Trend Study 4-6-06

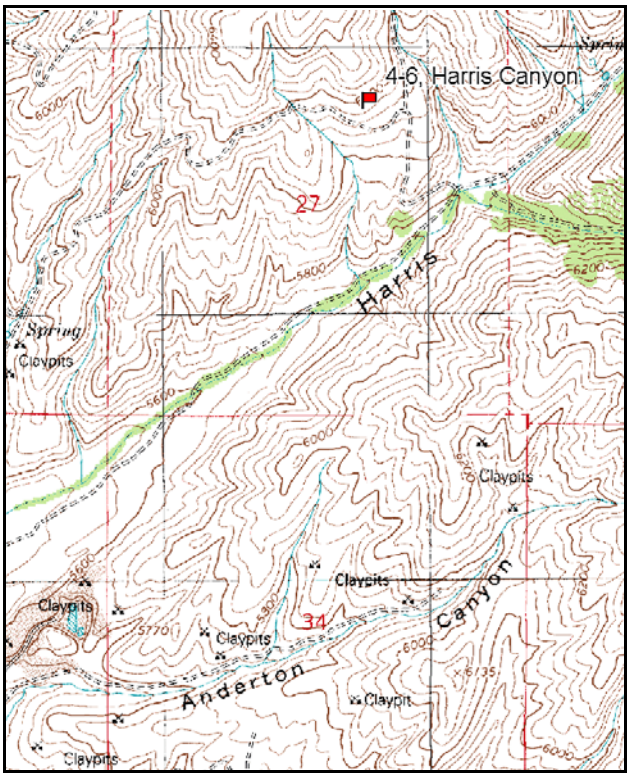
Study site name: Harris Canyon . Vegetation type: Big Sagebrush-Grass .

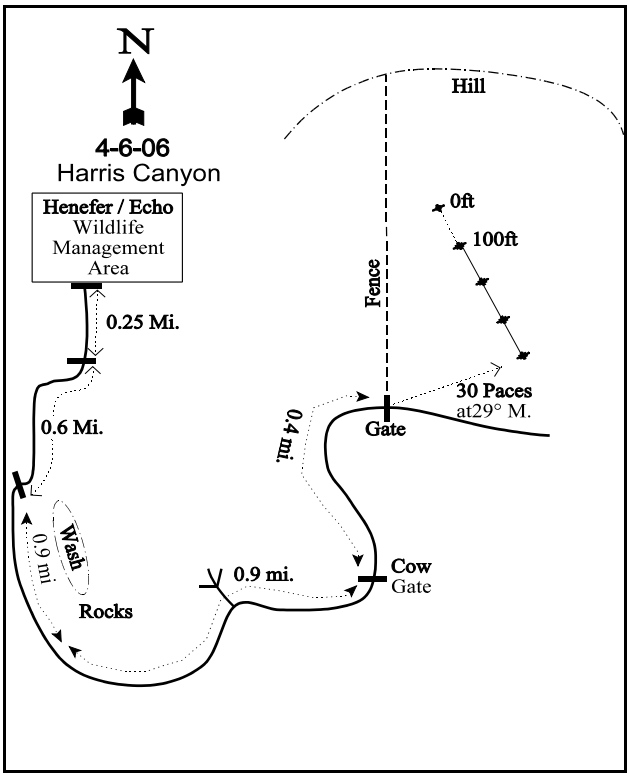
Compass bearing: frequency baseline 164 degrees magnetic.

Frequency belt placement: Line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From the "R" Ranch main gate, proceed northwest for 3.5 miles (towards Croyden) to the Croyden access road. At the DWR/R-Ranch property, turn right and travel 0.25 miles. Turn right at the DWR fence line and proceed 0.6 miles to another gate. Stay to the right, traveling around a wash for 0.9 miles. Travel 1.2 miles to a cow gate. Continue for 0.4 miles to a fence with a gate. Stop here and park. From the gate walk 30 paces (at 29 degrees magnetic) to the 400-foot baseline stake. Walk 400 feet to the north at a bearing of 342 degrees magnetic to the 0-foot baseline stake. The 0-foot stake is marked by browse tag #7975.





Map Name: Henefer

Diagrammatic Sketch

Township 4N , Range 4E , Section 27

UTM NAD 27, UTM 12T 4544767 N 459759 E

DISCUSSION

Harris Canyon - Trend Study No. 4-6

Study Information

This study samples a mountain big sagebrush/grass type within the Echo-Henefer Wildlife Management Area (elevation: 6,200 feet, slope: 35%, aspect: south). Deer use has been exceptionally heavy in the past, which, coupled with low precipitation from 1987 to 1990, has greatly impacted the health and vigor of the browse in the area. Cattle and sheep, owned by ranchers to the north and south of the property, graze the lower elevations of the WMA from April 15 to July 15. Deer pellet groups have been sampled in approximately 25% of the quadrats since 1996. Elk pellet groups were also present in relatively few quadrats in 1996, but approximately the same as deer pellet groups since 2001. Some cattle were observed near the study site during the 1996 reading. A pellet group transect read in 2001, estimated 79 deer and 22 elk days use/acre (195 ddu/ha and 55 edu/ha). Most elk and deer pellet groups appeared to be from spring. In 2006, 46 deer and 29 elk days use/acre (112 ddu/ha and 71 edu/ha) were estimated from pellet group transect readings.

Soil

The soil is in the Horrocks-Cutoff series complex which is moderately deep, well drained, moderately permeable, and formed in glacial deposits, residuum, and colluvium. It is derived from andesite, quarzite, sandstone, and conglomerate parent materials (USDA-NRCS 2006). It is moderately rocky and most surface rocks are rounded and cobblestone-like. The soil texture is a clay loam with a neutral soil reaction (pH of 7.2). The effective rooting depth is estimated at a little over 12 inches. The phosphorus concentration was 6.9 ppm, which is marginal and may limit normal plant growth and development (Tiedemann and Lopez 2004). Organic matter content is relatively high at 4%. The color of the surface soil is reddish, which indicates some iron oxide. The relative bare ground cover was 4% in 1996, 13% in 2001, and 12% in 2006. Surface erosion does not appear excessive. The erosion condition class was slight in 2001 and 2006.

Browse

The total browse density is well below optimum for this location. Although species composition includes four desirable shrubs, it also includes two increasers. The key species are mountain big sagebrush and antelope bitterbrush. Sagebrush density has remained relatively low. In 1996, sagebrush density was 840 plants/acre, decreased slightly to 680 plants/acre in 2001, then decreased to 440 plants/acre in 2006. Use was heavy in 1984 and 1990, but has been light-moderate since 1996. Since 1996, the percent decadence has been low and those classified as dying has been below 10% of the population. Recruitment was good in 1996; young individuals made up 24% of the population. Young individuals only made up 6% of the population in 2001 and 9% in 2006. Forty plants/acre were identified with the sagebrush defoliator moth (*Aroga websterii*) in 2006, but many individuals in the population appeared infested.

Bitterbrush had an estimated density of 380 plants/acre in 1996, 300 plants/acre in 2001, and 280 plants/acre in 2006. These shrubs have a prostate growth form and have averaged only about 17 inches in height, yet they have a crown of almost 3 feet. They have been consistently heavily hedged, due to their high palatability and low numbers. Vigor has been good on all plants sampled and percent decadence has been low. White stem rubber rabbitbrush offers some additional browse forage. Unfortunately, the population has decreased steadily from 1,180 plants/acre in 1996 to 640 plants/acre in 2006. A few serviceberry plants are also present.

Stickyleaf low rabbitbrush and broom snakeweed are both common. Broom snakeweed decreased dramatically from 2,600 plants/acre in 1996 to 80 plants/acre in 2006. Stickyleaf low rabbitbrush has also decreased, but less dramatically; from 1,380 plants/acre in 1996 to 900 plants/acre in 2006.

Herbaceous Understory

The understory is dominated by bluebunch wheatgrass, which has provided 12-13% cover since 1996. Other perennial grasses are rare. Annual grasses, Japanese brome and cheatgrass, are also abundant; they provided

around 9% cover in 1996 and 2001, and 19% cover in 2006. The annual grass cover is high enough to provide fine fuels to carry a devastating fire. A fair number of forbs are also present, but few are abundant. Among these are yellow salsify, Utah milkvetch, thistle, and Louisiana sage. Annual forbs are quite abundant; pale alyssum is the dominant annual forb.

1990 TREND ASSESSMENT

The relatively low density of mountain big sagebrush has been heavily used, remains in poor condition, and has a high rate of decadence. Precipitation data from Morgan indicate that drier-than-normal conditions have existed since 1987. There was no seed production in 1990, but seedling and young plants currently make up 37% of the population. The seedlings have reduced vigor due to the prolonged drought conditions. Rubber rabbitbrush and stickyleaf low rabbitbrush are the most common browse plants and both have increased in density. Even the less desirable stickyleaf low rabbitbrush has been heavily hedged. Bitterbrush is infrequent and heavy hedging has led to a high percentage of decadent plants. Bluebunch wheatgrass is common and the sum of the nested frequency of perennial grasses increased 16%. The nested frequency of perennial forbs decreased 57%, the majority of which was in the desired species yellow salsify.

browse - stable (0) grass - slightly up (+1) forb - down (-2)

1996 TREND ASSESSMENT

The trend for browse is stable for the two key species mountain big sagebrush and antelope bitterbrush. Density of both species has increased, but this is likely due to the larger sample size used beginning in 1992, which better estimates shrub populations with clumped and/or discontinuous distributions. Heavy use and percent decadence have declined and vigor improved. The grass trend is slightly down. The nested frequency of perennial grasses decreased 27%, but some of that change is likely due to the larger sample area. Bluebunch wheatgrass and Sandberg bluegrass both decreased significantly. Annual grasses were sampled for the first time and were moderately to highly abundant. The forb trend is up. The nested frequency of perennial forbs increased more than two-fold and the nested frequency of yellow salsify returned to values similar to those in 1984. The Desirable Components Index score was fair due to moderate preferred browse cover, low browse decadence, good perennial grass cover, and moderate perennial forb cover.

winter range condition (DC Index) - fair (55) Mid-level potential scale
browse - stable (0) grass - slightly down (-1) forb - up (+2)

2001 TREND ASSESSMENT

Trend for the key browse species, mountain big sagebrush and bitterbrush, is stable. Density of mountain big sagebrush has declined slightly due to a reduction in the number of young plants. Utilization is light to moderate, vigor is normal on most plants, and percent decadence, although higher than 1996, is only moderate at 21%. All bitterbrush sampled display heavy use, but the population has remained fairly stable, vigor is normal on all plants, and there were no decadent plants sampled. The grass trend is slightly up. The nested frequency of perennial grasses increased and the nested frequency of Sandberg bluegrass increased significantly. The sum of the nested frequency of annual grasses remained unchanged, although the nested frequency of cheatgrass decreased significantly. The forb trend is slightly down. The nested frequency of perennial grasses decreased 10% and the nested frequency of yellow salsify decreased significantly. Storksbill increased significantly. Kimball and Schiffmann (2003) showed that high densities of storksbill can outcompete native species and prevent native seed establishment, specifically native perennial grasses, under grazing pressure. The Desirable Components Index score remained fair.

winter range condition (DC Index) - fair (59) Mid-level potential scale
browse - stable (0) grass - slightly up (+1) forb - slightly down (-1)

2006 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush decreased 35%, the decreases were all in the mature and decadent age classes. Decadence remained about 20% and vigor changed little. Nearly 10% of the population was identified as infested by the sagebrush defoliator moth. The grass trend is stable. The nested frequency of perennial and annual grasses did not change. Japanese brome decreased significantly, but cheatgrass compensated by increasing significantly. The forb trend is down. The nested frequency of perennial forbs decreased 25%, mainly due to a significant decrease in yellow salsify. The Desirable Components Index score decreased to poor to fair due to a decrease in preferred browse cover and an increase in annual grass cover.

winter range condition (DC Index) - poor to fair (50) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 04 , Study no: 6

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
G	Agropyron cristatum	-	-	-	-	3	-	-	.03
G	Agropyron intermedium	$_{a}$3	$_{a}$2	$_{a}$5	$_{a}$7	$_{b}$20	.03	.33	.97
G	Agropyron spicatum	$_{ab}$218	$_{b}$231	$_{a}$182	$_{ab}$189	$_{ab}$219	11.84	11.55	12.99
G	Bromus brizaeformis (a)	-	-	4	3	3	.01	.03	.00
G	Bromus japonicus (a)	-	-	$_{b}$205	$_{b}$227	$_{a}$151	2.62	3.64	1.90
G	Bromus tectorum (a)	-	-	$_{b}$267	$_{a}$239	$_{b}$310	6.97	5.10	16.68
G	Elymus cinereus	-	-	-	4	-	-	.38	.38
G	Elymus junceus	-	-	-	-	2	-	-	.00
G	Festuca ovina	-	-	-	2	-	-	.03	-
G	Oryzopsis hymenoides	4	16	11	20	5	.36	.50	.29
G	Poa pratensis	$_{b}$17	$_{ab}$5	$_{a}$-	$_{a}$2	$_{a}$-	-	.03	-
G	Poa secunda	$_{a}$-	$_{b}$26	$_{a}$6	$_{b}$28	$_{a}$7	.06	.77	.04
Total for Annual Grasses		0	0	476	469	464	9.60	8.77	18.59
Total for Perennial Grasses		242	280	204	252	256	12.31	13.61	14.72
Total for Grasses		242	280	680	721	720	21.92	22.39	33.32
F	Achillea millefolium	$_{b}$7	$_{a}$-	$_{ab}$6	$_{ab}$2	$_{ab}$2	.01	.15	.15
F	Agoseris glauca	-	1	-	5	1	-	.01	.00
F	Alyssum alyssoides (a)	-	-	$_{a}$245	$_{b}$304	$_{b}$291	1.12	6.27	2.84
F	Allium sp.	-	-	4	11	4	-	.03	.01
F	Arabis drummondi	-	-	-	-	-	-	-	.03
F	Arenaria sp.	-	-	-	-	3	-	-	.03
F	Artemisia ludoviciana	$_{a}$24	$_{a}$23	$_{a}$30	$_{b}$68	$_{a}$45	.53	2.45	1.49
F	Astragalus beckwithii	-	-	-	-	6	-	-	.36
F	Aster chilensis	$_{b}$15	$_{a}$2	$_{a}$1	$_{a}$1	$_{a}$-	.00	.00	-

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
F	Astragalus sp.	$_{b}$31	$_{a}$-	$_{a}$7	$_{a}$-	$_{a}$-	.21	-	-
F	Astragalus utahensis	2	1	3	2	-	.03	.03	.00
F	Castilleja linariaefolia	-	-	4	-	3	.18	-	.15
F	Camelina microcarpa (a)	-	-	2	17	5	.00	.04	.01
F	Cirsium undulatum	$_{b}$23	$_{ab}$27	$_{ab}$16	$_{a}$5	$_{ab}$7	.21	.24	.37
F	Collomia linearis (a)	-	-	-	2	-	-	.01	-
F	Collinsia parviflora (a)	-	-	10	7	10	.02	.07	.05
F	Crepis acuminata	-	-	-	-	4	-	-	.09
F	Cryptantha sp.	$_{b}$10	$_{a}$-	$_{a}$-	$_{a}$-	$_{a}$-	-	-	-
F	Cymopterus sp.	$_{a}$-	$_{b}$8	$_{ab}$3	$_{ab}$2	$_{ab}$2	.03	.03	.03
F	Cynoglossum officinale	-	-	2	2	2	.00	.03	.15
F	Descurainia pinnata (a)	-	-	-	9	1	-	.04	.00
F	Draba sp. (a)	-	-	$_{a}$-	$_{a}$-	$_{b}$14	-	-	.03
F	Erodium cicutarium (a)	-	-	$_{a}$24	$_{b}$77	$_{a}$38	.10	1.62	.22
F	Hackelia patens	-	-	7	-	-	.04	-	-
F	Helianthus annuus (a)	-	1	-	-	-	-	-	-
F	Hedysarum boreale	-	7	2	6	1	.15	.04	.03
F	Holosteum umbellatum (a)	-	-	$_{a}$32	$_{b}$130	$_{c}$181	.09	.60	.66
F	Lactuca serriola	$_{a}$-	$_{a}$-	$_{a}$6	$_{b}$16	$_{a}$-	.01	.08	-
F	Lithospermum ruderale	6	6	-	-	-	-	-	.03
F	Microsteris gracilis (a)	-	-	$_{a}$-	$_{b}$35	$_{b}$21	-	.20	.09
F	Oenothera caespitosa	6	-	1	-	2	.03	-	.03
F	Penstemon sp.	5	-	-	-	-	-	-	-
F	Ranunculus testiculatus (a)	-	-	-	3	2	-	.00	.01
F	Streptanthus cordatus	-	2	-	-	-	-	-	-
F	Taraxacum officinale	-	-	-	2	3	-	.03	.03
F	Tragopogon dubius	$_{c}$134	$_{ab}$37	$_{c}$96	$_{b}$66	$_{a}$11	1.27	.48	.09
F	Vicia americana	$_{a}$-	$_{a}$-	$_{bc}$52	$_{b}$29	$_{c}$67	.65	.42	2.18
Total for Annual Forbs		0	1	313	584	563	1.34	8.88	3.94
Total for Perennial Forbs		263	114	240	217	163	3.39	4.06	5.28
Total for Forbs		263	115	553	801	726	4.74	12.94	9.22

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

BROWSE TRENDS --
Management unit 04 , Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'96	'01	'06	'96	'01	'06
B	Amelanchier utahensis	4	1	1	.41	.15	.63
B	Artemisia tridentata vaseyana	30	30	16	3.45	7.90	4.65
B	Chrysothamnus nauseosus albicaulis	37	31	25	1.99	5.21	2.04
B	Chrysothamnus viscidiflorus viscidiflorus	32	28	24	1.61	.95	1.42
B	Gutierrezia sarothrae	41	35	3	1.43	.75	.15
B	Leptodactylon pungens	0	0	0	-	.15	-
B	Mahonia repens	4	5	6	.06	.27	.63
B	Purshia tridentata	10	8	10	.69	.22	1.14
Total for Browse		158	138	85	9.66	15.61	10.67

CANOPY COVER, LINE INTERCEPT --
Management unit 04 , Study no: 6

Species	Percent Cover
	'06
Artemisia tridentata vaseyana	7.68
Chrysothamnus nauseosus albicaulis	3.54
Chrysothamnus viscidiflorus viscidiflorus	1.76
Mahonia repens	.11
Purshia tridentata	.93

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 04 , Study no: 6

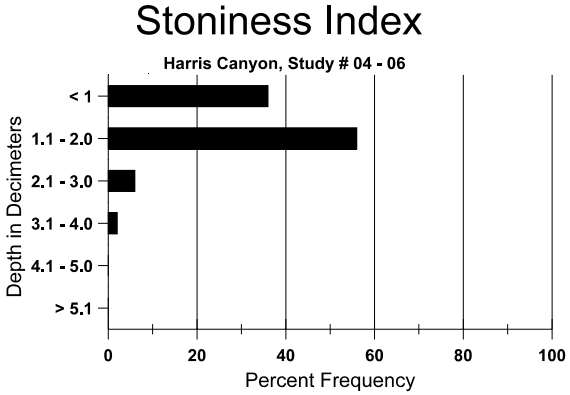
Species	Average leader growth (in)	
	'01	'06
Artemisia tridentata vaseyana	2.6	2.0
Purshia tridentata	-	2.7

BASIC COVER --
Management unit 04 , Study no: 6

Cover Type	Average Cover %				
	'84	'90	'96	'01	'06
Vegetation	2.25	10.00	40.52	52.22	47.18
Rock	19.00	16.50	13.25	18.04	20.68
Pavement	5.25	5.00	.59	.80	.70
Litter	55.00	38.50	48.43	33.40	33.34
Cryptogams	0	0	.33	.14	.51
Bare Ground	18.50	30.00	4.82	14.94	14.47

SOIL ANALYSIS DATA --
Herd Unit 04, Study no: 06, Harris Canyon

Effective rooting depth (in)	Temp °F (depth)	PH	Clay loam			%0M	PPM P	PPM K	dS/m
			%sand	%silt	%clay				
12.4	67.6 (12.3)	7.2	43.3	26.7	30.0	4.0	6.9	163.2	0.8



PELLET GROUP DATA --
Management unit 04 , Study no: 6

Type	Quadrat Frequency		
	'96	'01	'06
Rabbit	-	-	9
Elk	4	20	31
Deer	25	22	25
Cattle	-	1	-

Days use per acre (ha)	
'01	'06
-	-
22 (55)	29 (71)
79 (195)	46 (112)
-	-

BROWSE CHARACTERISTICS --
Management unit 04 , Study no: 6

		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												
84	**33**	-	-	-	33	-	0	100	100	-	100	-/-
90	**33**	-	-	-	33	-	0	100	100	61	100	-/-
96	**80**	-	-	40	40	-	50	25	50	-	0	27/28
01	**20**	-	-	-	20	-	0	0	100	-	0	48/29
06	**20**	-	-	20	-	-	100	0	0	-	0	40/37
Artemisia tridentata vaseyana												
84	**632**	-	166	66	400	-	11	63	63	-	0	6/6
90	**698**	133	166	166	366	-	10	81	52	6	24	26/31
96	**840**	-	200	560	80	560	17	2	10	5	5	25/44
01	**680**	-	40	500	140	320	26	3	21	9	9	28/46
06	**440**	20	40	320	80	220	32	5	18	5	5	30/44
Chrysothamnus nauseosus albicaulis												
84	**232**	-	33	133	66	-	0	100	28	-	0	36/27
90	**932**	-	766	66	100	-	4	0	11	-	0	40/52
96	**1180**	20	220	900	60	-	20	0	5	-	0	22/35
01	**800**	-	60	480	260	40	30	18	33	13	13	25/34
06	**640**	-	40	340	260	80	13	0	41	16	16	25/33
Chrysothamnus viscidiflorus viscidiflorus												
84	**33**	-	-	-	33	-	100	0	100	-	100	-/-
90	**765**	-	166	233	366	-	13	65	48	5	35	6/8
96	**1380**	20	240	1140	-	-	4	3	0	-	0	11/17
01	**1020**	-	60	940	20	-	2	0	2	-	0	9/14
06	**900**	20	20	880	-	-	0	0	0	-	0	15/18
Gutierrezia sarothrae												
84	**0**	-	-	-	-	-	0	0	0	-	0	-/-
90	**1132**	-	133	966	33	-	0	0	3	-	0	7/12
96	**2600**	4100	1380	1140	80	100	0	0	3	3	3	10/13
01	**2140**	-	140	1920	80	40	0	0	4	3	3	8/9
06	**80**	-	-	80	-	-	0	0	0	-	0	10/12

		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)
Mahonia repens												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**660**	-	660	-	-	-	0	0	-	-	0	-/-
01	**3300**	-	220	3080	-	-	0	0	-	-	0	3/4
06	**2540**	-	-	2540	-	-	0	0	-	-	0	2/4
Purshia tridentata												
84	**132**	-	-	66	66	-	0	100	50	-	0	15/15
90	**166**	-	33	33	100	-	20	80	60	24	60	11/28
96	**380**	-	20	340	20	-	42	47	5	-	0	16/29
01	**300**	-	-	300	-	-	0	100	0	-	0	15/30
06	**280**	40	-	220	60	-	14	86	21	-	0	19/35
Symphoricarpos oreophilus												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	15/22
01	**0**	-	-	-	-	-	0	0	-	-	0	-/-
06	**0**	-	-	-	-	-	0	0	-	-	0	17/24
Tetradymia canescens												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
01	**0**	-	-	-	-	-	0	0	-	-	0	-/-
06	**0**	-	-	-	-	-	0	0	-	-	0	8/13