

Trend Study 16A-12-07

Study site name: Tithing Mountain.

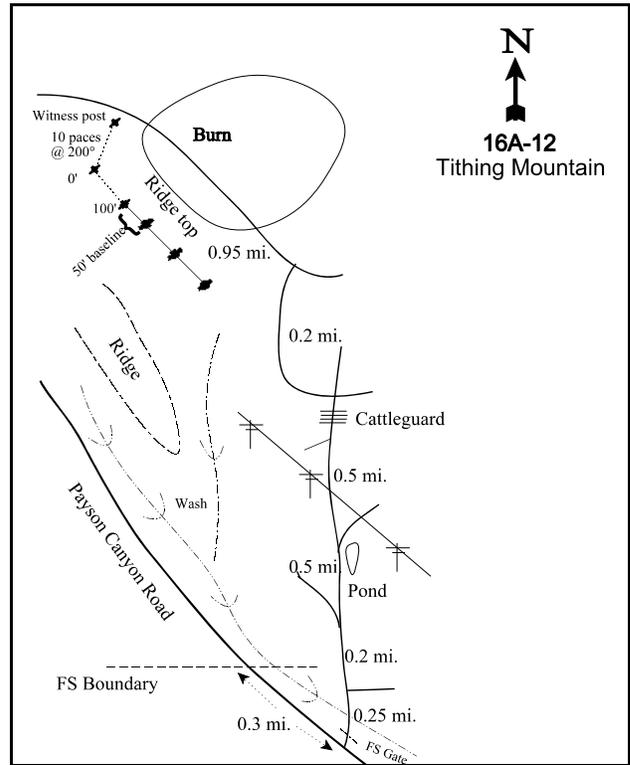
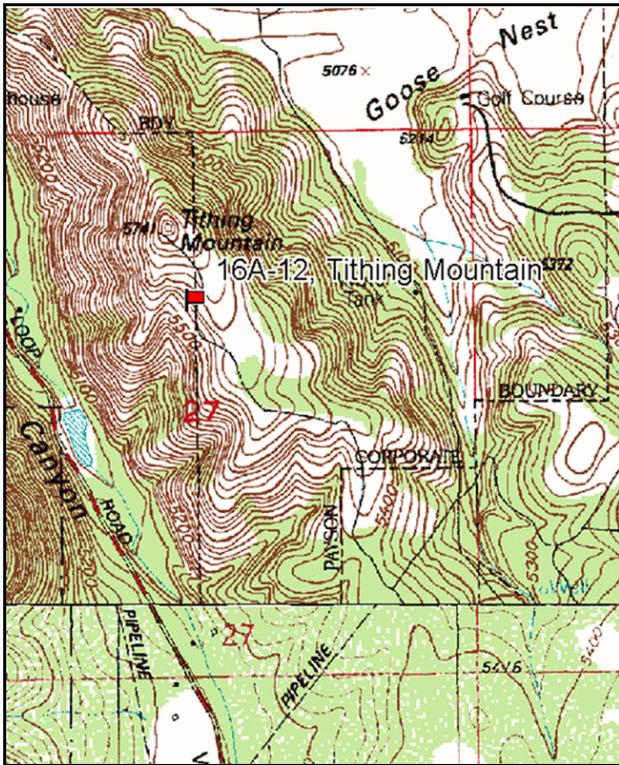
Vegetation type: Stansbury Cliffrose.

Compass bearing: frequency baseline 140 degrees magnetic.

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

LOCATION DESCRIPTION

[A key is needed to get in the gate]. From the old Peteetneet school at 100 North and 600 East in Payson, head south on 600 East which turns into the Payson Canyon Road. Go 2.9 miles to a flood control basin and a wide spot in the road. Either park here, cross the creek, follow the pipeline south to the first draw, then walk approximately 1/2 mile northwest up this draw to the burn, the road and the transect; **OR** continue driving up the Payson Canyon Road another 1.6 miles to the Forest Service boundary. Go another 0.3 miles and take a rough dirt road on the left (north). Go another 0.25 miles to a side road. Stay straight (left) 0.1 miles further until you cross a cattle guard. Go 0.1 miles beyond the cattle guard until you come to an intersection. At the intersection, go straight for 0.5 miles passing a pond (where you stay left) and crossing beneath the powerlines to another fork in the road. Go straight (north) for another 0.5 miles to a 4-way intersection. Stay left (west) and go 0.2 miles to a 3-way intersection where you will turn right (west). Go 0.95 miles to a witness post/rock pile on the left side of the road. From here, the 0-foot baseline stake (marked by browse tag #9083) is 10 paces away at 200 degrees magnetic.



Map Name: Spanish Fork

Diagrammatic Sketch

Township 9S, Range 2E, Section 27

GPS: NAD 83, UTM 12S 440081 E 4429054 N

DISCUSSION

Tithing Mountain - Trend Study No. 16A-12

Study Information

This study was established in 1989 on private land to monitor critical big game winter range southeast of Payson [elevation: 5,700 feet (1,737 m), slope: 17%, aspect: southeast]. The ridge is occupied by a stand of cliffrose (*Cowania mexicana* ssp. *stansburiana*) intermixed with mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Gambel oak (*Quercus gambelii*). The area has been used in the past by wintering deer and elk, as well as domestic sheep and cattle. Deer use was light in 1997 with a pellet group frequency of 7%, which increased to 21% in 2002 and 31% in 2007. Deer use was estimated at 68 days use/acre (167 ddu/ha) in 2002 and 93 days use/acre (230 ddu/ha) in 2007. Elk use was estimated at 3 days use/acre (8 edu/ha) in 2002 and 25 days use/acre (63 edu/ha) in 2007. Cattle use was estimated at 1 day use/acre (2 cdu/ha) in 2007. Sheep use was estimated at 3 days use/acre (7 sdu/ha) in 2002. Three deer were observed during the 2007 reading, and deer bedding areas were noted on and around the site.

Soil

The soil is classified as an association of the Henefer and Rake series (USDA-NRCS 2007). Soils in the Henefer series are very deep and well-drained, and formed in alluvium and colluvium from quartzite and sandstone. The Rake series consists of shallow to lime-cemented hardpan soils that formed in colluvium and local alluvium derived from limestone and minor amounts of quartz. The soil on the site is well-drained and moderately shallow. The texture is a clay loam, and is slightly acidic (pH 6.3). Cobble-sized rocks are common throughout the soil profile. The majority of the ground is covered by vegetation and litter, with very little bare soil exposed. The soil erosion condition was classified as stable in 2002 and 2007.

Browse

The preferred browse is Stansbury cliffrose, which has provided between 76% and 96% of the total browse cover since 1997. Cliffrose density increased from 466 plants/acre (1,151 plants/ha) in 1989 to 760 plants/acre (1,878 plants/ha) when the baseline was extended in 1997, then remained stable at 580 plants/acre (1,433 plants/ha) in 2002 and 2007. The population has remained mostly mature, with decadent plants composing less than 21% of the population. Young recruitment was high at 21% in 1989, but no young plants have been sampled since. The population has been generally vigorous, although during the initial sampling in 1989 it was noted that the older, taller cliffrose had large branches broken down. Mature plants have been measured up to 8.1 feet (2.5 m) in height. Over 50% of the sampled plants have shown moderate-heavy use in all sample years. Annual leader growth averaged 0.8 inches (2.1 cm) in 2002 and 2.7 inches (6.9 cm) in 2007.

Average sagebrush cover has decreased from 3% in 1997 to less than 1% in 2002 and 2007. Density was 666 plants/acre (1,646 plants/ha) in 1989, and has steadily decreased to 100 plants/acre (247 plants/ha) by 2007. The age structure of the population was stable in 1989, with 40% of the population consisting of young plants. Mature plants increased from 58% of the population in 1997 to 83% in 2002. By 2007, all of the sagebrush plants sampled were decadent, and 60% were classified as dying. Vigor was good until 2007, and use was mostly light, with some moderate and heavy hedging. Annual leader growth averaged 2.7 inches (6.9 cm) in 2007.

Herbaceous Understory

The herbaceous understory is abundant, but in poor condition. It is dominated by annuals and low-value perennial weeds. Annual grasses provided 29% cover in 1997, 15% in 2002, and 41% in 2007. Perennial grasses provided only 2% cover in 1997, 6% in 2002, and 12% in 2007. Cheatgrass (*Bromus tectorum*), Japanese brome (*Bromus japonicus*), and bulbous bluegrass (*Poa bulbosa*) comprised 97% of the total grass cover in 1997. Cheatgrass and bulbous bluegrass continued to increase in cover, while Japanese brome decreased. In 2007, cheatgrass and bulbous bluegrass combined provided 48% cover, which was 91% of the

total grass cover. Perennial grasses such as bluebunch wheatgrass (*Agropyron spicatum*), Kentucky bluegrass (*Poa pratensis*), and Sandberg bluegrass (*Poa secunda*), were sampled in low frequencies in 1989 and 1997, but diminished in 2002 and 2007 with the substantial increase in bulbous bluegrass.

Forbs are diverse, and have provided 26% to 35% cover since 1997. However, composition is extremely poor. Whitetop (*Cardaria draba*), a noxious weed, has been sampled since 1989, and provided the majority of the perennial forb cover in 2002 and 2007. Other common perennial species include prickly lettuce (*Lactuca serriola*) and dandelion (*Taraxacum officinale*). Storksbill (*Erodium cicutarium*) has steadily increased in nested frequency and cover since 1997. It comprised 50% of the total forb cover in 2007. Storksbill is an introduced annual, and has been shown to outcompete and prevent the establishment of native species (Buchanan et al. 1978). Bedstraw (*Galium aparine*), another annual, made up 22% of the total forb cover in 1997 and 2002, but decreased to 5% in 2007.

1997 TREND ASSESSMENT

The trend for browse is stable. Cliffrose density increased from 466 plants/acre (1,151 plants/ha) to 760 plants/acre (1,878 plants/ha), however, this increase was partly attributed to the increase in sampling area. The plants were mostly mature, and decadence decreased from 21% to 13% of the population. Young recruitment also decreased from 21% to 0%. Plants showing poor vigor increased from 0% to 8% of the population, and use remained moderate-heavy. Sagebrush density remained stable at 620 plants/acre (1,532 plants/ha). Decadence decreased from 30% to 13% of the population. Recruitment also decreased, but was still high, with 29% of the population composed of young plants. Vigor improved from 15% of the plants displaying poor vigor to only 3%, and use decreased to mostly light. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little, but 97% of the total grass cover was composed of undesirable species. The trend for forbs is up. The sum of nested frequency for perennial forbs, excluding whitetop, increased almost 70%. Prickly lettuce, dandelion, and yellow salsify (*Tragopogon dubius*), all of which are used by big game, increased significantly in nested frequency. However, whitetop also increased significantly in nested frequency. The Desirable Components Index (DCI) was rated as very poor due to low recruitment of preferred browse species, sparse perennial grass cover, high annual grass cover, and the presence of a noxious weed.

winter range condition (DCI) - very poor (29) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - up (+2)

2002 TREND ASSESSMENT

The trend for browse is down. Cliffrose density decreased from 760 plants/acre (1,878 plants/ha) to 580 plants/acre (1,433 plants/ha), although average cover remained stable at 14%. Decadence increased from 13% to 17% of the population, and no young plants were sampled. Plants displaying poor vigor increased from 8% to 14% of the population, and use remained moderate-heavy. Sagebrush density decreased from 620 plants/acre (1,532 plants/ha) to 240 plants/acre (593 plants/ha), and decadence increased from 13% to 17% of the population. Young recruitment declined from 29% to 0% of the population. All of the sampled plants were vigorous, and half of the population showed moderate-heavy use. The trend for grass is down. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 84%, and Sandberg bluegrass decreased significantly in nested frequency. Bulbous bluegrass increased significantly in nested frequency, and its average cover increased from 1% to 6%. Cheatgrass cover also slightly increased from 13% to 15%. The trend for forbs is down. The sum of nested frequency for perennial forbs, excluding whitetop, decreased 17%. Prickly lettuce decreased significantly in nested frequency, while whitetop and storksbill increased significantly in nested frequency. Total forb cover increased from 27% to 35%, but this change was attributed to a large increase in weedy annual forb cover. The DCI rating remained very poor.

winter range condition (DCI) - very poor (30) Mid-level potential scale
browse - down (-2) grass - down (-2) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is stable. Cliffrose density did not change, although its average cover decreased from 14% to 9%. The age structure of the population remained stable and vigor slightly improved, with 10% of the population displaying poor vigor. Use remained moderate-heavy. Sagebrush density continued to decrease from 240 plants/acre (593 plants/ha) to 100 plants/acre (247 plants/ha). All of the plants sampled were decadent, and 60% were classified as dying. Vigor was poor, and 40% of the plants showed heavy use. The trend for grass is down. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 83%. Cheatgrass increased significantly in nested frequency, and its average cover increased from 15% to 36%. Bulbous bluegrass also increased significantly in nested frequency, and its average cover doubled from 6% to 12%. Bluebunch wheatgrass was the only grass species sampled that benefits big game, and was sampled in only one quadrat. The trend for forbs is down. The sum of nested frequency for perennial forbs, excluding whitetop, decreased almost 40%, and dandelion decreased significantly in nested frequency. Storksbill increased significantly in nested frequency, and its average cover increased from 10% to 13%. The majority of forb species, including those of benefit to big game, are weedy exotics. The DCI rating remained very poor, however, the score declined due to the decrease in preferred browse and perennial forb cover, and the increase in noxious weed species sampled.

winter range condition (DCI) - very poor (3) Mid-level potential scale

browse - stable (0)

grass - down (-2)

forb - down (-2)

HERBACEOUS TRENDS --

Management unit 16A, Study no: 12

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	<i>Aegilops cylindrica</i> (a)	-	-	-	2	-	-	.03
G	<i>Agropyron spicatum</i>	_a 10	_a 3	-	_a 1	.03	-	.00
G	<i>Bromus brizaeformis</i> (a)	-	-	-	12	-	-	.05
G	<i>Bromus japonicus</i> (a)	-	_b 297	-	_a 44	15.63	-	.10
G	<i>Bromus tectorum</i> (a)	-	_a 300	_a 267	_b 375	12.92	15.48	35.83
G	<i>Festuca myuros</i> (a)	-	_a 47	-	_b 156	.18	-	4.50
G	<i>Poa bulbosa</i>	-	_a 15	_b 104	_c 167	1.45	5.55	11.68
G	<i>Poa pratensis</i>	_a 5	_a 5	_a 3	-	.03	.00	-
G	<i>Poa secunda</i>	_{ab} 28	_b 30	_a 3	-	.74	.04	-
Total for Annual Grasses		0	644	267	589	28.74	15.48	40.53
Total for Perennial Grasses		43	53	110	168	2.26	5.59	11.69
Total for Grasses		43	697	377	757	31.01	21.08	52.22
F	<i>Agoseris glauca</i>	-	-	-	3	-	-	.00
F	<i>Alyssum alyssoides</i> (a)	-	_b 98	_a 16	_b 67	.56	.05	.18
F	<i>Allium</i> sp.	_a 6	-	_a 2	-	-	.00	-
F	<i>Asclepias asperula</i>	3	-	-	-	-	-	-
F	Boraginaceae (a)	-	-	-	86	-	-	2.43
F	<i>Cardaria draba</i>	_a 49	_b 112	_c 188	_c 176	4.88	7.82	6.57
F	<i>Camelina microcarpa</i> (a)	-	_a 9	_a 9	_a 20	.04	.02	.38

T y p e	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	<i>Calochortus nuttallii</i>	-	a-	a2	-	.00	.00	-
F	<i>Collinsia parviflora</i> (a)	-	b61	b70	a11	.30	.49	.05
F	<i>Cymopterus longipes</i>	a7	a15	a15	a8	.11	.10	.04
F	<i>Epilobium brachycarpum</i> (a)	-	b59	a9	b48	.91	.04	.20
F	<i>Eriogonum brevicaulle</i>	-	-	11	-	-	.02	-
F	<i>Erodium cicutarium</i> (a)	-	a197	b229	c292	4.78	10.46	12.71
F	<i>Erigeron divergens</i>	-	-	3	-	-	.15	-
F	<i>Eriogonum ovalifolium</i>	-	-	2	-	-	.03	-
F	<i>Galium aparine</i> (a)	b104	bc140	c179	a52	6.00	7.63	1.32
F	<i>Helianthus annuus</i> (a)	9	-	-	-	-	-	-
F	<i>Holosteum umbellatum</i> (a)	-	b67	a19	a17	.28	.05	.04
F	<i>Lappula occidentalis</i> (a)	-	-	-	4	-	-	.01
F	<i>Lactuca serriola</i>	b148	c204	a89	a81	5.83	.86	.42
F	<i>Lomatium</i> sp.	-	-	6	-	-	.06	-
F	<i>Medicago sativa</i>	-	2	-	-	.00	-	-
F	<i>Microsteris gracilis</i> (a)	-	a9	-	a1	.01	-	.00
F	<i>Montia perfoliata</i> (a)	-	-	33	-	-	.22	-
F	<i>Phlox longifolia</i>	2	-	-	-	-	-	-
F	<i>Polygonum douglasii</i> (a)	-	a3	a5	a9	.00	.01	.02
F	<i>Ranunculus</i> sp.	-	-	37	-	-	.41	-
F	<i>Ranunculus testiculatus</i> (a)	-	a22	a29	-	.09	.09	-
F	<i>Taraxacum officinale</i>	a3	bc39	c61	ab20	1.21	2.37	.22
F	<i>Tragopogon dubius</i>	a25	b62	ab41	b53	.62	.46	.29
F	Unknown forb-annual (a)	-	a19	b56	-	.38	3.12	-
F	Unknown forb-perennial	-	4	-	-	.38	-	-
F	<i>Veronica biloba</i> (a)	-	a37	a46	a32	.57	.66	.59
F	<i>Zigadenus paniculatus</i>	a1	a3	a3	a2	.00	.00	.00
Total for Annual Forbs		113	721	700	639	13.96	22.86	17.95
Total for Perennial Forbs		244	441	460	343	13.05	12.32	7.57
Total for Forbs		357	1162	1160	982	27.02	35.18	25.53

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

BROWSE TRENDS --

Management unit 16A, Study no: 12

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	28	12	5	2.54	.66	.00
B	Chrysothamnus viscidiflorus viscidiflorus	0	0	1	-	-	-
B	Cowania mexicana stansburiana	32	26	26	13.96	14.17	9.32
B	Opuntia sp.	0	1	1	.03	.15	.00
B	Purshia tridentata	1	0	0	-	-	-
B	Quercus gambelii	1	2	2	1.82	.53	.41
Total for Browse		62	41	35	18.37	15.51	9.75

CANOPY COVER, LINE INTERCEPT --

Management unit 16A, Study no: 12

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	.06	.13
Cowania mexicana stansburiana	1.48	21.16
Quercus gambelii	-	.30
Rosa woodsii	-	.26

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 16A, Study no: 12

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	-	2.7
Cowania mexicana stansburiana	0.8	2.7

BASIC COVER --

Management unit 16A, Study no: 12

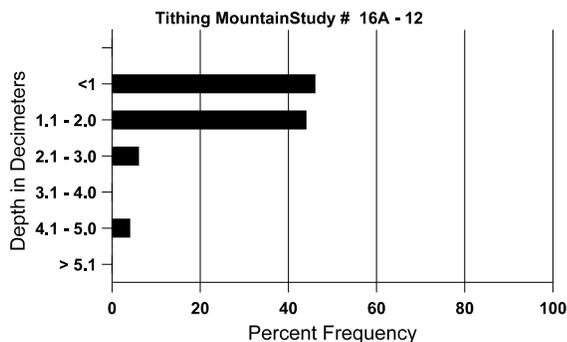
Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	2.50	59.62	64.40	73.30
Rock	5.25	9.61	7.72	9.42
Pavement	.25	3.13	1.05	.20
Litter	84.25	61.15	40.52	32.36
Cryptogams	.75	.06	0	.09
Bare Ground	7.00	3.39	6.54	.83

SOIL ANALYSIS DATA --

Herd Unit 16A, Study no: 12, Tithing Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%OM	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.4	53.6 (12.4)	6.3	38.4	29.1	32.6	3.4	22.0	92.8	.6

Stoniness Index



PELLET GROUP DATA --

Management unit 16A, Study no: 12

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	-	2	4
Elk	-	-	6
Deer	7	21	31
Cattle	-	-	-
Sheep	-	-	-

Days use per acre (ha)	
'02	'07
-	-
3 (8)	25 (63)
68 (167)	93 (230)
-	1 (2)
3 (8)	-

BROWSE CHARACTERISTICS --
Management unit 16A, Study no: 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)
<i>Artemisia tridentata vaseyana</i>												
89	666	-	266	200	200	-	30	20	30	5	15	20/38
97	620	-	180	360	80	180	3	16	13	3	3	24/37
02	240	-	-	200	40	120	25	25	17	-	0	24/31
07	100	-	-	-	100	220	0	40	100	60	60	26/35
<i>Chrysothamnus viscidiflorus viscidiflorus</i>												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	20	-	-	20	-	-	0	0	-	-	0	-/-
<i>Cowania mexicana stansburiana</i>												
89	466	-	100	266	100	-	50	29	21	-	0	56/58
97	760	-	-	660	100	80	26	61	13	8	8	97/105
02	580	-	-	480	100	20	10	48	17	10	14	87/89
07	580	-	-	480	100	20	17	34	17	10	10	97/97
<i>Grayia spinosa</i>												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	103/72
<i>Opuntia sp.</i>												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	20	-	-	20	-	-	0	0	-	-	0	3/7
07	20	-	-	20	-	-	0	0	-	-	0	6/22
<i>Purshia tridentata</i>												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	20	-	-	20	-	-	100	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	-/-
<i>Quercus gambelii</i>												
89	0	-	-	-	-	-	0	0	0	-	0	-/-
97	80	-	-	80	-	-	0	0	0	-	0	37/39
02	140	-	120	-	20	40	0	0	14	-	14	72/56
07	60	-	-	60	-	40	0	0	0	-	0	35/27

		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)
Rosa woodsii												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	73/91
07	0	-	-	-	-	-	0	0	-	-	0	-/-