Trend Study 16B-2-07

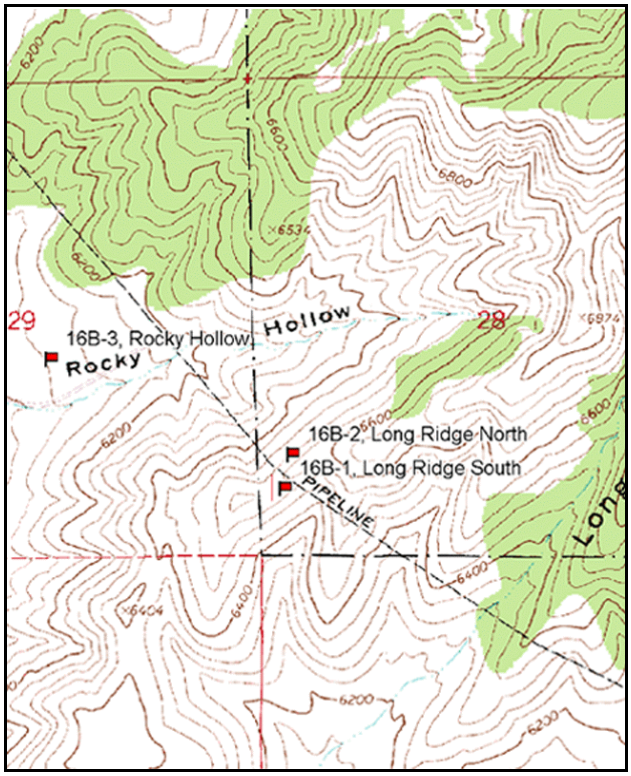
Study site name: Long Ridge North . Vegetation type: Big Sagebrush-Grass .

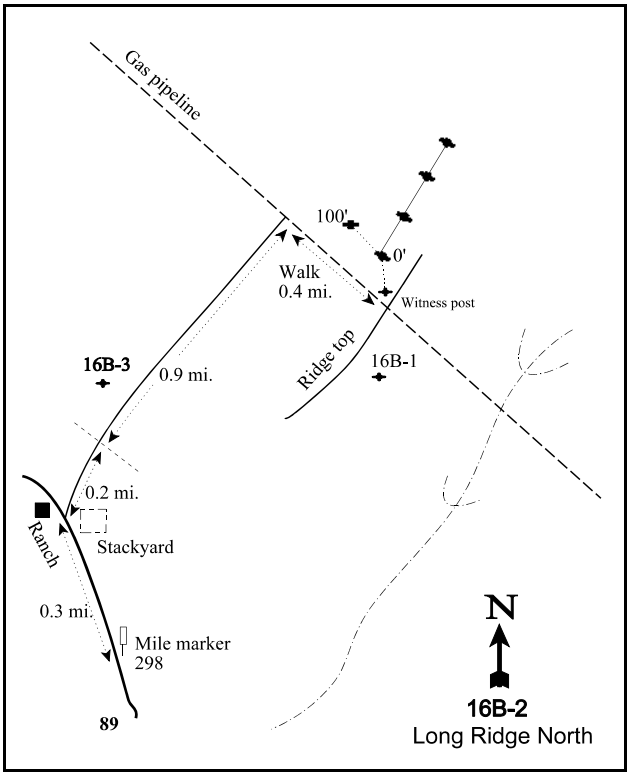
Compass bearing: frequency baseline 310 degrees magnetic (line 2 @ 440°M).

Frequency belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 1 on 2 ft, belt 5 on 10 ft, and belt 3 on 1 ft.

LOCATION DESCRIPTION

Go north from Fairview on U.S. 89 for approximately 15 miles to a ranch house and stackyard (0.3 miles north of mile marker 298). Turn right and go through a DWR gate into Lassen Draw property. Go 0.2 miles to another gate/fence. Continue up the road, past transect 16B-3, for about 0.9 miles to a pipeline intersection at the upper end of the valley. Walk 0.4 miles up the steep hill following the pipeline to the top of the first ridge. Stop here at an intersection/witness post. From the witness post, walk 21 paces at 5 degrees magnetic to the 0-foot baseline stake, marked by browse tag #173.





Map Name: Indianola

Diagrammatic Sketch

Township 11S , Range 4E , Section 28

GPS: NAD 83, UTM 12S 458241 E 4408965 N

DISCUSSION

Long Ridge North - Trend Study No. 16B-2

Study Information

This study is on the opposite side of the ridge from Long Ridge South (16B-1) and is on Division of Wildlife Resources land [elevation: 6,500 feet (1,980 m), slope: 25%-35%, aspect: northwest]. The vegetation is characterized as sagebrush/grass type with a few scattered serviceberry. This slope is designated as key big game winter range. Thistle Creek is located about 1.5 miles (2.4 km) to the west. An underground natural gas pipeline runs between this study and Long Ridge South. Both deer and elk use this study, and deer were observed in the area during the 1997 sampling. From the pellet group transect, deer use was estimated at 80 days use/acre (197 ddu/ha) in 2002 and 35 days use/acre (86 ddu/ha) in 2007. Elk use was estimated at 9 days use/acre (23 edu/ha) in 2002 and 19 days use/acre (46 edu/ha) in 2007.

Soil

The soil is similar to those on the nearby Long Ridge South study. Rock and pavement are common on the surface and throughout the profile. The parent material is a mixture of igneous rock and sandstone. Texture is sandy clay loam and pH is neutral (6.9). Organic matter is moderate at 2.8%. There are some microterraces and pedestals present, suggesting that soil movement has occurred. The erosion condition was classified as slight in 2002 and 2007.

Browse

The north side of the ridge supports the same key browse species that are found at Long Ridge South. Utah serviceberry *(Amelanchier utahensis)* and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are the most common while a small number of antelope bitterbrush (*Purshia tridentata*) seedlings were sampled in 1997 and 2007. The estimated Utah serviceberry density decreased from 666 plants/acre (1,650 plants/ha) in 1989 to 520 plants/acre (1,287 plants/ha) in 1997. In 2002 and 2007, the density was estimated at approximately 400 plants/acre (990 plants/ha). Serviceberry is a small component of the browse community, providing less than 1% of the canopy cover in 2007. Even though seedlings have not been sampled, the population has had good recruitment; young plants have comprised between 24% and 40% of the population. Decadent plants have decreased from 70% of the population in 1989 to 0% in 2007. Concurrently, plants exhibiting poor vigor have decreased from 50% to 0% of the population. The decreases in decadency and poor vigor have occurred along with an increase in moderate-heavy browse use and suggest that some factor other than browsing is causing the decline in density. Mature plants are relatively small averaging only 16 inches in height. Annual leader growth averaged 2.4 inches (6.1 cm) on serviceberry in 2002 and 2.9 inches (7.4 cm) in 2007.

Mountain big sagebrush is much more abundant on this study than on Long Ridge South. In 1989, sagebrush density was estimated at 4,665 plants/acre (11,545 plants/ha). Since 1997, the density has increased from 2,220 plants/acre (5,495 plants/ha) to 2,480 plants/acre (6,138 plants/ha) in 2002, and decreased to 2,100 plants/acre (5,200 plants/ha) in 2007. The decrease in density in 1997 and subsequent years likely resulted from the increased sample area. Decadence declined from a high of 70% of the population in 1989 to 31% in 2002, and increased to 44% in 2007. Recruitment of young plants was poor in both 1989 and 1997, but improved to approximately 10% of the population in 2002 and 2007. Poor vigor was estimated at 18% or less of the population in all years, despite moderate-heavy use. However, since 1997, all plants with poor vigor were classified as dying. Average annual growth on sagebrush grew from 1.9 inches (4.8 cm) in 2002 to 2.1 inches (5.3 cm) in 2007.

Herbaceous Understory

The understory is diverse and is dominated by perennial grasses. Bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass (*Poa secunda*), and muttongrass (*Poa fendleriana*) are the most abundant

species. Despite drought conditions in 2002 (Utah Climate Summaries 2007), bluebunch wheatgrass remained stable. However, Sandberg bluegrass and muttongrass significantly declined in nested frequency and then rebounded in 2007. Use on perennial grasses has been light each sample year. Cheatgrass (*Bromus tectorum*), although present, has accounted for less than 1% of the total ground cover.

Forb diversity is high and several preferred species are present. The most abundant species are longstalk springparsley (*Cymopterus longipes*), silvery lupine (*Lupinus argenteus*), and the annual forb, pale alyssum (*Alyssum alyssoides*). The drought in 2002 is suspected to be the cause of a large decline in total forb abundance. Sum of nested frequency for total forbs decreased by 45% between 1997 and 2002. Bur buttercup (*Ranunculus testiculatus*) quadrat frequency has steadily increased since 1997 and may have a negative impact on germination and growth of other herbaceous species (Buchanan et al. 1978).

1997 TREND ASSESSMENT

The browse trend is stable. Density decreased for Utah serviceberry and mountain big sagebrush by 22% and 52%, respectively. However, the decrease in density was likely from the change in sample area. There was a decrease in percent decadence for both species. The proportion of plants exhibiting poor vigor decreased for serviceberry and remained nearly stable for sagebrush. It was also noted that the average height and crown measurements nearly doubled, suggesting that the stand consisted of fewer, larger plants. The grass trend is stable. The sum of nested frequency for perennial grasses increased 4%. There was a significant increase in the nested frequency for Sandberg bluegrass and a significant decrease in that of needle-and-thread grass (*Stipa comata*). The forb trend is up. The sum of nested frequency for perennial forbs increased 30% due to a significant increase in the nested frequency of segolily (*Calochortus nuttallii*) and longstalk springparsley. The Desirable Components Index (DCI) score was categorized as fair due to the high perennial grass and forb cover and moderate shrub cover.

winter range condition (DCI) - fair (59) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - up (+2)

2002 TREND ASSESSMENT

The browse trend is stable. Mountain big sagebrush density increased by 12% and recruitment of young plants improved. Percent decadence in the sagebrush population also decreased from 38% to 31%. However, the number of plants exhibiting poor vigor increased from 8% to 15%, and browse use shifted from predominantly light-moderate to moderate-heavy. Utah serviceberry density decreased by 23%, but remained stable in percent decadence and vigor. The trend for grass is down. The sum of nested frequency for perennial grasses declined by 32%, with significant decreases in nested frequencies for muttongrass and Sandberg bluegrass. However, bluebunch wheatgrass cover increased from 7% to 18% and perennial grass cover increased from 14% to 21%. The forb trend is down. Nested frequency for perennial forbs declined by 57%, including a significant decrease in the nested frequencies of five perennial species. The loss of herbaceous species was likely the result of drought. The DCI score remained fair, although there was an increase in shrub recruitment and perennial grass cover.

winter range condition (DCI) - fair-good (63) Mid-level potential scale
browse - stable (0) grass - down (-2) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is slightly down. The density of mountain big sagebrush decreased by 15%, and decadent plants increased from 31% to 44% of the population. The percentage of sagebrush plants with poor vigor remained stable, and those with moderate and heavy use declined. Few flowering heads were observed on sagebrush. Utah serviceberry density increased by 5%, and none of the serviceberry plants sampled were decadent or had poor vigor. The trend for grass is up. The sum of nested frequency for perennial grasses increased by 37%. Sandberg bluegrass, muttongrass, needle-and-thread grass, and cheatgrass all increased

significantly in nested frequency. Although annual grasses increased in nested frequency, they still only account for 1% of the total ground cover. Perennial grasses had moderate seed head production in 2007. The forb trend is slightly up. The nested frequency of several perennial forbs increased significantly, and the sum of nested frequency increased 67%. The sum of nested frequency of annual forbs increased two-fold, but most of the increase was in ecologically neutral species with little forage value. There was also a significant increase in the nested frequency of bur buttercup (*Ranunculus testiculatus*), but it still only accounts for less than 1% of the vegetative cover. Bur buttercup is an allelopathic annual and may limit the germination and seedling growth of desirable plants in the future (Buchanan et al. 1978). Forbs were noted to have good vigor and flower production. The DCI score remained fair due. There was a decrease in shrub cover and an increase in shrub decadence.

winter range condition (DCI) - fair (55) Mid-level potential scale
browse - slightly down (-1) grass - up (+2) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 16B, Study no: 2

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	$_{ab}$295	$_{ab}$270	$_{b}$281	$_{a}$260	7.18	17.81	11.55
G	Bromus brizaeformis (a)	-	-	-	10	-	-	.02
G	Bromus japonicus (a)	-	-	-	19	-	-	.21
G	Bromus tectorum (a)	-	$_{a}$57	$_{a}$61	$_{b}$142	.46	.17	.86
G	Poa fendleriana	$_{bc}$164	$_{c}$177	$_{a}$68	$_{b}$137	3.37	1.69	4.91
G	Poa secunda	$_{a}$140	$_{c}$192	$_{b}$104	$_{c}$195	3.75	1.10	4.23
G	Sitanion hystrix	-	3	-	-	.00	-	-
G	Stipa comata	$_{c}$49	$_{ab}$29	$_{a}$5	$_{bc}$37	.16	.06	.98
Total for Annual Grasses		0	57	61	171	0.46	0.17	1.10
Total for Perennial Grasses		648	671	458	629	14.47	20.67	21.68
Total for Grasses		648	728	519	800	14.94	20.84	22.78
F	Agoseris glauca	-	$_{b}$49	$_{b}$34	$_{a}$14	.15	.22	.14
F	Alyssum alyssoides (a)	-	$_{a}$29	$_{b}$69	$_{c}$207	.05	.44	1.37
F	Allium sp.	-	3	-	-	.01	-	-
F	Antennaria rosea	$_{a}$20	$_{b}$55	$_{a}$23	$_{a}$22	.70	.59	.30
F	Arabis sp.	$_{c}$51	$_{a}$6	$_{a}$1	$_{b}$28	.01	.00	.14
F	Artemisia ludoviciana	$_{a}$3	$_{a}$3	$_{b}$13	$_{ab}$12	.15	.34	.21
F	Astragalus beckwithii	$_{b}$58	$_{b}$60	$_{a}$4	$_{a}$10	1.51	.03	.07
F	Astragalus convallarius	-	-	-	9	-	-	.24
F	Astragalus utahensis	-	$_{b}$21	$_{ab}$11	$_{a}$10	.51	.22	.08
F	Balsamorhiza sagittata	$_{a}$5	$_{a}$10	$_{a}$1	$_{a}$5	.36	.15	.36
F	Castilleja chromosa	$_{b}$31	$_{a}$8	$_{a}$5	$_{a}$5	.02	.04	.16
F	Calochortus nuttallii	$_{a}$6	$_{b}$101	$_{a}$5	$_{a}$10	.22	.01	.02

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	Chaenactis douglasii	$_{a}$2	-	-	$_{a}$3	-	-	.06
F	Cirsium sp.	$_{a}$1	$_{b}$5	-	-	.33	-	-
F	Collomia linearis (a)	-	$_{a}$46	$_{a}$26	$_{a}$37	.10	.06	.09
F	Comandra pallida	-	-	-	10	-	-	.10
F	Collinsia parviflora (a)	-	$_{a}$36	$_{a}$14	$_{b}$62	.27	.03	.38
F	Crepis acuminata	$_{a}$20	$_{a}$24	$_{a}$11	$_{a}$21	.05	.28	.41
F	Cryptantha sp.	$_{b}$47	$_{ab}$22	$_{a}$7	$_{ab}$26	.22	.22	.28
F	Cymopterus longipes	$_{ab}$67	$_{c}$117	$_{a}$56	$_{bc}$91	.75	.15	.42
F	Descurainia pinnata (a)	-	-	-	5	-	-	.01
F	Epilobium brachycarpum (a)	-	$_{a}$1	-	$_{a}$1	.00	-	.00
F	Eriogonum racemosum	$_{b}$64	$_{a}$31	$_{a}$36	$_{ab}$41	.23	.70	.35
F	Eriogonum umbellatum	$_{a}$29	$_{a}$18	$_{a}$29	$_{a}$32	.09	.27	.45
F	Lappula occidentalis (a)	-	$_{a}$5	-	$_{a}$5	.01	-	.01
F	Linum lewisii	$_{a}$1	$_{a}$3	$_{a}$4	$_{a}$5	.01	.01	.01
F	Lithospermum ruderale	$_{a}$8	$_{a}$17	$_{a}$9	$_{a}$13	.42	.26	.40
F	Lupinus argenteus	$_{b}$40	$_{bc}$47	$_{a}$12	$_{c}$67	2.43	.22	1.51
F	Microsteris gracilis (a)	-	$_{a}$12	$_{a}$7	$_{a}$21	.02	.02	.06
F	Phlox longifolia	$_{a}$24	$_{a}$12	$_{a}$10	$_{a}$16	.03	.03	.14
F	Ranunculus testiculatus (a)	-	$_{a}$8	$_{a}$33	$_{b}$170	.02	.06	.89
F	Sphaeralcea coccinea	$_{a}$13	$_{a}$9	$_{a}$7	$_{a}$8	.01	.04	.04
F	Taraxacum officinale	3	-	-	-	-	-	-
F	Tragopogon dubius	-	$_{b}$20	-	$_{a}$5	.04	-	.04
Total for Annual Forbs		0	137	149	508	0.50	0.62	2.82
Total for Perennial Forbs		493	641	278	463	8.31	3.87	5.97
Total for Forbs		493	778	427	971	8.81	4.49	8.80

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --
Management unit 16B, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	18	19	19	.63	.57	.52
B	Artemisia tridentata vaseyana	76	69	71	9.75	9.54	5.90
B	Chrysothamnus viscidiflorus viscidiflorus	41	40	49	2.69	1.49	2.32
B	Gutierrezia sarothrae	19	6	26	.07	.01	.67
B	Mahonia repens	3	3	3	.06	.15	.18
B	Opuntia sp.	15	19	23	.25	.41	.75
B	Purshia tridentata	0	0	0	.00	-	.00
B	Rosa woodsii	1	0	0	-	-	-
B	Symphoricarpos oreophilus	4	0	0	-	-	-
B	Tetradymia canescens	25	21	27	.52	.69	.61
Total for Browse		202	177	218	13.99	12.87	10.98

BROWSE TRENDS--
CANOPY COVER, LINE INTERCEPT --
Management unit 16B, Study no: 2

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	-	.15
Artemisia tridentata vaseyana	-	12.66
Chrysothamnus viscidiflorus viscidiflorus	-	3.09
Gutierrezia sarothrae	-	.65
Mahonia repens	-	.13
Opuntia sp.	-	.11
Tetradymia canescens	-	1.03

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 16B, Study no: 2

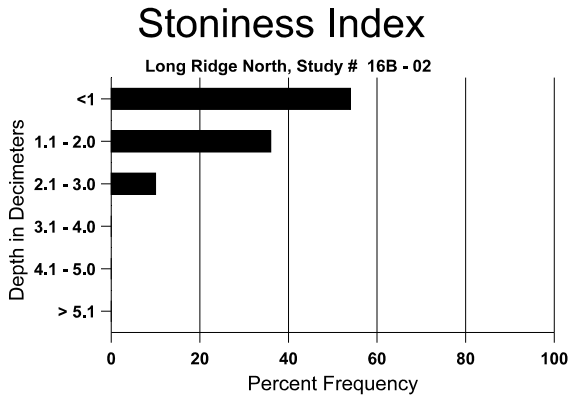
Species	Average leader growth (in)	
	'02	'07
Amelanchier utahensis	2.4	2.9
Artemisia tridentata vaseyana	1.9	2.1

BASIC COVER --
Management unit 16B, Study no: 2

Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	13.50	35.95	40.50	43.85
Rock	12.00	9.81	12.97	10.96
Pavement	31.75	10.85	17.20	15.61
Litter	35.75	33.23	26.77	27.77
Cryptogams	.50	.40	.06	.08
Bare Ground	6.50	17.84	10.21	13.31

SOIL ANALYSIS DATA --
Herd Unit 16B, Study no: 02, Long Ridge North

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.5	50.4 (14.0)	6.9	54.7	19.7	25.6	2.8	13.6	294.4	.6



PELLET GROUP DATA --
Management unit 16B, Study no: 2

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	3	1	10
Elk	29	2	21
Deer	41	30	46

Days use per acre (ha)	
'02	'07
-	-
10 (23)	19 (46)
80 (197)	35 (86)

BROWSE CHARACTERISTICS --
Management unit 16B, Study no: 2

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
89	**666**	-	200	-	466	-	30	30	70	33	50	-/-
97	**520**	-	160	300	60	40	8	31	12	4	4	15/22
02	**400**	-	160	200	40	-	20	25	10	5	5	16/19
07	**420**	-	100	320	-	-	19	48	0	-	0	18/22
Artemisia tridentata vaseyana												
89	**4665**	66	133	1266	3266	-	46	29	70	6	6	15/16
97	**2220**	20	80	1300	840	580	53	14	38	8	8	26/33
02	**2480**	60	280	1440	760	440	27	54	31	15	15	24/31
07	**2100**	120	180	1000	920	760	30	42	44	18	18	22/33
Chrysothamnus viscidiflorus viscidiflorus												
89	**399**	-	133	66	200	-	33	0	50	17	33	7/4
97	**1420**	-	40	1360	20	-	0	0	1	-	0	9/13
02	**1560**	-	120	1320	120	100	0	0	8	3	3	9/14
07	**1860**	-	100	1620	140	20	0	0	8	-	0	10/14
Echinocereus sp.												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	2/4
Gutierrezia sarothrae												
89	**732**	-	-	666	66	-	0	0	9	9	9	10/6
97	**500**	-	-	500	-	-	0	0	0	-	0	6/6
02	**120**	-	20	40	60	140	0	0	50	17	17	6/4
07	**1280**	20	180	940	160	-	0	0	13	3	5	9/10
Mahonia repens												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**520**	-	20	500	-	-	0	0	-	-	0	4/4
02	**320**	-	-	320	-	-	0	0	-	-	0	2/2
07	**580**	-	20	560	-	-	0	0	-	-	0	3/6
Opuntia sp.												
89	**399**	200	66	333	-	-	0	0	0	-	0	4/7
97	**380**	-	20	340	20	-	0	0	5	-	0	4/8
02	**400**	20	20	340	40	-	0	0	10	10	10	5/9
07	**540**	-	20	460	60	-	0	0	11	7	7	5/10

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Purshia tridentata												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	20	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	60	-	-	-	-	0	0	-	-	0	-/-
Rosa woodsii												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	8/7
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Symphoricarpos oreophilus												
89	**66**	-	66	-	-	-	100	0	-	-	100	-/-
97	**80**	-	20	60	-	-	25	0	-	-	0	3/8
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Tetradymia canescens												
89	**132**	-	66	66	-	-	0	0	0	-	0	6/4
97	**740**	-	80	580	80	-	0	0	11	-	0	9/16
02	**640**	-	80	520	40	-	0	0	6	-	0	8/12
07	**700**	-	120	460	120	-	0	0	17	3	3	9/14