Trend Study 30-29-08

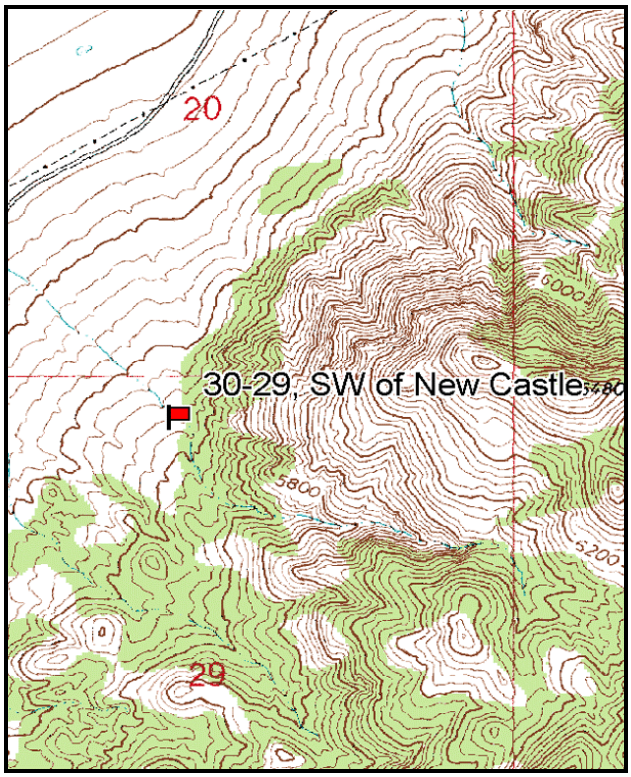
Study site name: Southwest of New Castle . Vegetation type: Sagebrush-Grass .

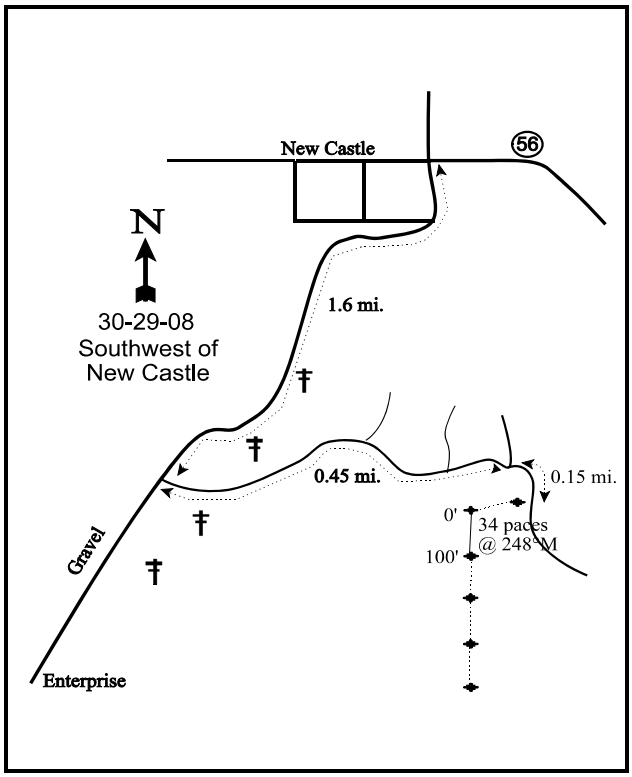
Compass bearing: frequency baseline 176 degrees magnetic.

Frequency belt placement: line 1 (12 & 92ft), line 2 (39ft), line 3 (50ft), line 4 (79ft). Rebar: All belts on 1ft.

LOCATION DESCRIPTION

From the intersection of Pinto-Canyon Road and Main Street in New Castle, proceed south on Main Street 1.0 mile towards Enterprise. Turn left (east) and travel 0.45 miles until you come to a fork. Take a right and continue 0.15 miles to a witness post on the right side of the road. From the witness post walk 34 paces at 248 degrees magnetic to the 0-foot stake. The study is marked by green steel "T" fence posts approximately 18 to 24 inches in height.





Map Name: New Castle

Diagrammatic Sketch

Township 36S , Range 15W , Section 20

GPS: NAD 83, UTM 12S 274236 E, 41696174 N

DISCUSSION

Southwest of Newcastle - Trend Study No. 30-29

Study Information

This study surveys winter range southwest of the town of Newcastle [elevation: 5,600 feet (1,707 m), slope: 11%, aspect: west]. The site is an alluvial fan occupied by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) underlain by a sparse herbaceous understory. The photo transects show that a lop and scatter treatment was done sometime between 2003 and 2008 to remove singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*). Pellet group data estimated heavy deer use in 1998 and 2003 (68 deer days use/acre:168 ddu/ha and 58 ddu/acre:144 ddu/ha, respectively), and very high use in 2008 (102 ddu/acre:251 ddu/ha). No sign of cattle grazing was noted during any of the readings.

Soil

Soil is alluvially deposited from basalt parent material. Effective rooting depth is estimated at just over 15 inches. Soil texture is a sandy clay loam which is slightly acidic (pH 6.4). The surface of the soil is covered by gravel 0.25 to 2 inches in size with some larger rocks mixed in. Rock is also common throughout the profile. Bare ground mostly occurs in small shrub interspaces associated with the rocky surface. Ground cover is composed mostly of shrub crowns and ephemeral litter from dead cheatgrass. Soil movement was widespread in 1982 with several small rills and gullies present. Relative combined vegetation and litter cover ranged from 52%-68% from 1998 to 2008. Relative combined rock and pavement cover ranged from 24%-36% from 1998 to 2008. Currently, erosion appears minimal and the erosion condition class was determined to be stable in 2003 and 2008.

Browse

Wyoming big sagebrush is the prominent and key browse species. Its population increased from 3,633 plants/acre to 5,799 plants/acre between 1982 and 1992. Density declined to 4,860 plants/acre in 1998 due to a reduction in the number of young and decadent plants. The number of dead plants in the population more than accounts for the decrease in the estimated population. In 2003, the sagebrush population was estimated at 3,680 plants/acre, a 24% decline since 1998. Sagebrush density decreased a further 28% to 2,660 plants/acre in 2008. Utilization of sagebrush was light in 1982, but heavy in 1992 with many plants displaying a clubbed growth form and stunted growth. During the 1998 reading, utilization was more moderate, yet heavy use was still noted on 20% of the sagebrush. Utilization of sagebrush was rated as heavy in 2003, and light to moderate in 2008. Overall, vigor was good from 1992 to 1998, but plants displaying poor vigor increased to 91% in 2003, before decreasing to 21% in 2008. Decadence was low to moderate from 1982 to 1998, increased drastically to 93% in 2003, and decreased to 54% in 2008. Recruitment of young plants was high in 1992, but young plants decreased to just 2% of the population in 1998, remained low at 1% in 2003, and increased slightly to 15% in 2008. During the 2003 reading, the population of Wyoming big sagebrush looked very poor after being subjected to several years of extreme drought. Weather station data from Enterprise show that only 37% of the normal precipitation fell in 2002. The spring of 2002 was exceptionally dry at 13% of normal and the spring of 2003 was 79% of normal. Spring precipitation in 2008 was 56% of normal (Utah Climate Summaries 2008).

The only other shrub of significance is narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) which numbered 920 plants/acre in 1998, decreased slightly to 880 plants/acre in 2003, then increased to 2,160 plants/acre. Broom snakeweed (*Gutierrezia sarothrae*) and prickly pear cactus (*Opuntia sp.*) are both present in small quantities, but pose little threat to the community at this time. The larger sample used in 1998, picked up a few green ephedra (*Ephedra nevadensis*) which provide some additional forage.

Prior to the lop and scatter treatment, singleleaf pinyon pine and Utah juniper trees were increasing down slope from the tree dominated hills to the east. Photo point comparisons suggest an increase in density and size of

the trees, but no point-quarter data is available from 1982 or 1992. Point-center quarter data estimated pinyon density to be 26 trees/acre in 1998, increasing to 31 trees/acre in 2003, and remaining similar at 32 trees/acre in 2008 even with the lop and scatter treatment. The average basal diameter of pinyon was 2.3 inches in 1998, increasing to 3.2 inches in 2003, and decreasing to 1 inch in 2008. Juniper density was estimated to be 32 trees/acre in 1998, increasing to 57 trees/acre in 2003, and decreasing to 47 trees/acre in 2008, after the lop and scatter treatment. The average basal diameter of juniper was 6.8 inches in 1998, decreasing to 3.7 inches in 2003, and increasing slightly to 4 inches in 2008.

Herbaceous Understory

Perennial grasses and forbs occur infrequently and are of little significance as a forage source. The two most abundant perennial grasses are galleta grass (*Hilaria jamesii*) and Sandberg bluegrass (*Poa secunda*). Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*) are also fairly common. Cheatgrass (*Bromus tectorum*) was present in 1982 but not widespread. By 1998, it represented the most abundant grass on the site, providing 65% of the total grass cover and 63% of the total herbaceous cover. Sixweeks fescue (*Vulpia octoflora*) was also fairly abundant in 1998. Annual grasses and forbs were not included in samples before 1998, so no comparisons can be made. By 2003, There was a decline in cheatgrass frequency and cover most likely caused by drought conditions. Cheatgrass frequency increased significantly again in 2008. Perennial grasses also declined in cover in 2003, but only bottlebrush squirreltail declined significantly in nested frequency. The cover and frequency of perennial grasses increased again in 2008, though Sandberg bluegrass frequency decreased significantly. Forbs are fairly diverse but are rare in their occurrence. Total forb cover averaged less than 1% in 1998, 2003, and 2008. The most common species are annuals.

1992 TREND ASSESSMENT

Trend for browse is stable. Density of Wyoming big sagebrush has increased 37%. Vigor is good, though decadence has increased slightly to 37%. Narrowleaf low rabbitbrush is stable and doesn't appear to be increasing. Data in 1982 for the herbaceous understory is limited to species quadrat frequencies. With this in mind, the trend for grasses is slightly up, and the trend for forbs is stable. All grass species increased in quadrat frequency and forbs increased in species composition, but are still rare.

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

1998 TREND ASSESSMENT

Trend for browse is stable. Differences in density of browse species may be related to the larger sample area used in 1998; therefore, trend for browse was determined using other parameters. The proportion of sagebrush displaying poor vigor has increased from 9% in 1992 to 15%. Decadence has declined slightly from 37% to 33%. Reproduction is currently poor, with few seedlings and young plants representing only 2% of the population. Trend for the grasses is slightly down and composition is still considered poor. The sum of nested frequency of perennial grasses has decreased by 20% from 1992 with a significant decrease in the frequency of bottlebrush squirreltail. Annual grasses are dominant on the site with cheatgrass providing 63% of the total herbaceous cover and sixweeks fescue being common on the site. The trend for forbs is up with a three-fold increase in the sum of nested frequency of perennial forbs, but perennial forbs are still lacking.

winter range condition (DCI) - poor (25) Low potential scale
browse - stable (0) grasses - slightly down (-1) forb - up (+2)

2003 TREND ASSESSMENT

This site has been greatly effected by drought which has caused downward trends in most areas. Trend for the key browse species, Wyoming big sagebrush, is down. Total population density declined only 24% yet the remaining shrubs are nearly all decadent and dying. Only 220 relatively healthy mature sagebrush plants/acre were sampled. Decadent plants represented 93% of the 3,680 plants/acre estimated and the proportion of

plants displaying poor vigor increased to 91%. Young recruitment is poor with young plants comprising only 1% of the population. Line-intercept cover of live sagebrush crowns was estimated at only 1.6%. Trend for the grasses is slightly down. Sum of nested frequency for perennial grasses declined by 10% from 1998 levels, and cover decreased from 9% in 1998 to 5%. There was a significant decline in the nested frequency of bottlebrush squirreltail, but there was also a significant decline in the nested frequency of the cheatgrass. Cover of cheatgrass also declined from 18% in 1998 to less than one tenth of 1%. Trend for forbs is down. There was a decrease of 59% in the sum of nested frequency of perennial forbs from 1998, but perennial forbs are rare. During the 2003 reading, fewer forbs were encountered than in 1998 even though average cover remained similar. Most of the cover of forbs was provided by annual species.

winter range condition (DCI) - very poor (7) Low potential scale
browse - down (-2) grass - slightly down (-1) forb - down (-2)

2008 TREND ASSESSMENT

Trend for browse is considered to be slightly up. Density of the primary browse species, Wyoming big sagebrush, has decreased by 28% to 2,660 plants, but the condition of the population has improved. Plants displaying poor vigor has declined from 91% in 2003 to 21%, and decadence has declined from 93% in 2003 to 54%. Reproduction and recruitment have also improved markedly with many seedlings and young plants comprising 15% of the population. The density of narrowleaf low rabbitbrush, considered to be an increaser species, has increased 59% from 2003 to 2,160 plants/acre. Trend for the grasses is up. The sum of nested frequency of perennial grasses increased by 21%, and cover increased from 5% in 2003 to 8%. The nested frequency of bottlebrush squirreltail and cheatgrass both increased significantly. Trend for forbs is slightly up. There was a two-fold increase in the sum of nested frequency of perennial forbs, and cover of perennial forbs increased. The composition of forbs is still poor and dominated by annual species.

winter range condition (DCI) - fair (27) Low potential scale
browse - slightly up (+1) grass - up (+2) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 30 , Study no: 29

Type	Species	Average Cover %						
		'92	'98	'03	'08	'98	'03	'08
G	Bromus tectorum (a)	-	$_{c}$368	$_{a}$35	$_{b}$342	18.18	.09	5.43
G	Hilaria jamesii	$_{a}$124	$_{ab}$151	$_{ab}$147	$_{b}$176	4.36	3.01	5.41
G	Oryzopsis hymenoides	26	30	19	28	1.47	.33	.49
G	Poa secunda	$_{ab}$77	$_{ab}$85	$_{b}$104	$_{a}$63	2.15	1.79	1.00
G	Sitanion hystrix	$_{c}$151	$_{b}$36	$_{a}$1	$_{b}$62	1.02	.00	1.38
G	Vulpia octoflora (a)	-	$_{b}$150	$_{a}$-	$_{a}$7	.98	-	.01
Total for Annual Grasses		0	518	35	349	19.17	0.09	5.44
Total for Perennial Grasses		378	302	271	329	9.01	5.16	8.30
Total for Grasses		378	820	306	678	28.18	5.25	13.75
F	Arabis sp.	-	2	-	-	.03	-	-
F	Astragalus sp.	2	-	-	1	-	-	.03
F	Calochortus flexuosus	$_{a}$3	$_{ab}$16	$_{b}$22	$_{ab}$14	.04	.06	.04
F	Castilleja linariaefolia	$_{a}$-	$_{a}$1	$_{a}$-	$_{b}$12	.03	-	.08
F	Collomia linearis (a)	-	3	-	-	.00	-	-
F	Cryptantha sp.	$_{a}$-	$_{b}$32	$_{a}$-	$_{a}$9	.19	-	.02
F	Cymopterus sp.	$_{a}$-	$_{ab}$9	$_{a}$2	$_{b}$17	.02	.03	.06
F	Descurainia pinnata (a)	-	$_{b}$24	$_{a}$-	$_{a}$-	.08	-	-
F	Draba sp. (a)	-	$_{b}$14	$_{a}$-	$_{a}$-	.05	-	-
F	Eriogonum cernuum (a)	-	-	-	3	-	-	.00
F	Eriogonum sp.	4	2	-	-	.00	-	-
F	Erigeron pumilus	3	7	-	-	.02	-	-
F	Gilia sp. (a)	-	49	27	45	.19	.36	.10
F	Heterotheca villosa	-	-	-	1	-	-	.00
F	Lupinus argenteus	-	4	-	-	.01	-	-
F	Lupinus brevicaulis (a)	-	-	-	8	-	-	.02
F	Navarretia intertexta (a)	-	$_{a}$37	$_{a}$29	$_{b}$164	.07	.10	.37
F	Phlox longifolia	14	22	15	24	.08	.06	.09
F	Sisymbrium altissimum (a)	-	-	-	9	-	-	.04
F	Sphaeralcea grossulariifolia	-	-	-	-	-	-	.03
F	Swertia albomarginata	-	1	-	-	.03	-	-
Total for Annual Forbs		0	127	56	229	0.41	0.46	0.55
Total for Perennial Forbs		26	96	39	78	0.45	0.15	0.35
Total for Forbs		26	223	95	307	0.87	0.62	0.90

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

BROWSE TRENDS --
Management unit 30 , Study no: 29

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'08	'98	'03	'08
B	Artemisia tridentata wyomingensis	89	80	73	11.61	6.51	6.20
B	Chrysothamnus viscidiflorus stenophyllus	32	31	53	1.56	1.24	3.65
B	Chrysothamnus viscidiflorus viscidiflorus	0	0	0	-	1.31	-
B	Ephedra nevadensis	3	3	4	.00	.15	.03
B	Gutierrezia sarothrae	1	0	1	.15	-	.00
B	Juniperus osteosperma	2	4	2	.00	.00	.00
B	Pediocactus simpsonii	8	9	7	.00	.00	.00
B	Opuntia sp.	0	2	0	.91	.71	1.76
B	Pinus monophylla	1	2	1	1.41	1.70	.66
B	Sclerocactus sp.	1	0	0	.00	-	-
Total for Browse		137	131	141	15.65	11.63	12.32

CANOPY COVER, LINE INTERCEPT --
Management unit 30 , Study no: 29

Species	Percent Cover	
	'03	'08
Artemisia tridentata wyomingensis	1.54	8.83
Chrysothamnus viscidiflorus stenophyllus	1.28	4.13
Ephedra nevadensis	.03	.15
Opuntia sp.	.86	1.51
Pinus monophylla	1.54	.96

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 30 , Study no: 29

Species	Average leader growth (in)	
	'03	'08
Artemisia tridentata wyomingensis	1.7	1.5

POINT-QUARTER TREE DATA --
Management unit 30 , Study no: 29

Species	Trees per Acre		
	'98	'03	'08
Juniperus osteosperma	32	57	47
Pinus monophylla	26	31	32

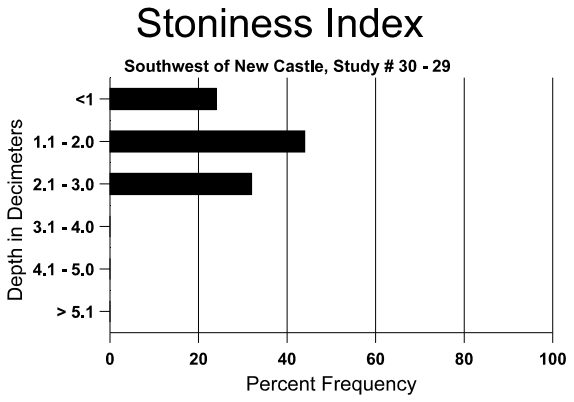
Average diameter (in)		
'98	'03	'08
6.8	3.7	4.0
2.3	3.2	0.9

BASIC COVER --
Management unit 30 , Study no: 29

Cover Type	Average Cover %				
	'82	'92	'98	'03	'08
Vegetation	4.00	24.25	43.79	19.89	28.57
Rock	11.50	10.50	7.65	7.56	6.74
Pavement	0	3.75	22.60	31.62	23.55
Litter	36.50	54.00	30.99	35.59	50.98
Cryptogams	.25	0	.39	.80	.17
Bare Ground	47.75	7.50	18.28	12.09	7.30

SOIL ANALYSIS DATA --
Management unit 30, Study no: 29, Study Name: Southwest of New Castle

Effective rooting depth (in)	Temp °F (depth)	pH	sandy clay loam			%0M	PPM P	PPM K	ds/m
			%sand	%silt	%clay				
15.2	49.0 (16.8)	6.4	54.0	21.4	24.6	1.6	9.4	105.6	0.6



PELLET GROUP DATA --
Management unit 30 , Study no: 29

Type	Quadrat Frequency		
	'98	'03	'08
Rabbit	31	22	93
Deer	54	51	37

Days use per acre (ha)		
'98	'03	'08
-	-	-
68 (168)	58 (144)	102 (251)

BROWSE CHARACTERISTICS --
Management unit 30 , Study no: 29

		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												
82	**3631**	499	533	2399	699	-	3	0	19	-	2	20/33
92	**5798**	99	1533	2099	2166	-	34	57	37	4	9	17/22
98	**4860**	40	100	3160	1600	1380	56	20	33	12	15	16/24
03	**3680**	40	40	220	3420	2440	9	85	93	89	91	13/20
08	**2660**	2640	400	820	1440	2380	37	11	54	21	21	15/23
Chrysothamnus viscidiflorus stenophyllus												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
92	**465**	-	99	366	-	-	0	0	0	-	0	11/11
98	**920**	-	60	860	-	20	0	0	0	-	0	12/18
03	**880**	-	20	300	560	140	0	2	64	41	41	10/13
08	**2160**	540	940	840	380	60	3	3	18	3	3	13/20
Ephedra nevadensis												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
92	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**100**	-	20	80	-	-	80	0	0	-	0	10/21
03	**80**	-	-	80	-	-	0	25	0	-	25	8/12
08	**220**	-	-	-	220	-	0	91	100	18	36	18/24
Gutierrezia sarothrae												
82	**433**	-	-	433	-	-	46	0	-	-	0	8/7
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**40**	20	-	40	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
08	**20**	-	-	20	-	-	0	0	-	-	0	5/4
Juniperus osteosperma												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
92	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**40**	-	40	-	-	-	0	0	0	-	0	-/-
03	**80**	-	80	-	-	-	0	0	0	-	0	-/-
08	**40**	40	20	-	20	-	0	0	50	-	50	9/9

		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)
Opuntia sp.												
82	**33**	-	-	33	-	-	0	0	0	-	0	4/17
92	**66**	-	-	66	-	-	0	0	0	-	0	5/14
98	**220**	-	20	200	-	-	0	0	0	-	0	7/13
03	**200**	-	-	180	20	-	0	0	10	-	10	8/23
08	**180**	-	-	140	40	20	11	0	22	11	11	10/28
Pediocactus simpsonii												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**60**	-	-	60	-	-	0	0	-	-	0	1/3
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Pinus monophylla												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	20	-	-	-	0	0	-	-	0	-/-
03	**40**	-	40	-	-	-	0	0	-	-	50	-/-
08	**20**	-	-	20	-	-	0	0	-	-	0	17/9
Sclerocactus sp.												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	-	20	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	1/2
08	**0**	-	-	-	-	-	0	0	-	-	0	2/2