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VEGETATIONAL STUDIES ON THE ALE RESERVE, 1972

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ABSTRACT

The 1972 annual report for the ALE Site emphasizes the impact of cattle grazing as a stress on shrub-steppe vegetation that has had a long history of no grazing. After the second consecutive year of spring grazing, cattle had reduced the amount of standing dead material of the perennial bunchgrasses and had removed about 70% of the net production for the 1972 season. Two plants were highly palatable to cattle, *Poa cusickii* and *Crepis atrabarba*. These plants may be greatly reduced in abundance with continued spring grazing.

Sagebrush comprises an unpalatable part of the vegetation in terms of cattle forage, but provides about 110 g/m^2 of aboveground producer standing crop in the form of live wood, standing dead wood, leaves, and inflorescences.

INTRODUCTION

The annual report for 1972 considers the impact of cattle grazing on a stand of shrub-steppe vegetation that has had a long history of no grazing. Cattle were introduced for the first time to replicate 9-ha pastures during April and May of 1971 when 15 yearling steers were grazed for 58 consecutive days with a weekly change of pastures. While the same stocking density was maintained for 1972, the number of grazing days was reduced to 41.

At the end of the 1972 grazing period there were visible differences in the vegetation of grazed and ungrazed pastures. *Agropyron spicatum* was the dominant cattle forage species. Much of the 1972 growth of *A. spicatum* was removed by grazing and the amount of standing dead grass also decreased. Although cattle were removed before the onset of flowering of *A. spicatum*, only a few seeds were formed by the plants in the grazed pastures as compared to the ungrazed pastures. *Poa cusickii* was particularly sought by cattle, and all the bunches available to cattle were grazed down to crown level. Some of the perennial forbs, particularly *Crepis atrabarba*, were also eaten. The half-shrubs and sagebrush were not grazed by cattle, but some plants were damaged by trampling. Some of the taller plants were damaged when cattle used them as rubbing posts. Alien winter annuals, i.e., cheatgrass which is characteristic of overgrazed pastures and has disturbed soil throughout the shrub-steppe region of Washington, contributed less than 1% of the total aboveground live biomass on grazed and ungrazed pastures.

Trampling by cattle resulted in breaking up the thin soil crust formed by lichens and algae.

RESULTS

Perennial Grasses

Four species of perennial grasses were harvested. *Poa secunda*, the smallest bunchgrass, was ubiquitous, occurring in every sample taken. But because the plant grows so close to the ground, it probably does not contribute significantly to cattle forage. However, the flowering stalks of this plant range from 1 to 2 dm in height and these can be grazed. *Agropyron spicatum* was the dominant grass and the most important for cattle forage. Occasionally this species did not occur in the 0.5 m^2 circular plot used for harvesting. Although cattle were removed from the pasture before the onset of flowering of *A. spicatum*, most of the plants did not produce seeds in the grazed pastures; on the ungrazed pasture, however, most plants produced at least a few seeds.

Poa cusickii was the most palatable grass and the earliest to flower. Only the clumps protected by sagebrush escaped grazing while unprotected clumps were grazed to crown level. It seems unlikely that *Poa cusickii* will survive another year under the spring grazing treatment administered during this experiment unless protected by shrub canopies.

Stipa thurberiana occurred on the pastures, but contributed only a small portion of the aboveground biomass.

The perennial grasses tripled in live aboveground biomass between March 6 and March 27 with the ungrazed pastures averaging slightly more growth than the grazed pastures. With the introduction of cattle the live aboveground biomass declined on the grazed pastures. On May 30 only 15 g/m^2 remained on the grazed pastures as compared to 47 g/m^2 on the ungrazed pastures (see Tables 1 to 6). From these data it was estimated that about 32 g/m^2 of live grass was removed by the grazing treatment.

Table 1. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 6 March 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum (Pursh) Scribn. & Smith	1.7 ± 0.3	2.1 ± 0.5
Poa cusickii Vasey		0.3 ± 0.2
Poa secunda Presl.	3.0 ± 0.3	3.6 ± 0.2
Stipa thurberiana Piper	0.04 ± 0.03	0.04 ± 0.04
Total	4.7 ± 0.4	6.1 ± 0.4
Half-Shrubs		
Antennaria dimorpha (Nutt.) T. & G.	0.5 ± 0.5	1.0 ± 0.5
Erigeron filifolius Nutt.	0.7 ± 0.3	1.3 ± 0.7
Phlox longifolia Nutt.		0.3 ± 0.2
Total	1.2 ± 0.5	1.6 ± 0.6
Perennial Forbs		
Astragalus purshii Dougl.		0.05 ± 0.05
Brodiaea douglasii Wats.	0.002 ± 0.001	
Calochortus macrocarpus Dougl.		0.04 ± 0.02
Lomatium macrocarpus (Nutt.) Coult. & Rose	0.04 ± 0.01	0.06 ± 0.01
Total	0.04 ± 0.01	1.2 ± 0.5
Winter Annuals	(Not harvestable)	
Shrubs		
Artemisia tridentata Nutt.		
Leaves	2.8 ± 1.6	1.4 ± 1.2
Wood	31.7 ± 20.3	20.4 ± 14.5

Table 2. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 27 March 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	7.6 ± 1.2	11.5 ± 1.8
Poa cusickii	1.1 ± 0.7	3.0 ± 1.2
Poa secunda	5.6 ± 0.6	6.4 ± 0.5
Stipa thurberiana	0.7 ± 0.4	0.08 ± 0.07
Total	15.0 ± 1.5	21.0 ± 2.0
Half-Shrubs		
Antennaria dimorpha	1.9 ± 0.9	0.7 ± 0.4
Erigeron filifolius	0.6 ± 0.3	1.2 ± 0.3
Phlox longifolia	0.3 ± 0.2	1.0 ± 0.4
Total	2.8 ± 0.8	2.9 ± 0.5
Perennial Forbs		
Astragalys purshii		0.014 ± 0.014
Calochortus macrocarpus	0.09 ± 0.05	0.06 ± 0.03
Crepis atrabarba Heller	1.20 ± 0.40	0.17 ± 0.11
Lomatium macrocarpus	0.11 ± 0.03	0.19 ± 0.06
Lupinus laxiflorus Dougl.	0.02 ± 0.02	0.11 ± 0.08
Achillea lanulosa Nutt.	0.003 ± 0.003	
Unidentified	0.01 ± 0.04	0.007 ± 0.006
Total	1.6 ± 0.4	0.55 ± 0.16
Winter Annuals		
Descurainea pinnata (Walt.) Britt.	0.019 ± 0.004	0.002 ± 0.001
Draba verna L.	0.006 ± 0.002	0.060 ± 0.030
Festuca octoflora Walt.	0.011 ± 0.002	0.004 ± 0.001
Bromus tectorum L.	0.002 ± 0.001	
Sisymbrium altissimum L.	0.001 ± 0.001	
Total	0.038 ± 0.003	0.062 ± 0.033
Shrubs		
Artemisia tridentata		
Leaves	1.2 ± 0.9	1.0 ± 0.79
Wood	36.6 ± 26.7	3.8 ± 2.40
Total	37.8 ± 27.5	4.8 ± 3.1

Table 3. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 17 April 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	21.0 ± 2.1	19.1 ± 2.7
Poa cusickii	0.6 ± 0.2	1.7 ± 1.0
Poa secunda	3.6 ± 0.5	5.2 ± 0.3
Stipa thurberiana	0.5 ± 0.3	
Total	25.8 ± 0.9	26.0 ± 2.9
Half-Shrubs		
Antennaria dimorpha	1.20 ± 0.90	2.2 ± 1.5
Erigeron filifolius	0.70 ± 0.30	1.4 ± 0.5
Phlox longifolia	0.01 ± 0.01	0.6 ± 0.2
Total	1.9 ± 1.0	4.2 ± 1.6
Perennial Forbs		
Astragalus purshii		0.09 ± 0.04
Calochortus macrocarpus	0.09 ± 0.05	0.03 ± 0.02
Crepis atrabarba	0.90 ± 0.30	0.20 ± 0.10
Lomatium macrocarpus	0.40 ± 0.30	0.20 ± 0.05
Lupinus laxiflorus	0.30 ± 0.30	0.30 ± 0.20
Total	1.7 ± 0.5	0.8 ± 0.3
Winter Annuals		
Descurainea pinnata	0.060 ± 0.020	0.001 ± 0.001
Draba verna	0.001 ± 0.001	
Festuca octoflora	0.500 ± 0.200	0.170 ± 0.050
Bromus tectorum	0.002 ± 0.001	0.002 ± 0.001
Total	0.6 ± 0.2	0.2 ± 0.05
Shrubs		
Artemisia tridentata		
Leaves	7.6 ± 5.7	27.7 ± 21.1
Wood	1.3 ± 0.8	12.0 ± 9.5
Total	8.9 ± 6.1	39.7 ± 27.8

Table 4. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 8 May 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	18.6 ± 2.6	25.70 ± 6.30
Poa cusickii	0.2 ± 0.1	0.80 ± 0.70
Poa secunda	dead	0.08 ± 0.08
Stipa thurberiana	0.1 ± 0.1	1.00 ± 0.70
Total	18.9 ± 2.6	28.3 ± 5.6
Half-Shrubs		
Antennaria dimorpha	3.5 ± 1.9	1.2 ± 1.0
Erigeron filifolius	0.9 ± 0.4	4.3 ± 2.3
Phlox longifolia	0.05 ± 0.04	2.2 ± 0.9
Total	4.5 ± 2.3	8.4 ± 2.4
Perennial Forbs		
Astragalus purshii		2.60 ± 2.00
Calochortus macrocarpus	0.20 ± 0.10	0.11 ± 0.04
Crepis atrabarba	0.40 ± 0.20	1.40 ± 0.80
Lomatium macrocarpus	0.07 ± 0.02	0.18 ± 0.08
Lupinus laxiflorus	0.01 ± 0.01	0.90 ± 0.60
Total	0.66 ± 0.22	5.1 ± 1.8
Winter Annuals		
Descurainea pinnata	0.11 ± 0.09	0.001 ± 0.001
Festuca octoflora	1.10 ± 0.40	1.100 ± 0.200
Bromus tectorum	0.01 ± 0.01	0.008 ± 0.008
Plantage purchii R. & S.	0.20 ± 0.20	
Total	1.4 ± 0.45	1.1 ± 0.2
Shrubs		
Artemisia tridentata		
Leaves	5.1 ± 4.3	11.2 ± 6.5
Wood	26.4 ± 24.9	44.1 ± 29.3
Total	31.5 ± 25.0	55.3 ± 35.5

Table 5. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 30 May 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	14.00 ± 2.50	44.1 ± 7.2
Poa cusickii	0.07 ± 0.06	1.7 ± 1.5
Poa secunda	0.18 ± 0.08	1.0 ± 0.3
Stipa thurberiana	0.30 ± 0.20	0.5 ± 0.5
Total	14.6 ± 2.4	47.2 ± 6.4
Half-Shrubs		
Antennaria dimorpha	3.20 ± 2.00	10.6 ± 6.0
Erigeron filifolius	2.60 ± 0.80	2.7 ± 1.8
Phlox longifolia	0.02 ± 0.02	0.5 ± 0.1
Total	5.8 ± 2.3	13.3 ± 6.3
Perennial Forbs		
Calochortus macrocarpus		0.07 ± 0.04
Astragalus purshii		0.30 ± 0.20
Crepis atrabarba	0.500 ± 0.200	4.10 ± 2.30
Lomatium macrocarpus	0.002 ± 0.001	0.002 ± 0.002
Lupinus laxiflorus	0.080 ± 0.070	0.10 ± 0.10
Brodiaea douglasii		0.40 ± 0.40
Total	0.6 ± 0.2	5.0 ± 2.4
Winter Annuals		
Descurainea pinnata	0.020 ± 0.008	0.003 ± 0.003
Festuca octoflora	0.050 ± 0.050	
Bromus tectorum	0.009 ± 0.003	
Plantago purshii	0.100 ± 0.070	
Total	0.17 ± 0.12	0.003 ± 0.003
Shrubs		
Artemisia tridentata		
Leaves	0.4 ± 0.4	12.3 ± 12.0
Woods	1.2 ± 1.2	0.6 ± 0.6
Total	1.6 ± 1.6	12.9 ± 12.0

Table 6. Live aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 22 June 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	11.3 ± 2.6	26.1 ± 3.3
Poa cusickii	0.5 ± 0.5	0.7 ± 0.7
Poa secunda		
Stipa thurberiana	0.3 ± 0.2	
Total	12.1 ± 2.9	26.7 ± 3.5

(Other plants not harvested.)

Perennial Forbs

It was clear that the forb most preferred by cattle was *Crepis atrabarba*. All unprotected plants in the grazed pastures were grazed to ground level. *Lupinus laxiflorus* was also grazed by cattle, but other perennial forbs were not utilized.

Half-Shrubs

Three species of half-shrubs occurred on the pastures that had aboveground parts that were more than 1 year old: *Antennaria dimorpha, Phlox longifolia,* and *Erigeron filifolius*. These plants were not grazed by cattle (see Tables 1 to 5).

Winter Annuals

Several species of winter annuals occurred on the pastures, but always in amounts too low to be of value as cattle forage (see Tables 1 to 5).

Shrubs

Only one shrub species, *Artemisia tridentata*, occurred on the pastures. Because of its relatively large size and importance in terms of aboveground biomass, *A. tridentata* was sampled separately from other species (see Tables 7 and 8).

During the 1971 season, sagebrush shrubs were harvested from 24 randomly located circular plots, 2 m^2 in size, in both grazed and ungrazed treatments. The statistical design and analysis procedure is described by Rickard, Gilbert, and Cline (1971). The resulting weight estimates were highly variable due to the irregular spacing and relatively large size of the individual shrubs. In an attempt to obtain better estimates of the mean biomass per square meter during the 1972 season, a double sampling technique was employed.

Table 7. Sagebrush biomass in g/bush October 1972 on the ALE Site. Data are $\bar{Y}_{ds}$ ± SE, where $\bar{Y}_{ds}$ = mean biomass per bush obtained using double sampling.

Sagebrush Parts	Grazed	Ungrazed	Combined
Leaves	28.00 ± 3.04	27.60 ± 2.68	25.78 ± 1.99
Live wood	226.16 ± 19.51	433.07 ± 46.27	315.65 ± 25.79
Leaves and live wood	254.17 ± 20.92	460.67 ± 48.13	341.53 ± 26.84
Flowers	3.45 ± 1.07	1.30 ± 0.32	2.00 ± 0.48
Deadwood	112.55 ± 12.61	138.22 ± 30.97	116.79 ± 18.55
Miscellaneous	14.20 ± 1.52	21.41 ± 2.60	16.86 ± 1.56
Live wood and deadwood	338.71 ± 23.97	571.29 ± 70.89	432.49 ± 39.32
Flowers and leaves	31.46 ± 3.43	28.90 ± 2.79	27.78 ± 2.15
Total	384.37 ± 26.21	621.60 ± 74.26	477.08 ± 41.07

Table 8. Sagebrush biomass in g/m^2 October 1972 on the ALE Site[a].

Sagebrush Parts	Grazed	Ungrazed[b]	Combined
Leaves	7.17 ± 1.48	5.85 ± 0.60	6.03 ± 0.84
Live wood	57.90 ± 11.34	91.72 ± 16.63	73.86 ± 10.49
Leaves and Live wood	65.07 ± 12.63	97.57 ± 17.55	79.89 ± 11.21
Flowers	0.88 ± 0.31	0.28 ± 0.08	0.468 ± 0.12
Deadwood	28.81 ± 6.01	29.27 ± 7.84	27.328 ± 5.38
Miscellaneous	3.63 ± 0.75	4.53 ± 0.86	3.945 ± 0.59
Live wood and Deadwood	86.71 ± 16.43	121.00 ± 23.23	101.19 ± 14.93
Flowers and leaves	8.05 ± 1.67	6.12 ± 1.07	6.50 ± 0.91
Total	98.40 ± 18.55	131.65 ± 24.88	111.64 ± 16.15

a/ Data are $\bar{Y} \pm SE$, where $\bar{Y}$ = mean biomass per square meter. The estimates $\bar{X}_g$, $\bar{X}_{ug}$, and $\bar{X}_c$ used to obtain the above results using equations (1) and (2) are 0.256 ± 0.45, 0.212 ± 0.031, and 0.234 ± 0.027, respectively ($\bar{X} \pm SE$).

b/ The higher yields in the ungrazed treatment are due in large part to one of the six sampling plots of size 5 × 15 m falling partly over a gully which contained a large number of very old and large sagebrush. The inclusion of these samples results in standard errors of greater magnitude than obtained for the the grazed treatment, as well as increasing the spread between the mean yields of the grazed and ungrazed treatments.

Table 7 contains estimates of mean biomass *per bush*. These data are converted to *per square meter* in Table 8. The relationship between the data in Tables 7 and 8 is given in the next section.

Please note that during the 1972 harvest season shrubs were also harvested as part of the sampling program used for herbaceous species and were reported for completeness, rather than for their informative content.

Standing Dead Perennial Grass

Although cattle tend to select the green material from the grass clumps, they also eat some standing dead grass produced in past years. Because the grazed treatment pastures has also been grazed in 1971, there was not as much standing material in the pasture in 1972 as in the ungrazed pasture. Harvest results presented in Tables 9 to 14 for standing dead aboveground biomass (g/m^2) are briefly summarized below.

Sample Date	Treatment	
	Grazed	Ungrazed
March 6	59 ± 6	77 ± 12
March 27	41 ± 6	76 ± 15
April 17	47 ± 5	60 ± 12
May 8	42 ± 6	48 ± 9
May 30	23 ± 3	72 ± 9
June 22	18 ± 6	42 ± 9
Average	38	62

At the end of the growing season there was less standing dead material in the grazed pastures than on the ungrazed pastures.

Table 9. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 6 March 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	49.9 ± 7.0	64.6 ± 11.4
Poa cusickii		1.9 ± 1.3
Poa secunda	7.6 ± 1.0	8.2 ± 0.6
Stipa thurberiana	1.2 ± 1.0	2.1 ± 2.1
Total	58.6 ± 6.2	76.7 ± 12.1
Half-Shrubs		
Antennaria dimorpha		0.8 ± 0.8
Erigeron filifolius	0.11 ± 0.08	0.8 ± 0.5
Phlox longifolia		1.3 ± 0.7
Total	0.11 ± 0.08	2.0 ± 0.5
Perennial Forbs		
Lomatium macrocarpus		0.06 ± 0.06
Lupinus laxiflorus		0.03 ± 0.03
Total		0.09 ± 0.06
Shrubs		
Artemisia tridentata	45.2 ± 18.2	35.9 ± 25.5

Table 10. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 27 March 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	34.4 ± 7.0	64.5 ± 15.5
Poa cusickii	0.5 ± 0.3	5.7 ± 3.2
Poa secunda	3.8 ± 0.8	5.7 ± 0.5
Stipa thurberiana	2.7 ± 1.6	0.2 ± 0.2
Total	41.4 ± 6.2	76.0 ± 15.0
Half-Shrubs		
Antennaria dimorpha	0.60 ± 0.22	
Erigeron filifolius	0.05 ± 0.05	0.09 ± 0.08
Phlox longifolia		1.50 ± 1.50
Total	0.65 ± 0.23	1.6 ± 1.5
Perennial Forbs		
Crepis atrabarba	0.9 ± 0.3	0.30 ± 0.30
Lupinus laxiflorus		0.02 ± 0.02
Total	0.9 ± 0.3	0.3 ± 0.3
Shrubs		
Artemisia tridentata	51.6 ± 29.6	76.6 ± 27.4

Table 11. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 17 April 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	42.9 ± 4.7	54.9 ± 12.4
Poa cusickii	0.5 ± 0.3	1.0 ± 0.7
Poa secunda	3.1 ± 0.3	4.4 ± 0.4
Stipa thurberiana	0.8 ± 0.5	
Total	47.3 ± 4.8	60.3 ± 12.5
Half Shrubs		
Antennaria dimorpha	0.12 ± 0.12	0.4 ± 0.4
Erigeron filifolius		0.4 ± 0.3
Phlox longifolia		1.7 ± 1.2
Total	0.12 ± 0.12	2.5 ± 0.8
Perennial Forbs		
Crepis atrabarba	0.3 ± 0.2	0.6 ± 0.6
Winter Annuals		
Festuca octoflora	0.3 ± 0.2	
Shrubs		
Artemisia tridentata	33.0 ± 14.1	22.2 ± 17.3

Table 12. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 8 May 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	37.7 ± 6.6	38.3 ± 9.6
Poa cusickii	0.3 ± 0.2	0.9 ± 0.9
Poa secunda	4.2 ± 0.7	7.6 ± 0.6
Stipa thurberiana	0.3 ± 0.2	0.7 ± 0.5
Total	42.5 ± 6.4	48.3 ± 8.9
Half-Shrubs		
Antennaria dimorpha		0.8 ± 0.8
Erigeron filifolius		0.6 ± 0.6
Total		1.4 ± 1.0
Perennial Forbs		
Crepis atrabarba	0.2 ± 0.2	1.1 ± 0.1
Shrubs		
Artemisia tridentata	14.2 ± 12.0	

Table 13. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 30 May 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	20.5 ± 3.4	63.8 ± 10.5
Poa cusickii	0.2 ± 0.1	2.4 ± 2.3
Poa secunda	1.7 ± 0.3	4.1 ± 0.8
Stipa thurberiana	1.1 ± 0.7	0.7 ± 0.7
Total	23.5 ± 3.4	71.7 ± 8.7
Half-Shrubs		
Erigeron filifolius	0.3 ± 0.2	0.4 ± 0.3
Phlox longifolia		0.8 ± 0.4
Total	0.3 ± 0.2	1.2 ± 0.5
Perennial Forbs		
Crepis atrabarba	0.6 ± 0.4	2.4 ± 1.7
Shrubs		
Artemisia tridentata	16.1 ± 16.1	19.7 ± 14.2

Table 14. Standing dead aboveground biomass (g/m^2) in grazed and ungrazed pastures on the ALE Site, south central Washington, 22 June 1972.

Vegetation	Grazed	Ungrazed
Perennial Grasses		
Agropyron spicatum	17.8 ± 6.5	41.7 ± 9.0
Poa cusickii		
Poa secunda		
Stipa thurberiana	0.5 ± 0.4	
Total	18.2 ± 6.4	41.7 ± 9.0

(No harvest of half-shrubs, perennial forbs, or shrubs.)

Grass Crowns

All the perennial bunchgrasses have discrete crowns which can be separated from roots with a fine-toothed, flexible saw blade (hacksaw blade). Because of the high degree of soil contamination, the cut crowns are washed and floated in water to remove associated soil particles. The dry weights of washed crowns are listed in Table 15.

Because the pastures have had quite similar past histories, it is expected that the short grazing history associated with the grazed pastures would not be reflected in changes in crown weights. On the average 160 g/m^2 of crowns were harvested on the grazed pastures as compared to 151 g/m^2 on the ungrazed pastures.

Sagebrush Wood

Because the pastures have supported sagebrush plants for a long time and there has been no recent fire, wood derived from twigs and stems is present in variable quantities. On the average the grazed pastures yielded 65 g/m^2 of deadwood compared to 55 g/m^2 on the ungrazed pasture (Table 16). It is not expected that the short grazing history of the grazed pastures would have affected the quantity of deadwood.

Belowground Biomass

Belowground biomass was estimated three times during the spring growing season in early March, mid-April, and early June. Samples were taken to a depth of 8 dm in 1 dm^2 segments using a sharp sand auger with a core 86 mm in diameter. Forty-eight cores were sampled in March and June, but only 24 in April. A summary of results is presented in Table 17. The data indicate that maximum belowground biomass occurred in April in the grazed pastures while maximum biomass occurred in June in the ungrazed pastures. The analysis for replicate 2 in the ungrazed pastures is not yet complete. A statistical analysis of the data is also pending.

Table 15. Crown[a] biomass in grazed and ungrazed pastures on the ALE Site, south central Washington, 1972.

Vegetation	6 March	27 March	17 April	8 May	30 May	Avg
			Grazed			
Agropyron spicatum	65.7 ± 10.1	51.1 ± 11.7	95.7 ± 11.4	12.8 ± 16.0	97.9 ± 12.1	
Poa cusickii	0.0 ± 0.0	17.7 ± 10.6	18.2 ± 14.7	14.4 ± 8.0	12.6 ± 9.4	
Poa secunda	51.2 ± 7.0	52.3 ± 8.9	55.7 ± 5.0	66.1 ± 9.2	57.3 ± 11.5	
Stipa thurberiana	0.9 ± 0.8	9.8 ± 6.7	1.6 ± 1.1	0.5 ± 0.5	1.4 ± 0.9	
Total	117.8 ± 12.4	130.8 ± 18.2	171.2 ± 17.7	208.9 ± 14.1	169.1 ± 14.7	159.56
			Ungrazed			
Agropyron spicatum	72.4 ± 11.4	78.8 ± 12.0	59.6 ± 9.9	64.6 ± 14.1	114.8 ± 7.5	
Poa cusickii	7.3 ± 5.4	24.5 ± 9.6	8.1 ± 5.8	8.6 ± 8.3	13.4 ± 13.3	
Poa secunda	67.6 ± 5.4	59.3 ± 5.1	48.0 ± 5.2	61.2 ± 12.0	58.8 ± 7.4	
Stipa thurberiana	3.8 ± 3.8	0.0 ± 0.0	0.0.± 0.0	1.2 ± 0.9	2.0 ± 2.0	
Total	151.1 ± 13.2	162.6 ± 18.4	115.7 ± 13.6	135.7 ± 14.4	189.1 ± 16.6	150.84

a/ Values are oven dry weights of washed crowns not corrected for residual soil contamination.

Table 16. Deadwood biomass in grazed and ungrazed pastures on the ALE Site, south central Washington, 1972.

Date	Grazed	Ungrazed
6 March	51.4 ± 16.2	67.6 ± 22.3
27 March	59.3 ± 19.2	96.6 ± 24.3
17 April	92.3 ± 15.3	22.6 ± 5.9
8 May	49.0 ± 14.0	47.8 ± 16.3
30 May	74.1 ± 30.4	52.3 ± 15.6
Total	65.2 ± 9.3	54.7 ± 9.8

Grazed and ungrazed combined 61.3 ± 3.4

Table 17. Belowground biomass in grazed and ungrazed pastures during 1972, ash free weight. n = 48 except on 17 April when n = 24. Multiply nontotal values by 172 to convert to g/m^2.

Depth (dm)	6 March		17 April		1 June	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Grazed Treatment						
0 - 1	1.43 ± .22	1.62 ± .36	2.41 ± .30	3.61 ± .80	2.10 ± .66	3.25 ± .46
1 - 2	.61 ± .07	1.07 ± .30	1.48 ± .13	2.44 ± .60	.99 ± .11	1.66 ± .18
2 - 3	.51 ± .04	.69 ± .10	1.07 ± .12	1.20 ± .22	.69 ± .09	1.01 ± .09
3 - 4	.54 ± .08	.56 ± .04	1.04 ± .11	1.10 ± .25	.69 ± .06	.90 ± .07
4 - 5	.41 ± .08	.63 ± .09	.97 ± .20	.87 ± .12	.66 ± .03	.74 ± .06
5 - 6	.51 ± .06	.46 ± .04	.89 ± .07	.86 ± .16	.62 ± .04	.75 ± .07
6 - 7	.46 ± .06	.37 ± .04	.69 ± .05	.68 ± .10	.56 ± .04	.64 ± .04
7 - 8	.30 ± .04	.38 ± .04	.58 ± .05	.55 ± .09	.50 ± .07	.52 ± .05
Total	4.80 ± .36	5.78 ± .57	9.12 ± .71	11.34 ± .21	6.82 ± .99	9.49 ± .80
g/m^2	826	994	1569	1950	1173	1632
Ungrazed Treatment						
0 - 1	1.08 ± .22	1.54 ± .13	1.40 ± .24	1.46 ± .27	2.63 ± .32	M[a/]
1 - 2	.60 ± .06	.64 ± .04	1.11 ± .21	1.21 ± .31	1.48 ± .20	M
2 - 3	.58 ± .14	.66 ± .10	.67 ± .10	.73 ± .08	.95 ± .08	M
3 - 4	.49 ± .11	.59 ± .04	.67 ± .11	.69 ± .08	.33 ± .07	M
4 - 5	.46 ± .05	.52 ± .02	.65 ± .07	.64 ± .06	.65 ± .08	M
5 - 6	.42 ± .02	.53 ± .03	.58 ± .04	.67 ± .04	.79 ± .08	M
6 - 7	.38 ± .02	.48 ± .02	.61 ± .06	.55 ± .07	.63 ± .03	M
7 - 8	.32 ± .03	.39 ± .02	.44 ± .06	.49 ± .07	.56 ± .07	M
Total	4.32 ± .30	5.80 ± .33	6.18 ± .60	6.95 ± .74	8.54 ± .79	M
g/m^2	745	998	1063	1196	1469	M

a/ M = in progress.

SAGEBRUSH SAMPLING DESIGN AND RESULTS

The basic sampling procedure involved "double sampling" or "two-phase" sampling (Cochran 1963) in conjunction with regression estimation. Data collected in 1969 showed a high correlation between the volume of a sagebrush plant [volume = (largest diameter) × (smallest diameter) × (height)] and the dry weight of the shrub. We made use of this correlation by obtaining a sample of size n bushes. Two attributes of each bush were measured: (i) its volume determined by measuring in the field and (ii) its dry weight as determined in the laboratory. These n pairs of data points were used to estimate a linear calibration equation relating these two variables. Then a sample of size n' shrubs was chosen at random (n' > n) for which only volume measurements were obtained; i.e., they were not harvested. With the information from these two samples of size n and n', an estimate of $\bar{Y}_{ds}$ = mean biomass per bush and its standard error can be obtained using formulae given by Cochran (1963) (ds stands for double sampling). The estimate $\bar{Y}_{ds}$ is then multiplied by an estimate of the mean number of bushes per square meter ($\bar{X}$) to obtain the final estimate desired, the mean biomass per square meter, $\bar{Y}$. That is,

$$\bar{Y} = \bar{Y}_{ds}\, \bar{X} \qquad (1)$$

The standard error of $\bar{Y}$ was approximated using the so-called Delta method (Taylor series expansion) and by assuming that $\bar{Y}_{ds}$ and $\bar{X}$ are uncorrelated. Although this latter assumption may be wishful thinking, it is necessitated by a lack of knowledge concerning what the correlation is. We attempted to estimate this correlation using data obtained during the sampling plan, but the data were too variable for this purpose. Hence, the standard error of $\bar{Y}$ was approximated as

$$[\text{var}\ (\bar{Y})]^{1/2} = [\text{var}\ (\bar{Y}_{ds} \cdot \bar{X})]^{1/2}$$
$$\simeq [\bar{X}^2\ \text{var}\ (\bar{Y}_{ds}) + \bar{Y}_{ds}^2\ \text{var}\ (\bar{X})]^{1/2} \qquad (2)$$

If we had a good estimate of cov $(\bar{Y}_{ds}, \bar{X})$, then the term $2\bar{Y}_{ds}\ \bar{X}$ cov $(\bar{Y}_{ds}, \bar{X})$ would be added to the two terms inside the brackets in the above formula.

The above procedure was followed for both grazed and ungrazed treatments. An estimate of $\bar{X}$ (the mean number of bushes per square meter) was obtained for both treatments separately, denoted by $\bar{X}_g$ and $\bar{X}_{ug}$ (g = grazed, ug = ungrazed). Similarly, $\bar{Y}_{ds,g}$ was obtained for both treatments and are denoted by $\bar{Y}_{ds,g}$ and $\bar{Y}_{ds,ug}$ (Table 7). The results given in Table 8 do not warrant the conclusion that the biomass of sagebrush on a square meter basis is statistically different in the two treatments. This is not unreasonable in light of our feeling that cattle do not find sagebrush very palatable. Hence, we have also obtained a combined estimate over the two treatments of $\bar{X}$, $\bar{Y}_{ds}$, and $\bar{Y}$. The estimates obtained are thus:

Grazed	Ungrazed	Combined
$\bar{Y}_{ds,g}$	$\bar{Y}_{ds,ug}$	$\bar{Y}_{ds,c}$
$\bar{X}_g$	$\bar{X}_{ug}$	$\bar{X}_c$
$\bar{Y}_g = \bar{Y}_{ds,g}\ \bar{X}_g$	$\bar{Y}_{ug} = \bar{Y}_{ds,ug}\ \bar{X}_{ug}$	$\bar{Y}_c = \bar{Y}_{ds,c}\ \bar{X}_c$

where the standard errors of $\bar{Y}_g$, $\bar{Y}_{ug}$, and $\bar{Y}_c$ were approximated using equation (2).

The sample sizes n and n' used in estimating $\bar{Y}_{ds}$ and its standard error for grazed, and ungrazed, and combined are:

Sample size	Grazed	Ungrazed	Combined
n	64	96	160
n'	281	187	468

These samples of bushes were obtained by choosing three plots of size 5 × 15 m in each of the six strata in each treatment (Rickard et al. 1972). One of the three plots within each strata was chosen at random, and all bushes within these chosen plots (n) were both measured for volume and harvested to be dried and weighed in the laboratory. There was a total of n = 64 bushes in these plots for the grazed treatment and n = 96 in the ungrazed treatment as indicated above. The bushes in the remaining two 5 × 15 m plots in each strata were not harvested, but their volume measurements were obtained. The total number of these bushes (n') was 281 and 187 in the grazed and ungrazed treatments, respectively.

The biomass of each harvested sagebrush plant was separated in the laboratory into leaves, flowers, live wood, deadwood, and miscellaneous, and estimates were obtained for each category (see Tables 7 and 8). Sagebrush estimates were obtained twice during 1972, once in June, and once in October when the sagebrush was in bloom. For the June harvest we have data only on the biomass of the leaves obtained by harvesting all bushes present in six plots of size 5 × 15 m (cluster sampling) for each treatment. Volume measurements were not obtained on these bushes; hence, the doubling sampling scheme outlined above was used only on the October data. The mean ±SE biomass of leaves per square meter obtained from the June sampling was 10.66 ± 2.5 and 6.20 ± 1.1 for the grazed and ungrazed treatments, respectively. These compare well with 7.17 ± 1.48 and 5.85 ± 0.60 obtained in October (see Table 8).

ABIOTIC MEASUREMENTS

Soil Properties

A textural analysis of the soil profiles in grazed and ungrazed pastures is shown in Table 18. There were no strong differences in soil texture among the four pastures. Silt sized particles ranged between 55% and 63% of the total composition as compared to a range of between 31% and 40% for sand and 3.3% to 6.9% for clay.

Soil pH values increased with depth. The upper decimeter of soil profile had pH values in the range 6.7% to 7.2%, and lower portions of the soil profile had values in the range of 8.2% to 8.3% (Table 19). Other chemical properties of the soil profile are listed in Table 19 and generally show little difference between the various pastures.

Soil Water

Soil water content of the upper meter of soil profile at various times of the year from October 1971 to July 1972 is shown in Table 20. Soil water content increased in fall and winter months and declined in the spring coincident with the spring flush of plant growth. As in 1971 soil water penetration was shallow, to about 6 dm. Below this depth soil water remained relatively constant, indicating no recharge or removal of soil water.

Air Temperatures

The daily maximum and minimum air temperatures taken from hygrothermograph strip chart records are shown in Appendices I and II. Also the daily maximum and minimum soil temperatures taken from strip charts on soil thermographs with sensors placed at a 1-dm depth are presented in Appendices III and IV.

Precipitation

Weekly precipitation values measured in inches for the period October 1971 to September 1972 are presented in Appendix V.

Table 18. Soil textural analysis in grazed and ungrazed pastures.

Depth (dm)	% Sand	% Silt	% Clay
	Grazed treatment (rep. 1)		
0 - 1	33.9	60.8	5.3
1 - 2	32.1	61.6	6.3
2 - 4	34.7	59.3	6.0
4 - 6	37.1	57.7	5.2
6 - 10	38.5	55.7	5.8
	Grazed treatment (rep. 2)		
0 - 1	33.1	60.0	6.9
1 - 2	32.4	61.3	6.3
2 - 4	36.0	60.0	4.0
4 - 6	40.2	56.5	3.3
6 - 10	39.4	55.5	5.1
	Ungrazed treatment (rep. 1)		
0 - 1	31.1	63.0	5.9
1 - 2	31.6	61.5	6.9
2 - 4	35.2	59.8	5.0
4 - 6	36.3	58.5	5.2
6 - 10	40.2	55.5	4.3
	Ungrazed treatment (rep. 2)		
0 - 1	39.8	54.0	6.2
1 - 2	33.9	61.1	5.0
2 - 4	39.7	60.8	4.5
4 - 6	36.1	59.7	4.2
6 - 10	38.0	56.9	4.1

Table 19. Soil properties in grazed and ungrazed pastures.

Property	Depth (dm)	Grazed		Ungrazed	
		Rep. 1	Rep. 2	Rep. 1	Rep. 2
pH	0 - 1	7.2	7.0	6.7	6.8
	1 - 2	7.0	7.1	7.1	7.0
	2 - 4	7.5	7.2	7.1	7.3
	4 - 6	7.9	7.7	7.4	7.8
	6 - 10	8.2	8.2	8.3	8.3
Organic Matter (%)	0 - 1	0.6	0.7	0.6	0.5
	1 - 2	0.8	0.4	0.5	0.4
	2 - 4	0.4	0.5	0.6	0.4
	4 - 6	0.6	0.8	0.8	0.5
	6 - 10	0.4	0.1	0.5	0.5
P (ppm)	0 - 1	10.0	10.0	14.0	12.0
	1 - 2	11.0	10.0	10.0	8.0
	2 - 4	8.0	2.0	10.0	8.0
	4 - 6	2.0	0.5	4.0	2.0
	6 - 10	2.0	0.5	2.0	15.0
K (ppm)	0 - 1	230.0	250.0	320.0	270.0
	1 - 2	300.0	220.0	320.0	120.0
	2 - 4	170.0	160.0	200.0	180.0
	4 - 6	100.0	100.0	100.0	110.0
	6 - 10	80.0	80.0	80.0	100.0
Ca (meq/100 g)	0 - 1	6.0	5.0	4.8	5.3
	1 - 2	5.2	5.8	5.8	5.8
	2 - 4	7.0	6.8	6.5	6.5
	4 - 6	27.6	11.7	8.0	9.3
	6 - 10	28.8	29.6	30.0	31.0
Mg (meq/100 g)	0 - 1	3.7	3.2	3.1	3.2
	1 - 2	3.2	3.9	3.4	3.7
	2 - 4	3.9	4.1	3.9	3.8
	4 - 6	4.7	4.5	4.0	4.0
	6 - 10	4.9	4.8	5.1	5.1
N (%)	0 - 1	0.038	0.039	0.042	0.044
	1 - 2	0.048	0.022	0.034	0.050
	2 - 4	0.039	0.022	0.040	0.048
	4 - 6	0.039	0.044	0.042	0.049
	6 - 10	0.022	0.039	0.022	0.040
Total Bases (meq/100 g)	0 - 1	10.2	8.8	8.7	9.1
	1 - 2	9.2	10.2	10.0	9.8
	2 - 4	11.3	11.3	10.9	10.8
	4 - 6	32.6	16.5	12.3	13.6
	6 - 10	34.0	34.7	35.4	36.4

Table 20. Soil water (% dry wt) in ungrazed pastures during the 1971-72 growing season.

Depth (dm)	1971								
	27 Oct	4 Nov	24 Nov	2 Dec	17 Jan	17 Feb	1 Mar	24 Mar	3 Apr
0-1	3.9	5.2	9.1	13.7	16.9	17.4	10.9	10.1	8.6
1-2	4.0	4.2	5.0	5.4	14.9	16.4	12.3	12.0	10.9
2-3	4.5	4.6	5.8	3.5	11.4	15.3	12.3	12.1	11.3
3-4	4.9	5.2	5.3	5.6	9.0	13.9	11.5	11.5	11.3
4-5	5.2	5.6	5.2	5.8	8.6	11.8	9.4	9.7	10.8
5-6	5.3	5.9	5.3	5.8	7.4	11.7	7.1	8.5	8.2
6-7	5.3	5.7	4.9	5.5	5.7	7.1	5.3	6.5	6.7
7-8	4.8	5.2	4.6	5.4	5.6	5.9	5.3	5.0	5.7
8-9	4.3	4.6	4.2	5.0	4.8	--	4.7	4.5	4.9
9-10	4.0	4.0	4.1	5.1	4.0	--	4.4	4.2	4.3

Depth (dm)	1971							
	10 Apr	20 Apr	27 Apr	9 May	1 Jun	21 Jun	27 Jun	10 Jul
0-1	7.7	5.7	4.6	11.8	4.4	3.4	6.0	3.2
1-2	9.9	8.1	8.2	6.5	6.2	4.8	4.9	4.7
2-3	10.4	9.1	8.9	6.7	6.3	5.5	5.3	5.5
3-4	10.6	9.4	9.0	6.9	6.7	6.0	5.4	6.0
4-5	11.1	9.7	9.1	7.4	6.7	5.8	5.5	6.5
5-6	10.3	9.4	8.8	7.6	6.4	5.8	5.4	6.4
6-7	8.0	7.7	7.6	6.8	7.2	5.5	5.2	5.3
7-8	6.2	5.5	6.3	5.9	5.7	5.0	4.6	5.1
8-9	4.7	4.8	5.6	4.6	4.2	4.4	4.1	4.8
9-10	4.0	4.5	4.5	4.3	4.1	4.1	3.9	4.0

Table 20. (continued)

Depth (dm)	1971				1972					
	27 Oct	4 Nov	24 Nov	2 Dec	17 Jan	17 Feb	1 Mar	24 Mar	3 Apr	10 Apr
0-1	3.7	5.4	7.6	14.2	18.8	15.4	11.5	10.3	7.6	7.2
1-2	4.0	4.5	7.2	7.0	15.6	14.8	13.1	15.0	10.5	9.4
2-3	4.5	5.1	5.1	5.7	11.0	14.3	13.3	11.1	11.6	9.6
3-4	5.2	5.6	5.7	6.1	10.0	11.6	13.0	10.3	11.6	10.2
4-5	5.5	5.7	6.0	6.0	8.2	7.9	11.6	10.1	10.0	9.8
5-6	5.2	5.9	6.3	5.9	6.1	6.3	7.9	9.0	6.2	9.3
6-7	4.5	5.0	5.6	5.6	5.4	5.8	5.1	6.5	5.3	7.6
7-8	4.0	4.1	4.6	5.2	4.7	5.6	4.5	5.9	5.0	5.9
8-9	3.7	4.4	4.8	5.0	4.1	--	4.4	5.0	4.4	5.0
9-10	3.6	4.0	4.2	5.1	4.0	--	4.3	4.8	4.3	4.4

Depth (cm)	1972						
	20 Apr	27 Apr	9 May	1 Jun	21 Jun	27 Jun	10 Jul
0-1	5.1	4.2	11.9	5.5	4.8	7.3	3.8
1-2	7.7	7.8	6.7	7.0	5.3	5.6	5.3
2-3	9.2	9.1	7.2	6.3	6.1	6.1	5.8
3-4	10.3	9.2	7.7	7.1	6.4	6.0	6.1
4-5	10.6	9.9	7.6	7.4	6.0	6.0	6.0
5-6	8.0	9.1	7.3	7.0	5.8	5.7	5.9
6-7	5.7	6.8	6.4	5.4	6.0	5.3	5.4
7-8	5.2	5.6	5.4	4.5	5.4	4.7	4.9
8-9	5.1	4.8	4.5	4.7	4.9	4.3	6.5
9-10	4.5	4.8	4.4	4.3	4.5	4.1	4.3

DISCUSSION

The ALE Site located in the shrub-steppe region of south central Washington differs from other sites in the US/IBP Comprehensive Network not only floristically but also because the dominant grasses are arranged in widely spaced, discrete clumps. Superimposed over the bunchgrasses are small statured and widely spaced plants of the long-lived evergreen shrub *Artemisia tridentata*. The land use history of the ALE Site is unique because of a long period of no grazing under the management of the United States Atomic Energy Commission. The introduction of cattle to the ALE pastures represents a stress to a stand of vegetation that probably has had little previous cattle grazing. The pastures have also not sustained a fire for more than 30 years although adjacent areas have burned as recently as 1957.

Sampling at the ALE Site, unlike other sites, was conducted concurrently with cattle grazing. It is anticipated that in 1973 one previously grazed pasture (1971 and 1972) will not be grazed. Another pasture will be grazed for the third consecutive year, and the third pasture will be one that has not been grazed at all. By sampling concurrently with cattle grazing, an estimate of forage use can also be obtained for that particular pasture.

Although sagebrush is not a palatable forage for cattle, the plant is a prominent part of the vegetation. It was clearly demonstrated that the kind of sampling used for herbaceous plants would not be useful as a measure of the annual net production of sagebrush. The sampling method used in 1972 may provide a more accurate assessment of annual production, although it makes no allowance for growth in stem diameter nor does it fully account for leaves and other persistent tissues that may have been produced prior to the current sample year. However, it is believed that the error introduced here is small compared to decisions made in separating live wood and deadwood. Sagebrush plays a role in protecting grasses beneath its canopy from cattle grazing. Furthermore, sagebrush probably competes with herbaceous plants for water and scarce nutrient elements.

Interpretation of results obtained for belowground biomass harvests involves inherent difficulties in distinguishing and separating new growth roots from those produced in previous seasons.

The climatic regime of the ALE Site differs from other network sites located east of the Rocky Mountains because winter precipitation is followed by a prolonged summer drought. Soil water is replenished during fall and winter months, then steadily declines in spring. Soil water penetration has been shallow during both years of study, averaging about 6 dm. However, roots were found in the soil profile below the soil water penetration depth, suggesting that in other years there was deeper percolation of precipitation.

Generally, plants with the shallowest root systems flower earlier in the spring than those with deeper roots. This may be a response to soil drought since the soil profile ordinarily dries from the surface downward. Sagebrush, which has an unusual phenology, flowers in the autumn after enduring several months of soil drought and extreme summer temperatures.

A unique feature of this grassland is the possibility of winter growth (also characteristic of California annual grassland). Growth starts in fall with the first soaking rain and may continue in short periods of above-freezing temperatures. As spring temperatures rise, soil water reserves are depleted and the growth cycle is complete. Thus, the growing season is confined to a short period during which adequate soil water and moderate temperatures occur simultaneously.

The ALE version of the ELM model uses field data collected in 1971 and 1972. Applying ELM to shrub-steppe vegetation has pointed out several weaknesses in the model. The data have been used to develop modeling representations of topics not addressed in the Pawnee version of ELM. For example, the role of crown material in grasses (and perhaps live wood in shrubs as well) appears to be overwinter storage, and as such this biomass category has been removed from the root categories which now serve as absorptive structures only. Thus, the effect of cattle grazing on the crowns and the relative vigor of the important species can be simulated by observing the material stored in the crowns. Another example involves ability to address the biomass and phenological dynamics of annual species. This ability, absent in the Pawnee version of ELM, has been added to the ALE version to account for *Bromus tectorum*, a vigorous annual grass. Also, the fall flowering time of sagebrush initiated an extensive revision of the phenological dynamics section of the model, and this section now produces good relationships between plant development and climatic variability and change. In summary, the ELM model is much improved for its application to the phenological and biomass dynamics of the rather unique vegetation of the ALE reserve. The resulting changes in ELM are expected to improve ELM's applicability to other sites in the Grassland Biome.

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APPENDIX I

MAXIMUM AIR TEMPERATURES (°C) 1971-72 GROWING SEASON, ALE

	1971				1972									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		19.0	11.0	2.0	9.0		2.0		17.0	10.0	16.5	34.0	29.0	26.5
2		19.0	10.0	3.5	5.5		9.5	10.5	23.0	11.5	28.0	32.0	30.0	24.5
3		24.5	15.0	1.5	-1.0		6.5	13.5	24.0	14.0	30.0	33.0	31.0	24.5
4		26.5	11.5	6.5	1.0		5.5	18.5	25.0	26.5	33.5	35.0	33.0	19.0
5	30.0	26.0	5.5	11.0	7.0		17.0	20.5	24.0	31.5	35.5	36.5	28.0	18.0
6	20.0	25.5	4.5	5.0	10.0		10.0	14.5	23.0	34.5	36.5	39.5	23.5	19.5
7	21.5	24.5	10.0	-1.0	8.0		8.5	10.5	20.0	30.0	31.0	40.5	24.0	21.0
8	26.5	24.0	6.5	6.0	5.5		9.0	11.0	11.0	29.0	23.0	41.5	25.5	23.0
9	25.0	23.5	13.0	7.0	7.0		9.0	11.5	16.5	27.0	23.0	37.0	21.0	21.5
10	29.5	23.5	11.0	4.0	5.0		16.5	12.0	19.5	19.5	23.0	35.0	21.0	11.0
11	23.5	22.0	8.5	-2.0	9.0		15.0	12.0	23.5	20.0	25.5	32.0	23.0	13.5
12	26.0	21.0	10.5	2.0	4.0		14.0	10.0	25.5	23.5	33.5	28.5	22.0	16.5
13	23.0	20.0	10.5	4.5	-1.0		15.5	14.5	30.0	24.5	31.0	26.5	24.0	16.0
14	21.0	13.5	10.0	4.5	-1.0		13.5	15.5	28.0	26.5	30.5	29.0	26.5	15.5
15	21.5	13.0	9.5	3.5	1.0		16.0	14.5	22.0	30.5	32.0	20.0	30.5	15.5
16	20.0	11.0	8.5	6.5	11.0		21.0	10.5	21.0	24.0	34.0	19.5	29.0	17.0
17	21.0	12.0	6.5	10.0	9.5		21.0	8.5	13.5	25.0	33.0	22.0	24.5	18.0
18	21.5	14.5	6.5	5.5	5.5		16.5	12.0	16.5	25.0	29.5	25.0	18.5	17.0
19	24.0	13.5	11.5	5.0	10.5		15.5	15.5	25.5	28.0	24.5	28.5	18.0	16.5
20	19.0	13.5	14.0	6.0	12.0		14.0	14.5	24.0	29.0	21.5	30.5	16.0	19.0
21	20.5	12.0	8.5	6.5	12.0		15.5	12.0	14.0	24.0	25.0	31.0	19.5	20.0
22	23.0	12.0	9.5	9.5			12.0	11.0	20.0	25.5	31.5	25.5	18.0	17.0
23	25.5	10.0	4.0	8.0			11.5	18.0	17.0	19.0	30.5	26.5	12.0	16.0
24	21.0	13.5	8.0	6.5			12.0	15.5	17.0	17.0	31.0	29.5	14.0	14.5
25	19.0	13.5	6.5	6.0			9.0	15.5	20.5	21.0	32.0	31.5	14.0	
26	20.0	11.5	4.0	-2.0			9.0	17.0	25.0	23.5	33.5	35.0	16.5	
27	16.5	6.0	9.0	-4.0			11.0	23.0	29.0	29.0	33.0	36.5	13.0	
28	18.0	3.5	6.5	-7.0			9.0	13.5	32.0	34.5	36.0	37.0	19.0	
29	14.5	5.0	5.0	-4.0		9.0		10.0	35.0	33.0	37.0	35.0	20.0	
30	16.5	-1.0	6.5	-2.0				13.5	31.0	31.0	36.5	26.0	24.5	
31		8.5		4.5					31.0		36.5	26.0		

APPENDIX II

MINIMUM AIR TEMPERATURES (°C) 1971-72 GROWING SEASON, ALE

	1971				1972									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		8.0	4.5	1.0	0.0		-1.0		2.0	10.0	16.5	18.5	17.0	12.0
2		6.0	1.5	1.5	-3.0		-1.0	0.0	9.0	11.5	15.0	20.5	18.5	13.5
3		10.0	4.5	-1.0	-6.0		0.0	0.0	9.0	14.0	14.5	19.0	18.0	11.5
4		13.5	-1.0	-1.0	-4.0		0.0	9.5	12.0	13.0	19.5	20.0	18.0	9.5
5	14.0	14.0	-4.0	0.0	1.0		4.5	7.0	13.5	15.5	21.0	20.5	15.0	7.0
6	10.0	15.5	-1.0	-1.0	3.0		-1.0	3.5	11.5	19.5	21.0	22.0	11.5	5.5
7	8.0	12.0	0.0	-6.0	0.5		-2.0	2.0	9.0	16.5	13.5	23.0	12.0	7.0
8	10.0	11.5	3.5	-6.0	0.0		0.5	1.5	6.5	15.0	12.0	24.5	12.0	8.0
9	15.0	11.0	4.0	0.0	3.0		1.0	0.0	6.5	15.5	11.5	20.0	10.5	9.5
10	14.0	10.5	6.0	-2.0	2.0		5.5	4.0	5.5	10.0	9.5	18.0	8.0	5.5
11	13.5	10.0	4.0	-5.0	2.0		8.0	4.5	8.0	15.0	13.0	15.5	13.5	5.0
12	10.0	9.0	3.5	-4.0	-5.0		7.0	3.0	12.0	8.0	20.0	13.5	11.5	8.5
13	13.5	4.5	2.0	-4.0	-7.0		5.0	3.5	11.5	13.5	20.0	11.0	9.0	9.0
14	10.0	3.5	2.0	1.0	-7.0		3.5	1.5	14.0	13.0	14.0	16.0	11.0	9.0
15	8.0	3.0	2.0	-5.0	-6.0		5.5	3.5	11.0	14.5	19.5	11.0	14.0	5.0
16	11.5	2.0	0.5	-5.0	-5.0		8.0	1.5	11.0	11.5	21.5	9.0	14.5	5.0
17	8.0	1.0	-1.0	5.0	-1.0		8.5	0.0	4.5	11.0	20.0	12.0	9.5	6.5
18	6.5	5.0	0.0	0.0	-3.0		7.0	0.5	2.0	13.0	19.5	13.0	8.5	7.0
19	9.5	6.0	3.0	-2.0	6.5		4.0	5.5	9.0	14.5	14.0	15.5	8.5	4.5
20	10.0	3.5	4.5	3.0	6.5		3.5	2.0	13.0	15.0	12.0	15.5	8.0	5.5
21	5.5	2.0	2.0	4.0			7.0	0.0	10.0	12.0	13.0	16.0	8.5	9.5
22	8.0	7.0	0.0	3.0			6.0	-2.0	6.5	10.0	16.0	16.0	7.0	7.0
23	10.5	4.0	-1.0	0.5			3.5	3.5	6.0	9.5	18.5	14.0	5.0	8.0
24	11.0	2.0	-1.0	2.0			0.5	5.5	6.0	9.0	17.0	16.0	3.5	4.5
25	11.0	3.0	0.0	-4.0			-1.0	4.5	8.0	9.5	14.5	16.5	1.5	
26	8.5	1.0	1.5	-9.0			-3.0	1.5	10.5	8.5	16.0	19.0	4.5	
27	10.0	-1.0	3.5	-10.0			-1.0	6.5	13.5	11.5	15.0	20.0	3.5	
28	8.0	-4.0	1.5	-9.0			-1.0	3.5	20.0	15.5	18.5	22.0	6.0	
29	6.0	-4.0	1.0	-9.0		1.5		-1.0	20.5	16.0	23.0	21.0	5.0	
30	6.5	-2.0	0.0	-8.0				-1.0	17.0	15.5	21.0	15.0	7.0	
31		-4.0		-4.0					15.0		22.0	15.5		

APPENDIX III

MAXIMUM SOIL TEMPERATURE
(1 decimeter deep)

	1971				1972									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		19.0	6.5	2.0		-4.0	3.0	14.5	19.5	27.0	31.5	36.0	30.0	21.0
2		19.0	7.0	1.0		-6.0	4.0	14.5	21.5	28.5	31.5	36.5	31.0	21.5
3		19.5	7.0	0.5		-7.0	3.0	15.0	23.0	25.5	31.5	36.0	32.0	21.5
4		23.0	9.5	0.0	-3.0	-6.0	3.5	15.5	24.0	25.5	32.0	37.0	33.0	19.0
5	28.5	22.0	6.0	2.0	-2.0	-6.0	7.0	14.5	24.0	29.0	34.0	38.0	30.0	18.5
6	24.5	21.0	3.5	2.0	-2.0	-4.0	8.0	14.5	23.5	32.0	35.0	38.5	28.5	15.0
7	25.5	22.0	4.5	0.5	-2.0	-3.0	6.5	12.0	23.0	31.0	33.0	39.5	27.0	19.5
8	26.5	22.0	5.5	-1.0	-2.0	-2.0	6.0	11.5	20.0	32.0	29.5	39.0	27.0	19.0
9	27.0	21.5	5.5	-1.0	-2.0	-2.0	6.0	13.0	18.0	29.0	28.0	39.0	26.0	20.0
10	28.0	21.0	7.0	-1.0	-1.0	-2.0	10.0	14.0	24.0	26.5	27.0	38.0	25.5	17.0
11	27.0	20.5	6.5	-1.0	-1.0	-2.0	9.5	13.5	24.5	23.5	26.5	37.0	24.5	13.0
12	26.0	19.5	7.0	-1.0	-1.0	-1.0	8.5	11.5	26.5	25.0	29.0	35.5	24.0	15.5
13	25.5	18.5	6.5	-1.0	-1.0	0.0	11.0	15.5	28.0	28.0	31.0	32.0	26.0	15.5
14	25.5	16.5	6.0	-1.0	-2.0	0.0	10.0	13.5	28.0	28.0	33.0	31.0	27.0	14.5
15	24.5	14.5	8.5	-1.0	-2.0	3.0	10.5	15.0	24.5	31.0	34.0	29.5	27.0	15.5
16	22.0	13.5	6.0	-1.0	-2.0	4.0	15.0	14.5	22.0	29.5	35.0	25.5	28.5	16.0
17	22.0	12.0	3.5	0.0	-2.0	0.0	15.5	12.0	19.5	29.0	35.0	28.5	26.5	15.5
18	23.0	13.5	3.5	0.0	-2.0	0.5	13.5	16.0	20.0	30.0	33.5	29.0	24.0	15.5
19	23.0	11.0	6.0	0.0	-1.0	2.0	13.5	14.5	22.0	30.0	31.6	29.5	22.0	15.5
20	21.5	11.5	9.5	0.5	0.0	4.5	14.5	15.0	23.5	28.5	27.0	32.0	19.5	15.0
21	22.0	12.0	6.0	0.5	1.0	1.0	13.5	14.5	20.5		26.5	33.0	18.5	16.0
22	23.0	11.5	5.5			3.0	11.5	15.5	19.0		30.5	29.0	19.0	16.0
23	22.0	10.5	3.0			5.0	13.5	15.5	20.5		30.0	31.0	15.5	15.0
24	22.0	11.5	2.0			4.0	11.0	16.0	19.0		28.5	31.5	15.5	14.5
25	20.0	9.5	3.0		-1.0	4.5	10.5	15.0	24.5		33.0	33.5	16.5	13.5
26	21.5	11.5	3.5		-1.0	4.0	11.0	19.0	26.0		34.5	34.0	18.0	13.0
27	19.5	9.0	4.0		-3.0	7.0	11.5	21.0	28.0	29.5	34.5	35.0	16.0	10.5
28	18.0	7.0	4.0		-4.0	9.0	13.5	16.5	30.5	32.0	36.0	35.0	16.0	9.0
29	16.0	5.0	4.5		-5.0	7.0	13.5	14.0	31.5	33.5	37.0	35.0	18.0	
30	17.0	4.5	4.5		-6.0		14.5	16.5	30.0	32.0	38.0	31.5	20.0	
31		3.5			-5.0		15.5		29.5		36.5	30.0		

APPENDIX IV

MINIMUM SOIL TEMPERATURE
(1 decimeter deep)

	1971				1972									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		11.0	3.5	1.0		-7.0	1.0	10.0	10.0	22.0	23.5	28.5	23.5	14.0
2		11.5	3.0	0.0		-9.0	0.5	7.0	13.5	21.5	23.0	29.0	23.5	15.0
3		13.0	5.0	0.0		-10.0	0.5	5.5	15.0	21.5	23.0	28.5	24.0	15.0
4		15.5	5.5	0.0	-3.0	-9.0	0.0	9.0	16.5	20.0	24.5	28.0	24.5	15.5
5	17.0	16.5	2.0	0.0	-3.0	-6.0	1.5	11.0	17.0	21.5	25.0	29.0	25.5	13.5
6	18.5	17.0	0.5	0.5	-2.0	-6.0	4.0	9.0	17.0	24.5	28.0	29.5	22.0	11.5
7	15.5	16.5	1.5	-1.0	-2.0	-4.0	0.5	7.0	17.0	26.5	25.5	30.0	21.5	12.0
8	16.5	16.0	3.0	-1.0	-2.0	-2.0	1.0	7.0	14.5	24.5	23.0	31.0	21.0	13.0
9	20.0	15.5	3.5	-1.0	-2.0	-2.0	2.6	5.5	10.5	24.0	20.5	31.5	20.0	15.0
10	19.5	15.5	5.5	-1.0	-2.0	-2.0	4.5	7.0	9.5	21.0	21.0	30.0	18.5	12.0
11	21.0	16.0	5.0	-1.0	-2.0	-2.0	6.0	9.5	13.5	18.5	21.0	30.0	19.5	10.0
12	19.0	15.0	5.0	-1.0	-1.0	-2.0	7.0	9.0	16.0	18.0	22.0	28.0	20.5	10.5
13	19.5	15.5	4.5	-1.0	-2.0	-2.0	7.0	6.5	18.0	20.0	24.5	25.0	18.0	12.0
14	18.5	12.0	3.0	-1.0	-2.0	-1.0	4.5	8.5	20.0	21.0	24.0	25.5	19.0	12.0
15	16.5	12.0	4.0	-1.0	-3.0	-1.0	5.0	10.0	19.5	22.0	25.5	24.5	20.0	10.0
16	17.0	9.5	2.0	-1.0	-3.0	0.0	6.5	9.0	16.0	23.0	26.5	17.0	21.5	9.5
17	15.5	8.5	1.0	-1.0	-2.0	-1.0	8.5	8.0	14.0	21.5	27.0	18.5	20.5	10.0
18	15.0	9.5	0.5	0.0	-2.0	-1.0	10.0	7.0	10.5	22.0	28.0	18.5	19.0	10.0
19	15.5	10.5	1.5	-1.0	-2.0	0.0	8.0	8.0	14.0	23.0	24.5	21.0	18.0	10.0
20	18.0	8.5	5.5	-1.0	-1.0	0.0	6.0	9.0	17.0	23.5	23.5	21.5	16.5	9.5
21	14.5	6.5	3.5	0.0	0.0	0 0	8.0	10.0	12.0		21.0	23.5	14.5	11.5
22	15.0	9.0	1.5			0.0	5.0	7.0	11.0		22.0	24.0	12.0	10.5
23	16.0	9.5	1.5			0.0	6.5	9.0	11.0		24.0	21.0	11.0	11.0
24	18.0	6.0	0.5			0.0	7.0	11.5	11.5		24.5	23.0	9.0	9.0
25	17.0	6.5	1.0		-1.0	0.0	4.0	10.5	12.0		23.0	24.0	8.5	8.0
26	15.5	9.0	2.0		-3.0	0.0	3.0	9.0	15.5		25.0	25.0	9.0	9.5
27	15.5	6.0	2.0		-6.0	3.5	3.5	11.5	18.0	19.5	25.5	26.0	9.5	6.5
28	13.5	3.5	3.0		-7.0	6.5	4.0	13.5	20.5	20.5	26.5	26.5	11.0	6.0
29	10.5	1.0	3.5		-7.0	1.0	5.5	9.5	22.0	23.0	28.5	27.0	11.0	
30	10.5	4.0	1.5		-9.0		6.0	8.5	23.0	24.0	29.0	26.0	12.0	
31		3.0			-7.0		7.0		25.0		29.5	24.0		

APPENDIX V

PRECIPITATION MEASURED IN INCHES 1971-72 GROWING SEASON, ALE

	1971			1972								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1											0.00	
2		0.00						0.02				
3										0.00		
4				0.17			0.01					
5												0.00
6									0.09			
7			0.52			0.29						
8					0.04						0.00	
9								0.56				
10												
11				0.00			0.10			0.08		
12												0.00
13									0.04			
14			0.60			0.47						
15					0.00						0.01	
16		0.12						0.07				
17												
18				0.00			0.03			0.00		
19												0.00
20								0.05				
21						0.00						
22					0.05						0.35	
23		0.00						0.79				
24				0.42								
25							0.02			0.02		
26												0.01
27									0.43			
28						0.02					0.00	
29					0.01							
30		0.45						0.00				
31				0.00								
Total	0.00	0.57	1.12	0.59	0.10	0.78	0.16	1.44	0.61	0.10	0.36	0.01

APPENDIX VI

FIELD DATA

The 1972 ALE Site aboveground herbage data are Grassland Biome data set number A2U00E1. They are recorded on form NREL-01 as per the modified instructions in Technical Report No. 145. A sample data form and a listing of these data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET – ABOVEGROUND BIOMASS

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	CLIP-EST.	GROWTH FM.	GENUS	SPECIES	SUBSPECIES	CATEGORY	WEIGHT ESTIMATE	SACK NO.	DRY WEIGHT	CROWN PLOT SIZE	CROWN WEIGHT
			DAY	MO.	YR.															
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21-23	25	27	29-30	31-32	34	35	36-40	42-45	47-52	54-57	59-64
01																				

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6 Grazed 1970, ungrazed 1971
7
8
9

CATEGORY
1 Live
2 Old dead
3 Recent dead

CLIP-ESTIMATE
1 Harvested
2 Harvest and Est.
3 Estimated
4 Est. for Insect
5 Est. for Reference
6 Est. for Future Clip

GROWTH FORM
1 Perennial grass
2 Annual grass
3 Sedge, rush, etc.
4 Annual forb
5 Biennial forb
6 Perennial forb
7 Half-shrub
8 Shrub
9 Tree
0 Miscellaneous

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5
1234567890123456789012345678901234567890123456789012345
 
0101WR 27037231 0.5  01 1 1 AGSP  1        49   1.25
0101WR 27037231 0.5  01 1 1 AGSP  2        49   3.91
0101WR 27037231 0.5  01 1 1 POSE  1        49   1.47
0101WR 27037231 0.5  01 1 1 POSE  2        49   1.00
0101WR 27037231 0.5  01 1 7 ERFI  1        49   1.28
0101WR 27037231 0.5  01 1 7 ANDI  1        49   2.45
0101WR 27037231 0.5  01 1 2 FEOC  1        49    .01
0101WR 27037231 0.5  01 1 6 CRAT  1        49    .00
0101WR 27037231 0.5  01 1 1 AGSP  5        49   4.75
0101WR 27037231 0.5  01 1 1 POSE  5        49   3.72
0101WR 27037231 0.5  02 1 1 AGSP  1        50   5.02
0101WR 27037231 0.5  02 1 1 AGSP  2        50  17.39
0101WR 27037231 0.5  02 1 1 POSE  1        50   1.51
0101WR 27037231 0.5  02 1 1 POSE  2        50   1.04
0101WR 27037231 0.5  02 1 6 LOMA  1        50    .01
0101WR 27037231 0.5  02 1 6 LULA  1        50    .08
0101WR 27037231 0.5  02 1 2 FEOC  1        50    .01
0101WR 27037231 0.5  02 1 7 ERFI  1        50    .60
0101WR 27037231 0.5  02 1 6 CRAT  1        50   2.65
0101WR 27037231 0.5  02 1 6 TOFL           50    .15
0101WR 27037231 0.5  02 1 6 CRAT  2        50   2.75
0101WR 27037231 0.5  02 1 4 DEPI  1        50    .05
0101WR 27037231 0.5  02 1 7 ERFI  2        50    .57
0101WR 27037231 0.5  02 1 1 AGSP  5        50  16.55
0101WR 27037231 0.5  02 1 1 POSE  5        50  25.54
0101WR 27037231 0.5  03 1 1 AGSP  1        51   1.96
0101WR 27037231 0.5  03 1 1 AGSP  2        51   6.37
0101WR 27037231 0.5  03 1 1 POSE  1        51   3.85
0101WR 27037231 0.5  03 1 1 POSE  2        51   1.65
0101WR 27037231 0.5  03 1 1 POCU  1        51   4.76
0101WR 27037231 0.5  03 1 1 POCU  2        51   2.31
0101WR 27037231 0.5  03 1 6 ACMI  1        51    .04
0101WR 27037231 0.5  03 1 4 SIAL  1        51    .01
0101WR 27037231 0.5  03 1 4 DEPI  1        51    .01
0101WR 27037231 0.5  03 1 8 ARTR 24        51  18.42
0101WR 27037231 0.5  03 1 6 CRAT  1        51    .86
0101WR 27037231 0.5  03 1 6 LOMA  1        51    .13
0101WR 27037231 0.5  03 1 6 CRAT  2        51    .60
0101WR 27037231 0.5  03 1 8 ARTR 11        51   3.75
0101WR 27037231 0.5  03 1 1 AGSP  5        51  18.15
0101WR 27037231 0.5  03 1 1 POSE  5        51  12.85
0101WR 27037231 0.5  03 1 1 POCU  5        51  53.12
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0101WR	27037231	0.5	04	1	1	AGSP	1	52	1.75
0101WR	27037231	0.5	04	1	1	AGSP	2	52	3.24
0101WR	27037231	0.5	04	1	1	POSE	1	52	.98
0101WR	27037231	0.5	04	1	1	POSE	2	52	.53
0101WR	27037231	0.5	04	1	1	POCU	1	52	2.24
0101WR	27037231	0.5	04	1	1	POCU	2	52	1.46
0101WR	27037231	0.5	04	1	6	CRAT	1	52	1.47
0101WR	27037231	0.5	04	1	6	TOFL	1	52	.87
0101WR	27037231	0.5	04	1	4	DEPI	1	52	.02
0101WR	27037231	0.5	04	1	6	CAMA	1	52	.07
0101WR	27037231	0.5	04	1	6	CRAT	2	52	1.71
0101WR	27037231	0.5	04	1	1	POSE	5	52	2.45
0101WR	27037231	0.5	04	1	1	POCU	5	52	47.80
0101WR	27037231	0.5	05	1	1	AGSP	1	53	.37
0101WR	27037231	0.5	05	1	1	AGSP	2	53	1.77
0101WR	27037231	0.5	05	1	1	POSE	1	53	1.64
0101WR	27037231	0.5	05	1	1	POSE	2	53	1.01
0101WR	27037231	0.5	05	1	1	STTH	1	53	3.18
0101WR	27037231	0.5	05	1	1	STTH	2	53	12.57
0101WR	27037231	0.5	05	1	6	CRAT	1	53	.01
0101WR	27037231	0.5	05	1	6	LOMA	1	53	.09
0101WR	27037231	0.5	05	1	7	ERFI	1	53	.16
0101WR	27037231	0.5	05	1	7	ANDI	1	53	5.24
0101WR	27037231	0.5	05	1	4	DEPI	1	53	.01
0101WR	27037231	0.5	05	1	2	FEOC	1	53	.01
0101WR	27037231	0.5	05	1	4	DRVE	1	53	.03
0101WR	27037231	0.5	05	1	7	ANDI	2	53	4.85
0101WR	27037231	0.5	05	1	1	AGSP	5	53	2.09
0101WR	27037231	0.5	05	1	1	POSE	5	53	9.90
0101WR	27037231	0.5	05	1	1	STTH	5	53	40.65
0101WR	27037231	0.5	06	1	1	AGSP	1	54	1.18
0101WR	27037231	0.5	06	1	1	AGSP	2	54	3.50
0101WR	27037231	0.5	06	1	1	POSE	1	54	2.23
0101WR	27037231	0.5	06	1	1	POSE	2	54	1.60
0101WR	27037231	0.5	06	1	1	STTH	1	54	3.06
0101WR	27037231	0.5	06	1	1	STTH	2	54	11.86
0101WR	27037231	0.5	06	1	2	FEOC	1	54	.01
0101WR	27037231	0.5	06	1	4	DRVE	1	54	.01
0101WR	27037231	0.5	06	1	1	AGSP	5	54	5.70
0101WR	27037231	0.5	06	1	1	POSE	5	54	6.85
0101WR	27037231	0.5	06	1	1	STTH	5	54	56.60
0101WR	27037231	0.5	07	1	1	AGSP	1	55	3.17
0101WR	27037231	0.5	07	1	1	AGSP	2	55	9.00
0101WR	27037231	0.5	07	1	1	POSE	1	55	2.35
0101WR	27037231	0.5	07	1	1	POSE	2	55	.88
0101WR	27037231	0.5	07	1	6	CRAT	1	55	.51
0101WR	27037231	0.5	07	1	6	LOMA	1	55	.01
0101WR	27037231	0.5	07	1	7	ERFI	1	55	.30
0101WR	27037231	0.5	07	1	4	DRVE	1	55	.01
0101WR	27037231	0.5	07	1	2	FEOC	1	55	.01
0101WR	27037231	0.5	07	1	4	DEPI	1	55	.04
0101WR	27037231	0.5	07	1	6	CRAT	2	55	.31
0101WR	27037231	0.5	07	1	1	AGSP	5	55	35.80
0101WR	27037231	0.5	07	1	1	POSE	5	55	18.15

0101WR	27037231	0.5	08	1	1	AGSP	1	56	5.61
0101WR	27037231	0.5	08	1	1	AGSP	2	56	28.03
0101WR	27037231	0.5	08	1	1	POSE	1	56	.81
0101WR	27037231	0.5	08	1	1	POSE	2	56	1.32
0101WR	27037231	0.5	08	1	7	ERFI	1	56	.60
0101WR	27037231	0.5	08	1	7	ANDI	1	56	1.58
0101WR	27037231	0.5	08	1	6	CAMA	1	56	.05
0101WR	27037231	0.5	08	1	2	FEOC	1	56	.01
0101WR	27037231	0.5	08	1	1	STTH	1	56	1.31
0101WR	27037231	0.5	08	1	1	STTH	2	56	4.87
0101WR	27037231	0.5	08	1	4	DEPI	1	56	.01
0101WR	27037231	0.5	08	1	2	BRTE	1	56	.01
0101WR	27037231	0.5	08	1	7	ANDI	2	56	2.33
0101WR	27037231	0.5	08	1	1	AGSP	5	56	39.90
0101WR	27037231	0.5	08	1	1	POSE	5	56	10.65
0101WR	27037231	0.5	08	1	1	STTH	5	56	15.42
0101WR	28037232	0.5	03	1	1	AGSP	1	63	5.68
0101WR	28037232	0.5	03	1	1	AGSP	2	63	6.12
0101WR	28037232	0.5	03	1	1	POSE	7	63	4.72
0101WR	28037232	0.5	03	1	1	POSE	2	63	7.20
0101WR	28037232	0.5	03	1	6	CAMA	1	63	0.50
0101WR	28037232	0.5	03	1	6	CRAT	1	63	3.92
0101WR	28037232	0.5	03	1	1	STTH	1	63	1.10
0101WR	28037232	0.5	03	1	1	STTH	2	63	2.60
0101WR	28037232	0.5	03	1	8	ARTR	24	63	269.90
0101WR	28037232	0.5	03	1	8	ARTR	2	63	238.60
0101WR	28037232	0.5	03	1	8	ARTR	11	63	6.65
0101WR	28037232	0.5	03	1	4	DEPI	1	63	0.01
0101WR	28037232	0.5	03	1	7	PHLO	1	63	2.95
0101WR	28037232	0.5	03	1	6	CRAT	2	63	3.80
0101WR	28037232	0.5	03	1	6	LOMA	1	63	0.01
0101WR	28037232	0.5	03	1	2	FEOC	1	63	0.01
0101WR	28037232	0.5	03	1	1	AGSP	5	63	29.00
0101WR	28037232	0.5	03	1	1	POSE	5	63	45.55
0101WR	28037232	0.5	03	1	1	STTH	5	63	4.40
0101WR	28037232	0.5	04	1	1	AGSP	1	64	12.00
0101WR	28037232	0.5	04	1	1	AGSP	2	64	35.38
0101WR	28037232	0.5	04	1	1	POSE	1	64	3.00
0101WR	28037232	0.5	04	1	1	POSE	2	64	2.07
0101WR	28037232	0.5	04	1	6	CRAT	1	64	.63
0101WR	28037232	0.5	04	1	8	ARTR	24	64	27.89
0101WR	28037232	0.5	04	1	8	ARTR	2	64	40.85
0101WR	28037232	0.5	04	1	8	ARTR	11	64	3.59
0101WR	28037232	0.5	04	1	6	CRAT	2	64	.25
0101WR	28037232	0.5	04	1	1	AGSP	5	64	97.95
0101WR	28037232	0.5	04	1	1	POSE	5	64	48.00

0101WR	27037232	0.5	05	1	1	AGSP	1	65	.54
0101WR	27037232	0.5	05	1	1	AGSP	2	65	3.58
0101WR	27037232	0.5	05	1	1	POSE	1	65	2.19
0101WR	27037232	0.5	05	1	1	POSE	2	65	3.19
0101WR	27037232	0.5	05	1	6	CALU	1	65	.12
0101WR	27037232	0.5	05	1	6	CRAT	1	65	.09
0101WR	27037232	0.5	05	1	2	FEOC	1	65	.01
0101WR	27037232	0.5	05	1	4	DEPI	1	65	.01
0101WR	27037232	0.5	05	1	8	ARTR	2	65	150.00
0101WR	27037232	0.5	05	1	6	LOMA	1	65	.05
0101WR	27037232	0.5	05	1	1	AGSP	5	65	2.25
0101WR	27037232	0.5	05	1	1	POSE	5	65	27.41
0101WR	27037232	0.5	06	1	1	AGSP	1	66	8.91
0101WR	27037232	0.5	06	1	1	AGSP	2	66	63.07
0101WR	27037232	0.5	06	1	1	POSE	1	66	2.83
0101WR	27037232	0.5	06	1	1	POSE	2	66	3.22
0101WR	27037232	0.5	06	1	8	ARTR	24	66	123.24
0101WR	27037232	0.5	06	1	6	LOMA	1	66	.14
0101WR	27037232	0.5	06	1	8	ARTR	2	66	19.05
0101WR	27037232	0.5	06	1	1	AGSP	5	66	71.70
0101WR	27037232	0.5	06	1	1	POSE	5	66	47.10
0101WR	27037232	0.5	07	1	1	AGSP	1	67	3.14
0101WR	27037232	0.5	07	1	1	AGSP	2	67	10.78
0101WR	27037232	0.5	07	1	1	POSE	1	67	2.19
0101WR	27037232	0.5	07	1	1	POSE	2	67	.93
0101WR	27037232	0.5	07	1	8	ARTR	2	67	9.50
0101WR	27037232	0.5	07	1	6	CRAT	1	67	.26
0101WR	27037232	0.5	07	1	7	ERFI	1	67	.29
0101WR	27037232	0.5	07	1	2	FEOC	1	67	.01
0101WR	27037232	0.5	07	1	6	LOMA	1	67	.04
0101WR	27037232	0.5	07	1	6	CAMA	1	67	.10
0101WR	27037232	0.5	07	1	1	AGSP	5	67	12.01
0101WR	27037232	0.5	07	1	1	POSE	5	67	15.20
0101WR	27037231	0.5	09	1	1	AGSP	1	57	3.88
0101WR	27037231	0.5	09	1	1	AGSP	2	57	5.93
0101WR	27037231	0.5	09	1	1	POSE	1	57	3.89
0101WR	27037231	0.5	09	1	1	POSE	2	57	2.51
0101WR	27037231	0.5	09	1	1	POCU	1	57	1.51
0101WR	27037231	0.5	09	1	1	POCU	2	57	.51
0101WR	27037231	0.5	09	1	6	CRAT	1	57	1.23
0101WR	27037231	0.5	09	1	6	LOMA	1	57	.11
0101WR	27037231	0.5	09	1	2	FEOC	1	57	.01
0101WR	27037231	0.5	09	1	6	CRAT	2	57	.68
0101WR	27037231	0.5	09	1	8	ARTR	2	57	36.70
0101WR	27037231	0.5	09	1	1	AGSP	5	57	22.82
0101WR	27037231	0.5	09	1	1	POSE	5	57	9.38
0101WR	27037231	0.5	09	1	1	POCU	5	57	50.85
0101WR	27037231	0.5	10	1	1	POSE	1	58	2.37
0101WR	27037231	0.5	10	1	1	POSE	2	58	2.28
0101WR	27037231	0.5	10	1	7	ANDI	1	58	8.19
0101WR	27037231	0.5	10	1	6	CRAT	1	58	.41
0101WR	27037231	0.5	10	1	8	ARTR	2	58	123.10
0101WR	27037231	0.5	10	1	1	POCU	1	58	1.11
0101WR	27037231	0.5	10	1	1	POCU	2	58	.06
0101WR	27037231	0.5	10	1	4	DEPI	1	58	.01
0101WR	27037231	0.5	10	1	1	POSE	5	58	20.30

0101WR	27037231	0.5	11	1	1	AGSP	1	59	1.63
0101WR	27037231	0.5	11	1	1	AGSP	2	59	3.73
0101WR	27037231	0.5	11	1	1	POSE	1	59	4.84
0101WR	27037231	0.5	11	1	1	POSE	2	59	1.83
0101WR	27037231	0.5	11	1	8	ARTR	2	59	1.70
0101WR	27037231	0.5	11	1	6	CRAT	2	59	.75
0101WR	27037231	0.5	11	1	6	LOMA	1	59	.06
0101WR	27037231	0.5	11	1	6	CAMA	1	59	.02
0101WR	27037231	0.5	11	1	4	DEPI	1	59	.01
0101WR	27037231	0.5	11	1	6	CRAT	1	59	2.05
0101WR	27037231	0.5	11	1	1	AGSP	5	59	6.70
0101WR	27037231	0.5	11	1	1	POSE	5	59	33.35
0101WR	27037231	0.5	12	1	1	AGSP	1	60	7.57
0101WR	27037231	0.5	12	1	1	AGSP	2	60	23.06
0101WR	27037231	0.5	12	1	1	POSE	1	60	3.05
0101WR	27037231	0.5	12	1	1	POSE	2	60	1.95
0101WR	27037231	0.5	12	1	6	CRAT	1	60	.15
0101WR	27037231	0.5	12	1	6	CAMA	1	60	.14
0101WR	27037231	0.5	12	1	7	ERFI	1	60	.02
0101WR	27037231	0.5	12	1	7	PHLO	1	60	.37
0101WR	27037231	0.5	12	1	4	DEPI	1	60	.01
0101WR	27037231	0.5	12	1	6	LOMA	1	60	.01
0101WR	27037231	0.5	12	1	1	AGSP	5	60	42.70
0101WR	27037231	0.5	12	1	1	POSE	5	60	34.80
0101WR	27037232	0.5	01	1	1	AGSP	1	61	4.22
0101WR	27037232	0.5	01	1	1	AGSP	2	61	64.06
0101WR	27037232	0.5	01	1	1	POSE	1	61	2.83
0101WR	27037232	0.5	01	1	1	POSE	2	61	1.09
0101WR	27037232	0.5	01	1	7	ANDI	1	61	4.79
0101WR	27037232	0.5	01	1	6	LOMA	1	61	.10
0101WR	27037232	0.5	01	1	6	CRAT	1	61	.02
0101WR	27037232	0.5	01	1	1	AGSP	5	61	21.85
0101WR	27037232	0.5	01	1	1	POSE	5	61	30.74
0101WR	27037232	0.5	02	1	1	AGSP	1	62	4.35
0101WR	27037232	0.5	02	1	1	AGSP	2	62	16.91
0101WR	27037232	0.5	02	1	1	POSE	1	62	2.95
0101WR	27037232	0.5	02	1	1	POSE	2	62	2.88
0101WR	27037232	0.5	02	1	2	BRTE	1	62	.01
0101WR	27037232	0.5	02	1	6	LOMA	1	62	.21
0101WR	27037232	0.5	02	1	2	FEOC	1	62	.01
0101WR	27037232	0.5	02	1	4	DEPI	1	62	.01
0101WR	27037232	0.5	02	1	6	CRAT	1	62	.04
0101WR	27037232	0.5	02	1	1	AGSP	5	62	34.90
0101WR	27037232	0.5	02	1	1	POSE	5	62	30.45

0101WR	29037211	0.5	02	1	1	AGSP	1	74	2.61
0101WR	29037211	0.5	02	1	1	AGSP	2	74	12.97
0101WR	29037211	0.5	02	1	1	POSE	1	74	1.49
0101WR	29037211	0.5	02	1	1	POSE	2	74	1.03
0101WR	29037211	0.5	02	1	7	ERFI	1	74	1.39
0101WR	29037211	0.5	02	1	6	CRAT	1	74	1.32
0101WR	29037211	0.5	02	1	7	ANDI	1	74	5.13
0101WR	29037211	0.5	02	1	4	DRVE	1	74	.01
0101WR	29037211	0.5	02	1	2	FEOC	1	74	.01
0101WR	29037211	0.5	02	1	6	ACLA	1	74	.07
0101WR	29037211	0.5	02	1	6	CRAT	2	74	3.62
0101WR	29037211	0.5	02	1	7	ERFI	2	74	.88
0101WR	29037211	0.5	02	1	1	AGSP	5	74	25.30
0101WR	29037211	0.5	02	1	1	POSE	5	74	5.40
0101WR	29037211	0.5	03	1	1	AGSP	1	75	4.53
0101WR	29037211	0.5	03	1	1	AGSP	2	75	20.83
0101WR	29037211	0.5	03	1	1	POSE	1	75	.40
0101WR	29037211	0.5	03	1	1	POSE	2	75	2.87
0101WR	29037211	0.5	03	1	6	LOMA	1	75	.24
0101WR	29037211	0.5	03	1	7	ANDI	1	75	.91
0101WR	29037211	0.5	03	1	2	FEOC	1	75	.01
0101WR	29037211	0.5	03	1	1	AGSP	5	75	22.12
0101WR	29037211	0.5	03	1	1	POSE	5	75	1.80
0101WR	29037211	0.5	04	1	1	AGSP	1	76	5.42
0101WR	29037211	0.5	04	1	1	AGSP	2	76	12.83
0101WR	29037211	0.5	04	1	1	POSE	1	76	1.44
0101WR	29037211	0.5	04	1	1	POSE	2	76	1.13
0101WR	29037211	0.5	04	1	6	LOMA	1	76	.13
0101WR	29037211	0.5	04	1	4	DEPI	1	76	.01
0101WR	29037211	0.5	04	1	6	ACLA	1	76	.01
0101WR	29037211	0.5	04	1	2	BRTE	1	76	.01
0101WR	29037211	0.5	04	1	6	CAMA	1	76	.02
0101WR	29037211	0.5	04	1	1	AGSP	5	76	30.58
0101WR	29037211	0.5	04	1	1	POSE	5	76	19.20
0101WR	29037211	0.5	05	1	1	AGSP	1	77	1.86
0101WR	29037211	0.5	05	1	1	AGSP	2	77	13.43
0101WR	29037211	0.5	05	1	1	POSE	1	77	2.82
0101WR	29037211	0.5	05	1	1	POSE	2	77	3.35
0101WR	29037211	0.5	05	1	6	CAMA	1	77	.04
0101WR	29037211	0.5	05	1	8	ARTR	24	77	5.79
0101WR	29037211	0.5	05	1	8	ARTR	11	77	1.65
0101WR	29037211	0.5	05	1	1	AGSP	5	77	34.15
0101WR	29037211	0.5	05	1	1	POSE	5	77	13.11
0101WR	29037211	0.5	06	1	1	AGSP	1	78	4.19
0101WR	29037211	0.5	06	1	1	AGSP	2	78	27.60
0101WR	29037211	0.5	06	1	1	POSE	1	78	2.49
0101WR	29037211	0.5	06	1	1	POSE	2	78	1.95
0101WR	29037211	0.5	06	1	6	LULA	1	78	.77
0101WR	29037211	0.5	06	1	6	CRAT	1	78	.07
0101WR	29037211	0.5	06	1	6	LULA	2	78	.25
0101WR	29037211	0.5	06	1	1	AGSP	5	78	49.65
0101WR	29037211	0.5	06	1	1	POSE	5	78	15.50

0101WR	28037211	0.5	07	1	1	AGSP	1	79	13.99
0101WR	28037211	0.5	07	1	1	AGSP	2	79	63.79
0101WR	28037211	0.5	07	1	1	POSE	1	79	3.68
0101WR	28037211	0.5	07	1	1	POSE	2	79	1.60
0101WR	28037211	0.5	07	1	6	CAMA	1	79	.05
0101WR	28037211	0.5	07	1	4	DRVE	1	79	.01
0101WR	28037211	0.5	07	1	7	ERFI	1	79	.27
0101WR	28037211	0.5	07	1	1	AGSP	5	79	76.05
0101WR	28037211	0.5	07	1	1	POSE	5	79	17.82
0101WR	27037232	0.5	08	1	1	AGSP	1	68	1.04
0101WR	27037232	0.5	08	1	1	AGSP	2	68	1.50
0101WR	27037232	0.5	08	1	1	POSE	1	68	2.91
0101WR	27037232	0.5	08	1	1	POSE	2	68	.81
0101WR	27037232	0.5	08	1	7	ERFI	1	68	1.64
0101WR	27037232	0.5	08	1	6	LOMA	1	68	.14
0101WR	27037232	0.5	08	1	1	POCU	1	68	3.06
0101WR	27037232	0.5	08	1	1	POCU	2	68	1.57
0101WR	27037232	0.5	08	1	2	FEOC	1	68	.01
0101WR	27037232	0.5	08	1	1	AGSP	5	68	2.90
0101WR	27037232	0.5	08	1	1	POSE	5	68	49.10
0101WR	27037232	0.5	08	1	1	POCU	5	68	61.05
0101WR	27037232	0.5	09	1	1	AGSP	1	69	1.86
0101WR	27037232	0.5	09	1	1	AGSP	2	69	8.59
0101WR	27037232	0.5	09	1	1	POSE	1	69	3.06
0101WR	27037232	0.5	09	1	1	POSE	2	69	.59
0101WR	27037232	0.5	09	1	7	ERFI	1	69	1.11
0101WR	27037232	0.5	09	1	1	AGSP	5	69	8.15
0101WR	27037232	0.5	09	1	1	POSE	5	69	18.30
0101WR	27037232	0.5	10	1	1	AGSP	1	70	5.67
0101WR	27037232	0.5	10	1	1	AGSP	2	70	58.55
0101WR	27037232	0.5	10	1	1	POSE	1	70	.46
0101WR	27037232	0.5	10	1	1	POSE	2	70	.14
0101WR	27037232	0.5	10	1	7	ERFI	1	70	1.16
0101WR	27037232	0.5	10	1	6	LOMA	1	70	.15
0101WR	27037232	0.5	10	1	4	DEPI	1	70	.01
0101WR	27037232	0.5	10	1	4	DRVE	1	70	.01
0101WR	27037232	0.5	10	1	2	FEOC	1	70	.01
0101WR	27037232	0.5	10	1	6	CRAT	1	70	.04
0101WR	27037232	0.5	10	1	1	AGSP	5	70	24.62
0101WR	27037232	0.5	10	1	1	POSE	5	70	8.12
0101WR	28037232	0.5	11	1	1	AGSP	1	71	4.77
0101WR	28037232	0.5	11	1	1	AGSP	2	71	18.29
0101WR	28037232	0.5	11	1	1	POSE	1	71	6.49
0101WR	28037232	0.5	11	1	1	POSE	2	71	3.90
0101WR	28037232	0.5	11	1	4	DEPI	1	71	.02
0101WR	28037232	0.5	11	1	6	CRAT	1	71	.27
0101WR	28037232	0.5	11	1	6	CAMA	1	71	.08
0101WR	28037232	0.5	11	1	4	DRVE	1	71	.01
0101WR	28037232	0.5	11	1	7	ERFI	1	71	.08
0101WR	28037232	0.5	11	1	1	AGSP	5	71	33.55
0101WR	28037232	0.5	11	1	1	POSE	5	71	55.22

0101WR	28037211	0.5	08	1	1	AGSP	1	80	1.95
0101WR	28037211	0.5	08	1	1	AGSP	2	80	6.08
0101WR	28037211	0.5	08	1	1	STTH	1	80	.76
0101WR	28037211	0.5	08	1	1	STTH	2	80	2.22
0101WR	28037211	0.5	08	1	1	POSE	1	80	2.68
0101WR	28037211	0.5	08	1	1	POSE	2	80	3.16
0101WR	28037211	0.5	08	1	6	CAMA	1	80	.09
0101WR	28037211	0.5	08	1	7	ERFI	1	80	.30
0101WR	28037211	0.5	08	1	4	DEPI	1	80	.01
0101WR	28037211	0.5	08	1	6	LOMA	1	80	.02
0101WR	28037211	0.5	08	1	1	POCU	1	80	4.11
0101WR	28037211	0.5	08	1	1	POCU	2	80	5.06
0101WR	28037211	0.5	08	1	8	ARTR	2	80	174.70
0101WR	28037211	0.5	08	1	1	AGSP	5	80	20.01
0101WR	28037211	0.5	08	1	1	POSE	5	80	38.62
0101WR	28037211	0.5	08	1	1	POCU	5	80	53.40
0101WR	28037211	0.5	09	1	1	AGSP	1	81	3.77
0101WR	28037211	0.5	09	1	1	AGSP	2	81	25.77
0101WR	28037211	0.5	09	1	1	POSE	1	81	4.70
0101WR	28037211	0.5	09	1	1	POSE	2	81	5.74
0101WR	28037211	0.5	09	1	7	PHLO	1	81	.12
0101WR	28037211	0.5	09	1	7	ERFI	1	81	.20
0101WR	28037211	0.5	09	1	8	ARTR	24	81	19.82
0101WR	28037211	0.5	09	1	8	ARTR	2	81	107.10
0101WR	28037211	0.5	09	1	8	ARTR	11	81	1.30
0101WR	28037211	0.5	09	1	7	ANDI	1	81	.83
0101WR	28037211	0.5	09	1	1	AGSP	5	81	17.40
0101WR	28037211	0.5	09	1	1	POSE	5	81	29.00
0101WR	28037211	0.5	10	1	1	AGSP	1	82	10.47
0101WR	28037211	0.5	10	1	1	AGSP	2	82	64.72
0101WR	28037211	0.5	10	1	1	POSE	1	82	1.56
0101WR	28037211	0.5	10	1	1	POSE	2	82	.94
0101WR	28037211	0.5	10	1	7	ANDI	1	82	.40
0101WR	28037211	0.5	10	1	6	LOMA	1	82	.00
0101WR	28037211	0.5	10	1	6	CRAT	1	82	.26
0101WR	28037211	0.5	10	1	6	CAMA	1	82	.10
0101WR	28037211	0.5	10	1	7	ERFI	1	82	1.24
0101WR	28037211	0.5	10	1	1	POCU	1	82	.89
0101WR	28037211	0.5	10	1	1	POCU	2	82	.26
0101WR	28037211	0.5	10	1	4	DRVE	1	82	.22
0101WR	28037211	0.5	10	1	1	AGSP	5	82	52.90
0101WR	28037211	0.5	10	1	1	POSE	5	82	12.55
0101WR	28037211	0.5	10	1	1	POCU	5	82	0.80
0101WR	28037211	0.5	11	1	1	AGSP	1	83	7.58
0101WR	28037211	0.5	11	1	1	AGSP	2	83	32.06
0101WR	28037211	0.5	11	1	1	POSE	1	83	5.12
0101WR	28037211	0.5	11	1	1	POSE	2	83	4.63
0101WR	28037211	0.5	11	1	8	ARTR	2	83	26.80
0101WR	28037211	0.5	11	1	7	ERFI	1	83	1.12
0101WR	28037211	0.5	11	1	6	LOMA	1	83	.02
0101WR	28037211	0.5	11	1	1	AGSP	5	83	28.85
0101WR	28037211	0.5	11	1	1	POSE	5	83	36.45

0101WR	28037211	0.5	12	1	1	AGSP	1	84	4.87
0101WR	28037211	0.5	12	1	1	AGSP	2	84	26.08
0101WR	28037211	0.5	12	1	1	POSE	1	84	3.48
0101WR	28037211	0.5	12	1	1	POSE	2	84	5.26
0101WR	28037211	0.5	12	1	8	ARTR	2	84	246.90
0101WR	28037211	0.5	12	1	7	ERFI	1	84	.48
0101WR	28037211	0.5	12	1	7	ERFI	2	84	.16
0101WR	28037211	0.5	12	1	1	AGSP	5	84	26.20
0101WR	28037211	0.5	12	1	1	POSE	1	84	36.40
0101WR	28037232	0.5	12	1	1	AGSP	1	72	6.12
0101WR	28037232	0.5	12	1	1	AGSP	2	72	19.72
0101WR	28037232	0.5	12	1	1	POSE	1	72	4.02
0101WR	28037232	0.5	12	1	1	POSE	2	72	2.55
0101WR	28037232	0.5	12	1	6	CRAT	1	72	0.05
0101WR	28037232	0.5	12	1	6	LULA	1	72	.18
0101WR	28037232	0.5	12	1	6	CAMA	1	72	.08
0101WR	28037232	0.5	12	1	7	ERFI	1	72	.48
0101WR	28037232	0.5	12	1	7	ANDI	1	72	.82
0101WR	28037232	0.5	12	1	6	LOMA	1	72	.02
0101WR	28037232	0.5	12	1	6	TOFL	1	72	.31
0101WR	28037232	0.5	12	1	1	AGSP	5	72	78.80
0101WR	28037232	0.5	12	1	1	POSE	5	72	64.20
0101WR	29037211	0.5	01	1	1	AGSP	1	73	8.74
0101WR	29037211	0.5	01	1	1	AGSP	2	73	35.47
0101WR	29037211	0.5	01	1	1	POSE	1	73	3.08
0101WR	29037211	0.5	01	1	1	POSE	2	73	3.60
0101WR	29037211	0.5	01	1	6	LOMA	1	73	.01
0101WR	29037211	0.5	01	1	6	ACLA	1	73	.01
0101WR	29037211	0.5	01	1	4	DEPI	1	73	.01
0101WR	29037211	0.5	01	1	7	ERFI	1	73	.16
0101WR	29037211	0.5	01	1	6	CAMA	1	73	.28
0101WR	29037211	0.5	01	1	1	AGSP	5	73	66.90
0101WR	29037211	0.5	01	1	1	POSE	5	73	27.65
0101WR	28037212	0.5	01	1	1	AGSP	1	85	19.22
0101WR	28037212	0.5	01	1	1	AGSP	2	85	131.30
0101WR	28037212	0.5	01	1	1	POSE	1	85	4.11
0101WR	28037212	0.5	01	1	1	POSE	2	85	2.60
0101WR	28037212	0.5	01	1	6	CRAT	1	85	.26
0101WR	28037212	0.5	01	1	6	CAMA	1	85	0.15
0101WR	28037212	0.5	01	1	4	DRVE	1	85	.17
0101WR	28037212	0.5	01	1	1	AGSP	5	85	134.30
0101WR	28037212	0.5	01	1	1	POSE	5	85	48.98
0101WR	28037212	0.5	02	1	1	AGSP	1	86	7.90
0101WR	28037212	0.5	02	1	1	AGSP	2	86	89.70
0101WR	28037212	0.5	02	1	1	POSE	1	86	2.45
0101WR	28037212	0.5	02	1	1	POSE	2	86	2.40
0101WR	28037212	0.5	02	1	2	FEOC	1	86	.01
0101WR	28037212	0.5	02	1	7	ERFI	1	86	3.00
0101WR	28037212	0.5	02	1	4	DRVE	1	86	.19
0101WR	28037212	0.5	02	1	1	AGSP	5	86	62.12
0101WR	28037212	0.5	02	1	1	POSE	5	86	8.90

0101WR	28037212	0.5	03	1	1	AGSP	1	87	4.75
0101WR	28037212	0.5	03	1	1	AGSP	2	87	24.30
0101WR	28037212	0.5	03	1	1	POSE	1	87	2.55
0101WR	28037212	0.5	03	1	1	POSE	2	87	1.32
0101WR	28037212	0.5	03	1	7	ERFI	1	87	0.55
0101WR	28037212	0.5	03	1	4	DRVE	1	87	.01
0101WR	28037212	0.5	03	1	2	FEOC	1	87	0.01
0101WR	28037212	0.5	03	1	6	LOMA	1	87	0.10
0101WR	28037212	0.5	03	1	1	AGSP	5	87	17.20
0101WR	28037212	0.5	03	1	1	POSE	5	87	25.90
0101WR	28037212	0.5	04	1	1	AGSP	1	88	6.60
0101WR	28037212	0.5	04	1	1	AGSP	2	88	28.02
0101WR	28037212	0.5	04	1	1	POSE	1	88	1.68
0101WR	28037212	0.5	04	1	1	POSE	2	88	.86
0101WR	28037212	0.5	04	1	7	ERFI	1	88	1.26
0101WR	28037212	0.5	04	1	6	LOMA	1	88	.21
0101WR	28037212	0.5	04	1	7	ANDI	1	88	.96
0101WR	28037212	0.5	04	1	2	FEOC	1	88	0.01
0101WR	28037212	0.5	04	1	4	DRVE	1	88	0.01
0101WR	28037212	0.5	04	1	1	AGSP	5	88	64.85
0101WR	28037212	0.5	04	1	1	POSE	5	88	6.80
0101WR	28037212	0.5	05	1	1	POCU	1	89	15.29
0101WR	28037212	0.5	05	1	1	POCU	2	89	25.69
0101WR	28037212	0.5	05	1	1	POSE	1	89	3.27
0101WR	28037212	0.5	05	1	1	POSE	2	89	1.80
0101WR	28037212	0.5	05	1	7	PHLO	1	89	2.70
0101WR	28037212	0.5	05	1	1	AGSP	1	89	1.01
0101WR	28037212	0.5	05	1	1	AGSP	2	89	2.09
0101WR	28037212	0.5	05	1	1	POCU	5	89	50.95
0101WR	28037212	0.5	05	1	1	POSE	5	89	40.30
0101WR	28037212	0.5	05	1	1	AGSP	5	89	7.78
0101WR	28037212	0.5	06	1	1	AGSP	1	90	4.88
0101WR	28037212	0.5	06	1	1	AGSP	2	90	26.13
0101WR	28037212	0.5	06	1	1	POSE	1	90	2.95
0101WR	28037212	0.5	06	1	1	POSE	2	90	2.58
0101WR	28037212	0.5	06	1	7	ERFI	1	90	3.62
0101WR	28037212	0.5	06	1	8	ARTR	24	90	20.09
0101WR	28037212	0.5	06	1	8	ARTR	2	90	12.90
0101WR	28037212	0.5	06	1	7	PHLO	1	90	.50
0101WR	28037212	0.5	06	1	1	STTH	1	90	.26
0101WR	28037212	0.5	06	1	6	LOMA	1	90	.25
0101WR	28037212	0.5	06	1	8	ARTR	11	90	9.19
0101WR	28037212	0.5	06	1	1	AGSP	5	90	25.55
0101WR	28037212	0.5	06	1	1	POSE	1	90	16.48
0101WR	28037212	0.5	07	1	1	AGSP	1	91	10.88
0101WR	28037212	0.5	07	1	1	AGSP	2	91	51.69
0101WR	28037212	0.5	07	1	1	POSE	1	91	2.51
0101WR	28037212	0.5	07	1	1	POSE	1	91	3.47
0101WR	28037212	0.5	07	1	7	PHLO	1	91	7.22
0101WR	28037212	0.5	07	1	7	ERFI	1	91	.35
0101WR	28037212	0.5	07	1	6	LOMA	1	91	.26
0101WR	28037212	0.5	07	1	4	DRVE	1	91	.01
0101WR	28037212	0.5	07	1	7	PHLO	2	91	17.79
0101WR	28037212	0.5	07	1	1	AGSP	5	91	44.00
0101WR	28037212	0.5	07	1	1	POSE	5	91	28.85

0101WR	28037212	0.5	08	1	1	AGSP	1	92	2.38
0101WR	28037212	0.5	08	1	1	AGSP	2	92	7.64
0101WR	28037212	0.5	08	1	1	POCU	1	92	6.53
0101WR	28037212	0.5	08	1	1	POCU	2	92	5.01
0101WR	28037212	0.5	08	1	1	POSE	1	92	4.05
0101WR	28037212	0.5	08	1	1	POSE	2	92	4.36
0101WR	28037212	0.5	08	1	7	PHLO	1	92	.66
0101WR	28037212	0.5	08	1	6	LOMA	1	92	.52
0101WR	28037212	0.5	08	1	7	ERFI	1	92	.42
0101WR	28037212	0.5	08	1	8	ARTR	2	92	215.00
0101WR	28037212	0.5	08	1	6	ASPU	1	92	.17
0101WR	28037212	0.5	08	1	1	AGSP	5	92	39.70
0101WR	28037212	0.5	08	1	1	POCU	5	92	102.50
0101WR	28037212	0.5	08	1	1	POSE	5	92	50.90
0101WR	28037212	0.5	09	1	1	AGSP	1	93	7.30
0101WR	28037212	0.5	09	1	1	AGSP	2	93	10.60
0101WR	28037212	0.5	09	1	1	POSE	1	93	4.38
0101WR	28037212	0.5	09	1	1	POSE	2	93	3.28
0101WR	28037212	0.5	09	1	6	LOMA	1	93	0.06
0101WR	28037212	0.5	09	1	7	PHLO	1	93	0.92
0101WR	28037212	0.5	09	1	4	DRVE	1	93	.01
0101WR	28037212	0.5	09	1	1	AGSP	5	93	40.40
0101WR	28037212	0.5	09	1	1	POSE	5	93	40.02
0101WR	28037212	0.5	10	1	8	ARTR	2	94	115.40
0101WR	28037212	0.5	10	1	1	AGSP	1	94	6.34
0101WR	28037212	0.5	10	1	1	AGSP	2	94	57.30
0101WR	28037212	0.5	10	1	1	POSE	1	94	7.80
0101WR	28037212	0.5	10	1	1	POSE	2	94	3.70
0101WR	28037212	0.5	10	1	6	LULA	1	94	.57
0101WR	28037212	0.5	10	1	6	LOMA	1	94	.34
0101WR	28037212	0.5	10	1	6	CRAT	1	94	.11
0101WR	28037212	0.5	10	1	1	AGSP	5	94	38.58
0101WR	28037212	0.5	10	1	1	POSE	5	94	63.90
0101WR	28037212	0.5	11	1	1	POSE	1	95	3.96
0101WR	28037212	0.5	11	1	1	POSE	2	95	2.58
0101WR	28037212	0.5	11	1	7	ERFI	1	95	.41
0101WR	28037212	0.5	11	1	4	LOMA	1	95	.00
0101WR	28037212	0.5	11	1	6	CAMA	1	95	.01
0101WR	28037212	0.5	11	1	1	POCU	1	95	9.67
0101WR	28037212	0.5	11	1	1	POCU	2	95	32.23
0101WR	28037212	0.5	11	1	4	DRVE	1	95	.01
0101WR	28037212	0.5	11	1	7	ANDI	1	95	.01
0101WR	28037212	0.5	11	1	1	POSE	5	95	39.30
0101WR	28037212	0.5	11	1	1	POCU	5	95	86.10
0101WR	28037212	0.5	12	1	1	AGSP	1	96	1.30
0101WR	28037212	0.5	12	1	1	AGSP	2	96	3.90
0101WR	28037212	0.5	12	1	1	POSE	1	96	4.07
0101WR	28037212	0.5	12	1	1	POSE	2	96	3.78
0101WR	28037212	0.5	12	1	6	LOMA	1	96	.09
0101WR	28037212	0.5	12	1	4	DRVE	1	96	.01
0101WR	28037212	0.5	12	1	1	AGSP	5	96	21.53
0101WR	28037212	0.5	12	1	1	POSE	5	96	87.65