Trend Study 21A-4-07

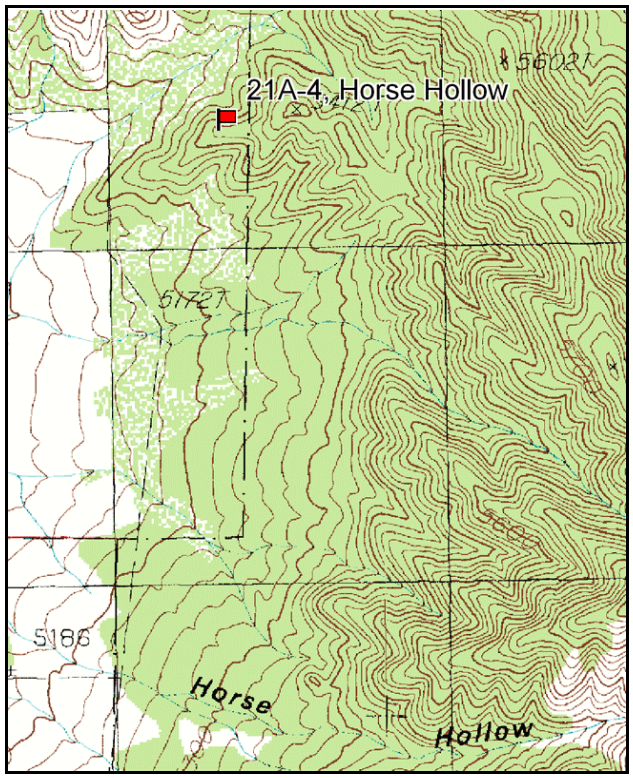
Study site name: Horse Hollow . Vegetation type: Juniper .

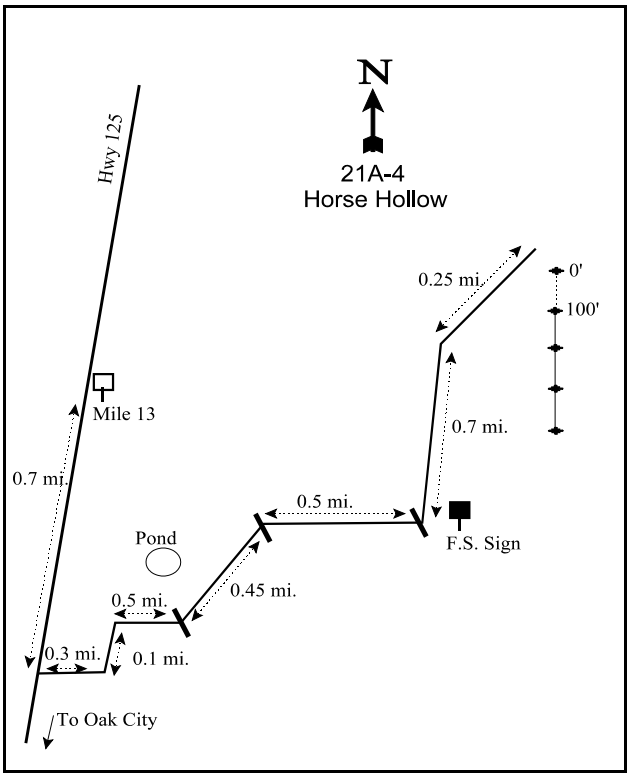
Compass bearing: frequency baseline 180 degrees magnetic.

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

LOCATION DESCRIPTION

Proceed north from Oak City on SR 125. At 0.7 miles south of mile marker 13, turn left (east). Drive 0.3 miles, turn left, and drive 0.1 miles parallel to a fence. Turn right and drive 0.5 miles to a gate. Stay left at the gate and drive 0.45 miles to another gate. Go through the gate and drive 0.5 miles to another gate. On the other side of the gate is a Forest Service sign. The road will turn left (north), drive 0.7 miles up the hill to a ridge. At the top of the hill turn right and drive 0.25 miles on a faint road up the ridge line. Look for a green and white fencepost 18 feet off the right side of the road. The fencepost marks the 0-foot end of the frequency baseline. All stakes are full high fence post.





Map Name: Oak City

Diagrammatic Sketch

Township 16S , Range 4W , Section Unsurveyed

GPS: NAD 83, UTM 12S 388271 E 4365558 N

DISCUSSION

Horse Hollow - Trend Study No. 21A-4

Study Information

This study is located on winter range dominated by Utah juniper (*Juniperus osteosperma*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and is located in the foothills above privately owned wheatfields. The transect runs down the south side of a rocky ridge and across a small wash [elevation: 5,300 feet (1,615 m), slope: 15%-20%, aspect: south]. Adjacent areas to the north and south were burned, seeded, then chained prior to study establishment in 1985. The area was also chained and seeded following a wildfire in 2006. Three of the sampling belts were located in burned and chained areas in 2007, while two were outside of the treatment. The land is managed by the Forest Service and is grazed by cattle. Pellet group transect data were estimated at 7 deer days use/acre (17 ddu/ha) in 1998, 3 deer days use/acre (7 ddu/ha) in 2003, and 4 deer days use/acre (10 ddu/ha) in 2007. Cattle use was estimated at only 2 days use/acre (5 cdu/ha) in 1998, with no cattle pats sampled in 2003 and 2007. Although not recorded in the pellet group transect data, rabbit pellet quadrat frequency steadily increased from 25% in 1998 to 43% in 2007. In 1998, grasshoppers were numerous and Mormon crickets (*Anabrus simplex*) had been on the site earlier in the season. Coyote scat was noted in the same year that contained numerous cricket remains.

Soil

The soil is classified as an Amtoft-Spager complex (USDA-NRCS 2007). The soils in the Amtoft series are shallow and well-drained, and formed in material weathered from calcareous sedimentary rocks. The Spager series consists of shallow soils over calcium carbonate cemented hardpan. They are somewhat excessively drained, and formed in alluvium weathered mainly from limestone. The soil texture is a sandy loam, and the pH is neutral (7.1). Soil phosphorus is low at 3.3 ppm. Values less than 6 ppm may limit normal plant growth and development (Tiedemann and Lopez 2004). The soil is moderately shallow and very rocky, both on the surface and throughout the profile. A thin hardpan is located at a depth of 6-8 inches (15-20 cm). Erosion is not a serious problem, although a small wash at the bottom of the hill shows some sedimentation. The erosion condition was classified as stable in 2003 and 2007.

Browse

Wyoming big sagebrush has been the dominant preferred browse since 1985. Sagebrush density increased from approximately 800 plants/acre (1,977 plants/ha) in 1985 and 1991 to 920 plants/acre (2,273 plants/ha) in 1998, then decreased to 640 plants/acre (1,581 plants/ha) in 2003. The wildfire and chaining treatment in 2006 eliminated the sagebrush population by the 2007 sampling. Decadence was high between 1985 and 2003, ranging from 39% to 50% of the population. Recruitment was low, with young plants comprising 8% of the population in 1985 and 4% in 1998, and no young plants sampled in 1991, 2003, and 2007. Vigor was good on over 80% of the plants in all sample years except 1991, when one-third of the population displayed poor vigor. Use was moderate in 1985, mostly light in 1991 and 2003, and light-moderate in 1998. Annual leader growth averaged 1.6 inches (4.1 cm) in 2003.

Nevada ephedra (*Ephedra nevadensis*) has also been sampled since 1998. Ephedra density increased from 100 plants/acre (247 plants/ha) in 1998 to 420 plants/acre (1,037 plants/ha) in 2003, and decadence increased from 0% to 71% of the population. After the fire and chaining treatment, young ephedra plants were sampled at a density of 40 plants/acre (99 plants/ha). All of the plants were vigorous in 1998 and 2007, and 19% of the population showed poor vigor in 2003. Use was moderate in 1998, moderate-heavy in 2003, and light in 2007. Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) was also sampled at a low density in 1998 and 2003, and showed moderate-heavy use in 2003. It was not sampled in 2007.

Before the burn and chaining, the overstory was dominated by large juniper trees. One patch of trees remained unburned in 2007. Juniper canopy cover averaged 14% in 1998, 7% in 2003, and only 1% in 2007 after the

treatment. Point-centered quarter data estimated juniper density at 82 trees/acre (203 trees/ha) in 1998 and 2003, and 29 trees/acre (72 trees/ha) in 2007. Nearly half of the sampled trees were greater than 12 feet (3.7 m) in height in 2003, while most trees in 2007 were 8-12 feet (2.4-3.7 m) tall.

Herbaceous Understory

The herbaceous understory has been sparse in all sample years, providing 16% cover in 1998, 9% in 2003, and 17% in 2007. It is composed of mostly grass. Cheatgrass (*Bromus tectorum*) dominated the understory in 1998 and 2007, providing 80% and 83% of the total herbaceous cover, respectively. Cheatgrass cover was most abundant in areas that remained unburned in 2007. In 2003, cheatgrass, bluebunch wheatgrass (*Agropyron spicatum*), and Sandberg bluegrass (*Poa secunda*) combined provided 92% of the herbaceous cover. Other perennial grasses, such as galleta (*Hilaria jamesii*) and Indian ricegrass (*Oryzopsis hymenoides*) are present in small frequencies. Forbs have provided very little cover since 1998, and annual species were dominant in 2007. The most abundant forbs were draba (*Draba* sp.), nodding eriogonum (*Eriogonum cernuum*), and tansymustard (*Descurainia pinnata*).

1991 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density remained stable at 800 plants/acre (1,977 plants/ha). However, decadence increased from 42% of the population to 50%, while young recruitment decreased from 8% of the population to 0%. Plants displaying poor vigor increased from 17% of the population to 33%. Use decreased from moderate to light. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased 18%, and galleta increased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased slightly.

browse - slightly down (-1) grass - slightly up (+1) forb - slightly down (-1)

1998 TREND ASSESSMENT

The trend for browse is slightly up. Sagebrush density increased from 800 plants/acre (1,977 plants/ha) to 920 plants/acre (2,273 plants/ha), although this increase may be attributed to the increase in sample area. Decadence decreased from 50% of the population to 39%, and young recruitment slightly increased from 0% to 4% of the population. Dead plants were sampled for the first time, at a density of 800 plants/acre (1,977 plants/ha). Plants displaying poor vigor decreased from 33% of the population to 13%, and use increased to moderate. Ephedra and cliffrose were sampled for the first time at 100 plants/acre (247 plants/ha) and 20 plants/acre (49 plants/ha), respectively. Use on ephedra was moderate, and use on cliffrose was light. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 41%. Bluebunch wheatgrass, galleta, and Indian ricegrass decreased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs remained low. The Desirable Components Index (DCI) was rated as very poor due to low browse and perennial herbaceous cover, and high annual grass cover.

winter range condition (DCI) - very poor (0) Low potential scale
browse - slightly up (+1) grass - down (-2) forb - stable (0)

2003 TREND ASSESSMENT

The trend for browse is down. Sagebrush density declined 30% to 640 plants/acre (1,581 plants/ha). Decadence increased from 39% to 47% of the population, and no young plants were sampled. The density of dead plants decreased to 500 plants/acre (1,235 plants/ha). Plants displaying poor vigor increased from 13% of the population to 19%, and use decreased to mostly light. Ephedra density increased from 100 plants/acre (247 plants/ha) to 420 plants/acre (1,038 plants/ha), however, decadence increased substantially, from 0% to 71% of the population. Nineteen percent of the plants showed poor vigor. Cliffrose density doubled to 40 plants/acre (99 plants/ha), but half of the sampled plants were decadent. Use of both ephedra and cliffrose was moderate-heavy. The trend for grass is up. The sum of nested frequency for perennial grasses increased 45% and cheatgrass decreased significantly in nested frequency. Perennial grass cover increased from 3% to 5%,

while cheatgrass cover decreased from 13% to only 3%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, and the number of perennial species sampled increased from three to eight. Cover remained stable and was almost nonexistent. The DCI rating increased to poor due to increases in browse and perennial grass cover, and a decrease in annual grass cover.

winter range condition (DCI) - poor (14) Low potential scale
browse - down (-2) grass - up (+2) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is down. The study burned and was chained in 2006, and the only sagebrush sampled in 2007 were two dead plants. No cliffrose plants were sampled. Ephedra was noted as resprouting and young plants were sampled at a density of 40 plants/acre (99 plants/ha). The trend for grass is down. The sum of nested frequency for perennial grasses decreased 46% and Sandberg bluegrass decreased significantly in nested frequency. Average perennial grass cover decreased from 5% to 2%. Cheatgrass increased significantly in nested frequency and its average cover increased from 3% to 14%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, while that for annual forbs increased substantially. Total forb cover increased to 1%, however, this increase was mostly attributed to annuals such as draba and tansymustard. The DCI rating declined to very poor due to the lack of browse cover, the decrease in perennial grass cover, and the increase in annual grass cover.

winter range condition (DCI) - very poor (-6) Low potential scale
browse - down (-2) grass - down (-2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 4

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'07	'98	'03	'07
G	Agropyron spicatum	$_{b}$73	$_{b}$77	$_{a}$19	$_{a}$35	$_{a}$31	.65	1.21	1.11
G	Bromus tectorum (a)	-	-	$_{b}$337	$_{a}$239	$_{b}$317	12.65	3.47	13.86
G	Hilaria jamesii	$_{a}$8	$_{b}$34	$_{a}$6	$_{a}$9	$_{a}$9	.10	.04	.25
G	Oryzopsis hymenoides	$_{ab}$29	$_{b}$31	$_{a}$12	$_{ab}$20	$_{ab}$11	.12	.56	.11
G	Poa secunda	$_{a}$54	$_{a}$47	$_{ab}$75	$_{b}$101	$_{a}$39	2.06	3.41	.31
G	Secale cereale (a)	-	-	5	-	-	.02	-	-
G	Sitanion hystrix	-	$_{a}$5	$_{a}$2	-	-	.06	-	-
Total for Annual Grasses		0	0	342	239	317	12.67	3.47	13.86
Total for Perennial Grasses		164	194	114	165	90	3.00	5.24	1.78
Total for Grasses		164	194	456	404	407	15.67	8.71	15.65
F	Alyssum alyssoides (a)	-	-	-	-	3	-	-	.00
F	Arabis drummondi	$_{a}$1	-	-	$_{a}$2	-	-	.00	-
F	Astragalus sp.	$_{b}$19	$_{ab}$8	$_{a}$4	-	-	.01	-	-
F	Astragalus utahensis	-	-	-	3	-	-	.00	-
F	Calochortus nuttallii	-	-	-	$_{a}$3	$_{a}$3	-	.00	.00
F	Cirsium sp.	-	-	$_{a}$7	$_{a}$1	$_{a}$5	.04	.00	.01

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'07	'98	'03	'07
F	Cryptantha sp.	$_{a}$5	$_{a}$1	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	$_{a}$2	$_{a}$2	-	.00	.38
F	Draba sp. (a)	-	-	-	-	11	-	-	.64
F	Eriogonum cernuum (a)	-	-	-	$_{a}$5	$_{b}$28	-	.01	.06
F	Erodium cicutarium (a)	-	-	-	-	4	-	-	.01
F	Erigeron eatonii	-	4	-	-	-	-	-	-
F	Eriogonum ovalifolium	-	2	-	-	-	-	-	-
F	Gilia sp. (a)	-	-	-	$_{a}$5	$_{a}$2	-	.01	.01
F	Hymenopappus filifolius	-	-	-	5	-	-	.01	-
F	Lomatium sp.	-	-	-	1	-	-	.00	-
F	Phlox austromontana	15	-	-	-	-	-	-	-
F	Phlox longifolia	$_{a}$2	-	$_{a}$3	$_{a}$3	$_{a}$2	.00	.00	.00
F	Sisymbrium altissimum (a)	-	-	-	-	3	-	-	.00
F	Unknown forb-perennial	3	-	-	-	-	-	-	-
F	Zigadenus paniculatus	-	$_{a}$1	-	$_{a}$1	$_{a}$1	-	.01	.00
Total for Annual Forbs		0	0	0	12	53	0	0.03	1.12
Total for Perennial Forbs		45	16	14	19	11	0.05	0.05	0.03
Total for Forbs		45	16	14	31	64	0.05	0.09	1.15

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

BROWSE TRENDS --
Management unit 21A, Study no: 4

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'07	'98	'03	'07
B	Artemisia tridentata wyomingensis	34	26	0	2.07	3.79	-
B	Chrysothamnus viscidiflorus stenophyllus	22	9	2	.21	.30	.03
B	Cowania mexicana stansburiana	1	2	0	-	.53	-
B	Ephedra nevadensis	3	4	2	.94	.68	.36
B	Gutierrezia sarothrae	41	18	4	1.49	.58	.16
B	Juniperus osteosperma	4	5	2	6.22	8.57	4.71
B	Opuntia sp.	1	1	0	-	-	-
Total for Browse		106	65	10	10.94	14.46	5.26

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 4

Species	Percent Cover		
	'98	'03	'07
Artemisia tridentata wyomingensis	-	3.86	-
Chrysothamnus viscidiflorus stenophyllus	-	.23	.01
Cowania mexicana stansburiana	-	.76	-
Ephedra nevadensis	-	.71	.95
Gutierrezia sarothrae	-	.06	.03
Juniperus osteosperma	13.80	7.46	1.35

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 4

Species	Average leader growth (in)	
	'03	'07
Artemisia tridentata wyomingensis	1.6	-

POINT-QUARTER TREE DATA --
Management unit 21A, Study no: 4

Species	Trees per Acre		
	'98	'03	'07
Juniperus osteosperma	81	82	29

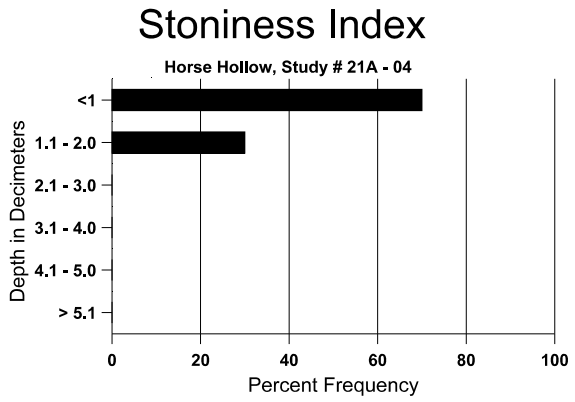
Average diameter (in)		
'98	'03	'07
8.3	7.8	15.1

BASIC COVER --
Management unit 21A, Study no: 4

Cover Type	Average Cover %				
	'85	'91	'98	'03	'07
Vegetation	3.25	1.00	25.25	22.73	21.28
Rock	7.00	18.00	12.65	14.71	17.14
Pavement	37.50	31.00	30.39	26.12	25.35
Litter	33.25	30.50	34.54	28.22	24.11
Cryptogams	2.75	3.25	3.94	6.81	3.88
Bare Ground	16.25	16.25	14.71	20.10	21.90

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 4, Horse Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.4	74.0 (12.6)	7.1	54.9	25.8	19.3	1.3	3.3	105.6	0.5



PELLET GROUP DATA --
Management unit 21A, Study no: 4

Type	Quadrat Frequency		
	'98	'03	'07
Rabbit	25	34	43
Deer	19	6	8

Days use per acre (ha)		
'98	'03	'07
-	-	-
7 (17)	3 (7)	4 (10)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 4

		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)
Artemisia tridentata wyomingensis												
85	**799**	66	66	400	333	-	58	0	42	-	17	15/18
91	**800**	-	-	400	400	-	0	0	50	-	33	15/28
98	**920**	-	40	520	360	800	43	4	39	13	13	22/35
03	**640**	-	-	340	300	500	3	3	47	19	19	24/38
07	**0**	-	-	-	-	40	0	0	0	-	0	23/26
Chrysothamnus nauseosus												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	18/33
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		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)
Chrysothamnus viscidiflorus stenophyllus												
85	**333**	-	-	-	333	-	0	0	100	20	100	-/-
91	**266**	-	-	266	-	-	0	0	0	-	0	9/14
98	**560**	-	-	500	60	140	25	75	11	-	29	10/17
03	**280**	-	-	160	120	260	0	0	43	14	14	7/12
07	**40**	-	-	-	40	20	0	0	100	50	100	4/6
Cowania mexicana stansburiana												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**20**	-	-	20	-	-	0	0	0	-	0	17/20
03	**40**	-	-	20	20	-	50	50	50	-	0	22/20
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Ephedra nevadensis												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**100**	-	-	100	-	-	100	0	0	-	0	17/41
03	**420**	-	-	120	300	20	29	19	71	19	19	14/20
07	**40**	-	40	-	-	-	0	0	0	-	0	13/49
Gutierrezia sarothrae												
85	**1266**	-	400	733	133	-	0	0	11	-	21	6/9
91	**1398**	-	66	1266	66	-	0	0	5	5	5	9/13
98	**2500**	-	80	2320	100	200	7	3	4	-	98	8/10
03	**600**	-	20	540	40	340	0	0	7	7	7	6/9
07	**100**	700	40	60	-	-	0	0	0	-	20	7/8
Juniperus osteosperma												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**80**	40	40	40	-	-	0	0	0	-	0	-/-
03	**120**	-	20	100	-	-	0	0	0	-	0	-/-
07	**40**	-	-	20	20	60	0	0	50	-	50	-/-
Opuntia sp.												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	-	20	-	-	0	0	-	-	0	11/26
03	**20**	-	-	20	-	-	0	0	-	-	0	4/19
07	**0**	-	-	-	-	-	0	0	-	-	0	2/4

		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)
Tetradymia spinosa												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	18/37
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-