	30.35	37.50	26.28	60.40	59.60	0.05	49.55	42.40	36.75	16.20	32.05	48.95	37.94	32.54	31.74
AF	1989	12.50	6.95	13.05	6.45	11.10	10.01	0.85	5.15	8.01	12.85	5.90	42.20	2.85	15.95	8.85	13.55	13.05	13.95	14.15	11.48	12.65
PF	1989	4.45	14.50	4.40	8.20	0.55	6.42	0.10	0.00	4.60	3.85	1.10	0.05	3.00	2.00	6.45	10.40	12.90	10.60	6.04	5.23	4.44
ALL	1989	47.10	63.50	93.50	37.90	45.80	57.64	46.30	90.30	60.69	99.60	79.80	108.15	58.45	86.50	74.40	75.25	96.05	85.55	84.66	73.31	70.47
AG	1990	36.80	16.80	17.50	32.40	53.35	31.37	12.90	5.45	25.03	18.60	7.75	61.55	13.65	25.39	23.80	35.45	36.55	19.75	27.01	26.06	28.71
PG	1990	3.30	12.85	18.35	12.70	0.05	9.45	18.40	17.55	11.89	18.70	0.00	0.00	30.00	12.18	11.90	10.70	9.30	12.10	11.59	11.73	10.66
AF	1990	7.95	2.60	8.15	4.55	8.90	6.43	0.10	0.00	4.61	7.75	2.35	15.70	3.35	7.2903	2.75	6.90	8.95	7.00	6.84	5.80	6.81
PF	1990	0.40	9.55	1.75	3.90	0.05	3.313	0.00	0.00	2.24	0.00	0.05	0.05	1.20	3	3.95	8.55	0.05	0.20	1.76	1.98	1.88
ALL	1990	48.45	41.80	45.30	53.55	62.35	50.29	31.40	23.00	43.69	45.05	10.15	77.30	48.20	45.18	42.40	61.60	53.85	39.05	47.20	45.56	48.02
AG	1991	40.25	15.25	40.05	38.55	48.15	35.85	17.85	5.90	25.14	26.15	20.80	65.55	18.90	32.85	36.95	37.25	48.30	38.25	36.52	33.81	34.52
PG	1991	7.60	32.05	26.35	14.45	2.30	11.14	38.40	60.60	25.96	41.75	50.55	1.35	38.70	29.09	23.55	12.80	0.00	22.85	23.94	26.14	11.12
AF	1991	36.25	15.00	16.75	37.30	21.60	24.29	4.85	7.30	19.86	0.25	4.20	13.35	1.85	4.92	4.75	6.30	35.13	16.65	10.31	14.77	16.26
PF	1991	4.45	6.35	1.95	2.35	0.30	3.08	0.30	0.00	2.24	0.00	0.10	0.60	0.90	0.25	3.35	12.20	0.05	1.70	2.29	2.25	1.88
ALL	1991	84.55	63.65	85.10	89.65	72.35	74.36	61.40	73.80	76.36	61.15	75.45	80.25	60.35	66.11	68.60	68.35	83.48	79.45	72.19	76.97	63.78
AG	1992	30.30	30.20	42.60	55.95	51.60	42.13	23.90	15.20	35.67	48.70	64.25	53.15	34.24	50.09	46.00	41.80	66.15	55.15	51.18	43.95	45.67
PG	1992	3.25	15.65	11.40	5.40	2.39	7.62	31.30	33.80	14.74	25.60	20.00	0.00	32.20	19.45	11.60	10.20	5.95	8.80	15.17	14.97	12.88
AF	1992	9.85	5.55	11.95	16.40	8.95	10.54	4.65	23.05	11.48	13.15	8.15	15.05	7.15	10.87	7.65	10.20	8.80	17.25	10.93	11.19	10.693
PF	1992	9.15	10.70	2.25	4.25	1.05	5.48	0.65	6.00	4.01	0.10	0.25	0.30	0.75	0.35	1.95	12.55	1.35	3.85	2.64	3.28	2.20
ALL	1992	52.55	62.10	68.20	82.00	63.99	65.77	60.50	72.70	65.90	87.55	92.65	68.50	74.34	80.76	74.20	74.75	82.25	85.05	79.92	73.39	72.44



Table 4. Mean Herbaceous Cover for 1975 through 1996 (continued)

CLASS	YEAR	S01	S02	S03	S04	S05	X S01-5	S06	S07	XS	O01	O02	O03	O04	X O01-4	O05	O06	O07	O08	XG	XSG	O01-4, S01-5
AG	1993	27.70	34.65	53.45	58.25	48.20	44.45	23.65	57.95	43.41	46.90	68.65	43.40	29.20	47.04	38.35	28.90	68.85	59.60	47.98	45.85	45.74
PG	1993	7.15	22.14	16.25	12.85	4.00	12.48	46.10	23.15	18.81	48.25	23.35	2.00	46.10	29.93	31.40	15.40	12.25	16.35	24.39	21.78	21.2
AF	1993	12.95	8.70	12.90	14.80	13.25	12.52	2.15	9.85	10.66	13.45	3.95	22.60	10.20	13.05	10.90	16.45	13.45	9.02	12.75	11.77	12.79
PF	1993	13.70	12.70	2.600	8.65	7.40	9.01	0.05	0.05	6.45	1.45	0.00	0.75	2.15	1.09	5.85	8.85	1.55	4.50	3.14	4.68	5.05
ALL	1993	58.10	77.49	85.20	94.55	71.35	77.34	71.95	88.90	78.22	110.00	97.95	66.25	87.55	90.44	86.00	69.60	94.40	89.27	87.63	84.08	83.89
AG	1994	23.30	11.00	28.40	21.20	35.50	23.88	5.35	9.70	19.21	47.50	61.85	27.50	9.05	36.48	6.35	16.70	42.40	51.20	32.88	26.50	30.18
PG	1994	2.65	16.95	5.70	3.75	2.15	6.24	11.20	9.55	7.42	5.50	4.30	0.60	34.30	11.18	9.55	16.65	2.20	7.20	10.04	8.82	8.71
AF	1994	8.10	2.70	7.40	3.30	7.65	5.83	0.15	2.90	4.60	4.10	1.90	18.15	2.50	6.66	2.20	6.65	11.35	2.25	6.14	5.42	6.25
PF	1994	2.25	7.15	3.60	4.50	7.50	5.00	1.30	6.45	4.68	0.15	0.05	11.25	0.60	3.01	5.30	11.10	0.75	2.80	4.00	4.32	4.01
ALL	1994	36.50	37.80	45.10	32.75	52.80	40.95	18.00	28.60	35.91	57.25	68.10	57.50	46.45	57.33	23.40	51.60	56.70	63.45	53.06	45.05	49.14
AG	1995	31.80	9.25	25.8	36.15	46.75	29.95	4.0	1.1	22.12	78.65	70.60	55.50	4.80	52.39	11.10	27.65	53.65	60.20	45.21	34.47	39.92
PG	1995	17.60	98.80	30.0	8.64	2.3	31.47	55.55	12.65	32.22	10.15	18.0	4.00	64.85	24.25	47.45	4.40	16.75	22.90	26.59	27.60	28.26
AF	1995	31.45	6.65	17.75	49.62	14.75	24.04	14.50	102.1	33.81	23.75	27.5	23.35	9.65	21.06	26.25	3.75	30.85	20.65	20.72	26.96	22.72
PF	1995	2.25	7.4	2.4	3.65	8.48	4.84	4.6	6.45	5.05	0.15	0.65	0.45	0.25	0.34	7.15	5.65	0.15	2.80	2.16	3.50	2.86
ALL	1995	83.10	122.1	75.95	98.06	72.28	90.30	78.45	122.30	93.18	112.70	116.75	83.30	79.55	98.08	91.95	41.45	101.40	106.55	91.71	92.39	93.76
AG	1996	58.0	24.35	52.60	54.40	69.30	51.73	15.95	50.80	46.49	8.70	82.55	72.35	22.05	64.66	24.15	40.15	67.25	71.05	57.66	52.44	58.20
PG	1996	10.5	36.36	12.15	14.60	3.65	15.45	56.70	14.15	21.16	13.10	11.60	3.55	41.90	17.54	37.20	14.85	9.55	10.40	17.77	19.35	16.50
AF	1996	6.50	4.95	4.45	8.25	6.85	6.20	2.10	72.45	15.08	7.60	7.70	3.85	8.55	7.43	10.3	5.15	6.40	5.30	7.11	10.88	6.81
PF	1996	.30	6.80	.35	6.35	8.20	3.13	0.00	0.00	4.00	.25	0	1.75	.25	.51	5.7	.25	.15	.05	1.05	2.01	1.82
ALL	1996	75.3	72.46	69.55	83.60	88.0	77.78	74.75	137.4	86.73	102.5	101.9	83.50	72.75	90.14	77.35	60.40	83.35	86.80	83.57	84.62	83.33

Table 5. Herbaceous Phytomass for 1996

DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./	
			WT.(g)	SQ.METER				WT.(g)	SQ.METER				WT.(g)	SQ.METER
05/30	G01	37-3	41.9	419.0	05/28	G05	37-3	4.5	44.7	05/23	S01	37-3	6.7	66.7
05/30	G01	25-5	53.5	535.0	05/28	G05	25-5	8.7	86.8	05/23	S01	25-5	4.9	48.5
05/30	G01	15-6	43.6	436.2	05/28	G05	15-6	1.4	13.7	05/23	S01	15-6	10.7	106.8
05/30	G01	9-1	27.6	276.1	05/28	G05	9-1	7.9	78.6	05/23	S01	9-1	3.8	37.7
05/30	G01	6-4	52.6	526.2	05/28	G05	6-4	2.2	22.2	05/23	S01	6-4	6.9	68.5
		AVG	43.9	438.5			AVG	4.9	49.2			AVG	6.6	65.6
		STD	9.4	93.6			STD	2.9	29.3			STD	2.4	23.6

DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./	
			WT.(g)	SQ.METER				WT.(g)	SQ.METER				WT.(g)	SQ.METER
05/24	G02	37-3	16.9	169.4	05/28	G06	37-3	2.1	21.1	05/30	S02	37-3	32.0	319.8
05/24	G02	25-5	23.8	238.1	05/28	G06	25-5	1.6	15.7	05/30	S02	25-5	56.1	560.8
05/24	G02	15-6	20.7	206.6	05/28	G06	15-6	27.9	279.4	05/30	S02	15-6	19.3	193.4
05/24	G02	9-1	15.9	158.5	05/28	G06	9-1	1.1	10.9	05/30	S02	9-1	2.7	26.5
05/24	G02	6-4	14.5	144.6	05/28	G06	6-4	5.1	50.5	05/30	S02	6-4	5.5	54.9
		AVG	18.3	183.4			AVG	7.6	75.5			AVG	23.1	231.1
		STD	3.4	34.2			STD	10.3	102.9			STD	19.5	195.4

DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./	
			WT.(g)	SQ.METER				WT.(g)	SQ.METER				WT.(g)	SQ.METER
05/29	G03	37-3	7.2	72.2	05/31	G07	37-3	2.7	27.3	05/24	S03	37-3	15.8	157.6
05/29	G03	25-5	13.9	138.7	05/31	G07	25-5	5.4	53.6	05/24	S03	25-5	13.9	138.8
05/29	G03	15-6	6.5	65.3	05/31	G07	15-6	2.6	26.4	05/24	S03	15-6	5.8	58.3
05/29	G03	9-1	5.3	52.7	05/31	G07	9-1	5.9	58.5	05/24	S03	9-1	9.5	94.9
05/29	G03	6-4	6.5	64.9	05/31	G07	6-4	5.5	54.7	05/24	S03	6-4	10.2	102.0
		AVG	7.9	78.8			AVG	4.4	44.1			AVG	11.0	110.3
		STD	3.1	30.6			STD	1.4	14.2			STD	3.5	34.8

DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./	
			WT.(g)	SQ.METER				WT.(g)	SQ.METER				WT.(g)	SQ.METER
05/23	G04	37-3	4.5	44.6	05/30	G08	37-3	26.5	265.2	05/28	S04	37-3	8.0	80.4
05/23	G04	25-5	1.2	11.8	05/30	G08	25-5	47.9	478.6	05/28	S04	25-5	3.8	37.9
05/23	G04	15-6	10.0	100.2	05/30	G08	15-6	40.5	405.1	05/28	S04	15-6	5.2	52.0
05/23	G04	9-1	4.6	45.5	05/30	G08	9-1	40.5	405.2	05/28	S04	9-1	2.7	26.7
05/23	G04	6-4	4.9	49.0	05/30	G08	6-4	2.9	29.0	05/28	S04	6-4	3.1	30.7
		AVG	5.0	50.2			AVG	31.7	316.6			AVG	4.6	45.5
		STD	2.8	28.4			STD	16.0	159.6			STD	1.9	19.4

DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./		DATE	SITE	PLOT	WT./	
			WT.(g)	SQ.METER				WT.(g)	SQ.METER				WT.(g)	SQ.METER
05/31	S05	37-3	6.4	63.8	05/20	S06	37-3	1.6	16.1	05/20	S07	37-3	22.5	224.5
05/31	S05	25-5	4.2	41.7	05/20	S06	25-5	6.5	65.0	05/20	S07	25-5	31.6	315.8
05/31	S05	15-6	5.4	53.7	05/20	S06	15-6	5.8	58.1	05/20	S07	15-6	34.7	347.0
05/31	S05	9-1	3.6	35.5	05/20	S06	9-1	7.9	79.3	05/20	S07	9-1	25.3	253.1
05/31	S05	6-4	12.4	124.1	05/20	S06	6-4	5.3	52.5	05/20	S07	6-4	26.6	265.9
		AVG	6.4	63.8			AVG	5.4	54.2			AVG	28.1	281.3
		STD	3.2	31.7			STD	2.1	21.1			STD	4.4	44.2

MEAN G01-G08  
MEAN S01-S07

Phytomass Summary  
154.5 Grams/sq. meter  
121.7 Grams/sq. meter

Table 6. Comparison of Herbaceous Phytomass (g/m<sup>2</sup>) for 1975 through 1996

YEAR	GO1	GO2	GO3	GO4	GO5	GO6	GO7	GO8	BO1	BO2	SO3	SO4	SO5	BO6	SO7
1975	359	302	-	-	-	-	-	-	126	144	88	-	-	-	-
1976	108	258	-	-	-	-	-	-	137	98	177	-	-	-	-
1977	21	11	-	-	-	-	-	-	4	7	7	-	-	-	-
1978	166	162	-	-	-	-	-	-	173	128	115	-	-	-	-
1979	64	37	-	-	-	-	-	-	21	28	16	-	-	-	-
1980	160	68	53	79	-	-	-	-	36	63	43	78	71	-	-
1981	200	255	261	159	-	-	-	-	180	115	31	52	81	-	-
1982	90	60	62	113	-	-	-	-	98	24	22	39	184	-	-
1983	77	137	64	82	-	-	-	-	171	232	54	68	136	-	-
1984	94	116	133	67	-	-	-	-	104	57	95	93	43	-	-
1985	70	27	12	37	-	-	-	-	5	1	27	11	61	-	-
1986	50	61	32	35	-	-	-	-	35	112	25	176	42	-	-
1987	83	77	134	90	-	-	-	-	62	144	48	108	145	-	-
1988	34	14	16	61	-	-	-	-	59	73	15	24	19	-	-
1989	173.3	65.7	105.1	49.5	43.2	61	113.1	112.3	53.9	72.8	67	39.8	103.7	72.7	149.5
1990	13.6	4.1	64	73.2	36.8	39.8	29.1	10	32.8	78.3	28.2	30.9	43.4	34	6.1
1991	87.7	97.2	161.6	67.6	171.8	101.4	168.4	137.3	225.1	58.2	87.6	185.2	11.3	225.1	226
1992	142.4	109.4	82.7	60	54.4	49.4	101.4	74.3	49.2	147.5	90.7	80.3	110.3	101.3	187.3
1993	146	156.6	70.3	109.8	75.3	162	150.7	100.3	80.2	84.1	91.7	261.4	173.1	93.5	330.3
1994	45.7	48.8	49.2	15.6	13.2	60.1	41.5	44.1	27.3	13.4	20.5	19.8	60.8	7	19.1
1995	208.5	174.5	33.5	65.5	35.5	92.4	106.9	139.3	76.5	84.6	53.8	244.1	113.9	73.5	214.5
1996	438.5	183.4	78.8	50.2	49.2	75.5	44.1	316.6	65.6	231.1	10.3	45.5	63.8	54.2	281.3

Table 7. Summary of Soil Chemistry for 1996

	pH	Conductivity µS/cm	Sulfate µg/gm	Chloride µg/gm	Copper µg/gm	Zinc µg/gm	Sodium µg/gm	Dicarbonate mg/HCl/gm
GO1	7.15	38.5	1.06	0.144	8.1	47.5	0.055	0.0013
GO2	7.15	40.5	0.90	0.224	7.9	42.9	0.058	0.0013
GO3	7.20	82.0	4.45	1.790	8.0	49.0	0.059	0.0020
GO4	7.05	28.0	0.67	0.164	6.3	36.0	0.053	0.0012
GO5	6.94	68.0	0.72	0.035	3.8	40.4	0.045	0.0020
GO6	7.04	21.0	0.74	0.173	6.6	28.1	0.054	0.0007
GO7	7.07	47.5	1.47	0.632	6.5	40.8	0.057	0.0130
GO8	7.11	30.0	0.63	0.290	5.5	33.1	0.045	0.0009
SO1	6.89	43.0	1.82	0.500	5.1	37.5	0.051	0.0008
SO2	7.66	46.0	0.63	0.129	4.9	36.6	0.037	0.0026
SO3	6.85	44.0	0.90	0.296	6.0	45.9	0.057	0.0012
SO4	7.12	52.0	0.77	0.415	6.2	59.5	0.059	0.0018
SO5	7.16	41.0	0.77	0.286	6.3	59.7	0.063	0.0013
SO6	7.73	112.5	0.94	0.326	4.7	28.5	0.038	0.0055
SO7	7.81	142.0	1.67	2.41	9.1	50.7	0.068	0.0090