

# UHURU data set visualization

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## A tip for working with Rmarkdown

The Working Directory inside this Rmarkdown r chunk is the following:

```
getwd()
```

```
## [1] "/Users/avineetkaur/Desktop/Bio197/Bio197/Documents"
```

Note: remember that working directories in a project and an R chunk are not always the same!

## Describing the working data set

UHURU data set

Introduction: The experimental treatment is to characterizing the effects in the system by removing the greatest size classes of herbivores successfully and measure how variation in precipitation regimes measure direction and magnitude of the effects. There are three herbivore-exclusion treatments along with an unfenced control that was applicable to the contiguous 1-ha plots. Mega is the exclusion of giraffes and elephants only, Meso is the exclusion of megaherbivores and mesoherbivores and Total is the exclusion os the exclusion of all herbivores.

The different variables that were measured MEGA, MESO, and TOTAL. The influence of the experimental group is that it clearly organizes all of the data points for MESO, MEGA, OPEN, and TOTAL in a way that can be easily interpreted as we can observe that certain groups possess a higher tree height while some possess a lower height. The acacias in the open plots were removed since the largest class of herbivores were removed from the experiment so there is no data to fill those open plots that are present.

## 2. Reading the data set

We are reading a data set in TSV format. This is a “tab separated values” tab file. To read it into R we use the function `read.csv` `read.csv()` with the `sep` argument `sep =` set to `"\t"` which represents a tab in computer language

```
read.csv(file = "../data raw/ACACIA_DREPANOLOBIUM_SURVEY.txt", sep = "\t")
```

##	SURVEY	YEAR	SITE	BLOCK	TREATMENT	PLOT	ID	HEIGHT	AXIS1	AXIS2	CIRC
## 1	1	2012	SOUTH	1	TOTAL	S1TOTAL	581	2.25	2.75	2.15	20.0
## 2	1	2012	SOUTH	1	TOTAL	S1TOTAL	582	2.65	4.10	3.90	28.0
## 3	1	2012	SOUTH	1	TOTAL	S1TOTAL	3111	1.5	1.70	0.85	17.0
## 4	1	2012	SOUTH	1	TOTAL	S1TOTAL	3112	2.01	1.80	1.60	12.0
## 5	1	2012	SOUTH	1	TOTAL	S1TOTAL	3113	1.75	1.84	1.42	13.0
## 6	1	2012	SOUTH	1	TOTAL	S1TOTAL	3114	1.65	1.62	0.85	15.0

## 7	1	2012	SOUTH	1	TOTAL	S1TOTAL	3115	1.2	1.95	0.90	9.0
## 8	1	2012	SOUTH	1	TOTAL	S1TOTAL	3199	1.45	2.00	1.75	12.2
## 9	1	2012	SOUTH	1	MESO	S1MESO	941	1.87	2.15	1.82	13.0
## 10	1	2012	SOUTH	1	MESO	S1MESO	942	2.38	5.55	4.82	35.0
## 11	1	2012	SOUTH	1	MESO	S1MESO	943	2.58	4.90	4.24	24.0
## 12	1	2012	SOUTH	1	MESO	S1MESO	944	2.65	3.75	3.10	27.0
## 13	1	2012	SOUTH	1	MESO	S1MESO	946	2.35	2.34	2.05	20.0
## 14	1	2012	SOUTH	1	MESO	S1MESO	947	1.88	2.10	1.85	28.0
## 15	1	2012	SOUTH	1	MESO	S1MESO	3116	2.32	3.05	2.63	30.0
## 16	1	2012	SOUTH	1	MESO	S1MESO	3117	2.39	2.21	2.10	13.0
## 17	1	2012	SOUTH	1	MESO	S1MESO	3118	2.2	1.80	1.50	10.0
## 18	1	2012	SOUTH	1	MESO	S1MESO	3119	1.05	0.90	0.55	8.0
## 19	1	2012	SOUTH	1	MESO	S1MESO	3120	2	1.25	1.20	10.0
## 20	1	2012	SOUTH	1	MESO	S1MESO	3131	1.28	1.14	1.00	10.0
## 21	1	2012	SOUTH	2	OPEN	S2OPEN	341	dead	NA	NA	NA
## 22	1	2012	SOUTH	2	TOTAL	S2TOTAL	3178	1.4	2.50	2.15	18.0
## 23	1	2012	SOUTH	2	TOTAL	S2TOTAL	101	1.9	3.31	2.65	15.0
## 24	1	2012	SOUTH	2	TOTAL	S2TOTAL	102	1.75	2.70	2.55	16.0
## 25	1	2012	SOUTH	2	TOTAL	S2TOTAL	103	1.8	2.75	2.30	16.0
## 26	1	2012	SOUTH	2	TOTAL	S2TOTAL	104	2.7	4.05	4.00	35.2
## 27	1	2012	SOUTH	2	TOTAL	S2TOTAL	105	2.02	2.85	1.49	17.0
## 28	1	2012	SOUTH	2	TOTAL	S2TOTAL	108	1.9	3.10	2.85	19.0
## 29	1	2012	SOUTH	2	TOTAL	S2TOTAL	109	1.85	2.45	1.90	19.0
## 30	1	2012	SOUTH	2	TOTAL	S2TOTAL	110	1.65	1.90	1.54	17.0
## 31	1	2012	SOUTH	2	TOTAL	S2TOTAL	111	1.4	2.35	1.45	14.0
## 32	1	2012	SOUTH	2	TOTAL	S2TOTAL	113	2.5	3.25	2.30	22.0
## 33	1	2012	SOUTH	2	TOTAL	S2TOTAL	115	2.05	5.40	4.50	33.0
## 34	1	2012	SOUTH	2	TOTAL	S2TOTAL	116	2.26	3.50	3.10	33.0
## 35	1	2012	SOUTH	2	TOTAL	S2TOTAL	117	2.13	2.40	2.30	20.0
## 36	1	2012	SOUTH	2	TOTAL	S2TOTAL	118	1.8	3.15	2.55	22.0
## 37	1	2012	SOUTH	2	TOTAL	S2TOTAL	1211	1.85	2.00	2.27	20.0
## 38	1	2012	SOUTH	2	TOTAL	S2TOTAL	1212	1.5	2.15	1.80	15.0
## 39	1	2012	SOUTH	2	TOTAL	S2TOTAL	1213	1.87	2.34	2.05	13.0
## 40	1	2012	SOUTH	2	TOTAL	S2TOTAL	1214	1.58	1.28	0.75	11.0
## 41	1	2012	SOUTH	2	TOTAL	S2TOTAL	1215	2.05	2.10	1.75	17.0
## 42	1	2012	SOUTH	2	TOTAL	S2TOTAL	1216	1.75	2.45	3.28	16.0
## 43	1	2012	SOUTH	2	TOTAL	S2TOTAL	1217	1.49	1.50	1.45	13.0
## 44	1	2012	SOUTH	2	TOTAL	S2TOTAL	1218	1.28	2.00	0.90	10.0
## 45	1	2012	SOUTH	2	TOTAL	S2TOTAL	1219	1.49	2.35	1.65	13.0
## 46	1	2012	SOUTH	2	TOTAL	S2TOTAL	1220	1.07	1.20	0.95	11.0
## 47	1	2012	SOUTH	2	TOTAL	S2TOTAL	1231	1.48	1.25	1.20	9.0
## 48	1	2012	SOUTH	2	TOTAL	S2TOTAL	1232	1.25	1.25	0.90	10.0
## 49	1	2012	SOUTH	2	TOTAL	S2TOTAL	1233	1.41	1.41	1.40	14.0
## 50	1	2012	SOUTH	2	TOTAL	S2TOTAL	1234	1.6	1.60	1.30	13.0
## 51	1	2012	SOUTH	2	TOTAL	S2TOTAL	1235	1.2	1.20	1.30	14.0
## 52	1	2012	SOUTH	2	TOTAL	S2TOTAL	1236	1.49	1.49	1.20	8.0
## 53	1	2012	SOUTH	2	TOTAL	S2TOTAL	1237	1.5	1.50	1.50	14.0
## 54	1	2012	SOUTH	2	TOTAL	S2TOTAL	1238	1.65	1.65	2.00	20.0
## 55	1	2012	SOUTH	2	TOTAL	S2TOTAL	1239	1.13	1.13	1.20	10.0
## 56	1	2012	SOUTH	2	TOTAL	S2TOTAL	1240	1.25	1.25	0.90	10.0
## 57	1	2012	SOUTH	2	TOTAL	S2TOTAL	1251	1.1	1.20	1.10	10.0
## 58	1	2012	SOUTH	2	TOTAL	S2TOTAL	1252	2.2	2.70	2.40	25.0
## 59	1	2012	SOUTH	2	TOTAL	S2TOTAL	1253	1.45	1.65	1.25	10.0
## 60	1	2012	SOUTH	2	TOTAL	S2TOTAL	1254	1.6	2.45	2.10	13.0

## 61	1	2012	SOUTH	2	TOTAL	S2TOTAL	1255	1.55	2.40	1.80	13.0
## 62	1	2012	SOUTH	2	TOTAL	S2TOTAL	1256	1.5	2.40	2.15	13.0
## 63	1	2012	SOUTH	2	TOTAL	S2TOTAL	1257	1.03	1.20	1.00	10.0
## 64	1	2012	SOUTH	2	TOTAL	S2TOTAL	1258	2.14	1.90	1.70	13.0
## 65	1	2012	SOUTH	2	TOTAL	S2TOTAL	1259	1.2	1.90	1.65	12.0
## 66	1	2012	SOUTH	2	TOTAL	S2TOTAL	1260	1.05	1.10	1.00	9.0
## 67	1	2012	SOUTH	2	TOTAL	S2TOTAL	2131	1.8	2.60	2.40	15.0
## 68	1	2012	SOUTH	2	TOTAL	S2TOTAL	2132	1.2	1.00	0.95	7.0
## 69	1	2012	SOUTH	2	TOTAL	S2TOTAL	2133	1.75	1.40	1.10	10.0
## 70	1	2012	SOUTH	2	TOTAL	S2TOTAL	2134	1.45	3.10	1.80	10.0
## 71	1	2012	SOUTH	2	TOTAL	S2TOTAL	2135	1.17	1.20	1.10	5.0
## 72	1	2012	SOUTH	2	TOTAL	S2TOTAL	2136	2.15	3.10	2.58	22.0
## 73	1	2012	SOUTH	2	TOTAL	S2TOTAL	2137	1.7	1.70	1.40	12.0
## 74	1	2012	SOUTH	2	TOTAL	S2TOTAL	3132	1.98	2.85	2.70	12.0
## 75	1	2012	SOUTH	2	TOTAL	S2TOTAL	3133	1.26	1.95	1.75	17.0
## 76	1	2012	SOUTH	2	TOTAL	S2TOTAL	3134	1.11	1.95	1.50	10.0
## 77	1	2012	SOUTH	2	TOTAL	S2TOTAL	3135	1.14	1.32	1.05	10.0
## 78	1	2012	SOUTH	2	TOTAL	S2TOTAL	3136	1.26	1.60	1.40	10.0
## 79	1	2012	SOUTH	2	TOTAL	S2TOTAL	3137	1.3	1.40	0.80	10.0
## 80	1	2012	SOUTH	2	TOTAL	S2TOTAL	3138	1.29	1.44	1.35	13.0
## 81	1	2012	SOUTH	2	TOTAL	S2TOTAL	3139	1.31	1.35	1.15	7.0
## 82	1	2012	SOUTH	2	TOTAL	S2TOTAL	3140	1.15	1.70	1.28	10.0
## 83	1	2012	SOUTH	2	TOTAL	S2TOTAL	3151	1.87	3.40	1.85	15.0
## 84	1	2012	SOUTH	2	TOTAL	S2TOTAL	3152	1.47	2.10	1.61	8.0
## 85	1	2012	SOUTH	2	TOTAL	S2TOTAL	3153	1.05	1.79	1.50	10.0
## 86	1	2012	SOUTH	2	TOTAL	S2TOTAL	3154	2.1	4.90	3.75	25.0
## 87	1	2012	SOUTH	2	TOTAL	S2TOTAL	3155	1.99	1.80	1.35	13.0
## 88	1	2012	SOUTH	2	TOTAL	S2TOTAL	3156	1.42	1.90	1.80	14.0
## 89	1	2012	SOUTH	2	TOTAL	S2TOTAL	3157	1.5	2.11	1.75	12.0
## 90	1	2012	SOUTH	2	TOTAL	S2TOTAL	3158	1.06	1.05	0.85	4.0
## 91	1	2012	SOUTH	2	TOTAL	S2TOTAL	3159	1.49	1.50	1.15	13.0
## 92	1	2012	SOUTH	2	TOTAL	S2TOTAL	3160	1.8	1.60	1.50	14.0
## 93	1	2012	SOUTH	2	TOTAL	S2TOTAL	3171	1.93	1.74	1.20	14.0
## 94	1	2012	SOUTH	2	TOTAL	S2TOTAL	3172	1.2	1.60	1.30	10.0
## 95	1	2012	SOUTH	2	TOTAL	S2TOTAL	3173	1.65	1.25	1.10	11.0
## 96	1	2012	SOUTH	2	TOTAL	S2TOTAL	3174	1.52	1.49	1.10	12.0
## 97	1	2012	SOUTH	2	TOTAL	S2TOTAL	3175	1.43	2.05	1.54	13.0
## 98	1	2012	SOUTH	2	TOTAL	S2TOTAL	3176	1.25	1.40	1.25	13.0
## 99	1	2012	SOUTH	2	TOTAL	S2TOTAL	3177	1.88	2.65	2.64	20.0
## 100	1	2012	SOUTH	2	TOTAL	S2TOTAL	3179	1.03	1.40	0.60	13.0
## 101	1	2012	SOUTH	2	TOTAL	S2TOTAL	3180	1.1	1.30	1.20	10.0
## 102	1	2012	SOUTH	2	TOTAL	S2TOTAL	3191	1.4	1.05	1.00	10.0
## 103	1	2012	SOUTH	2	TOTAL	S2TOTAL	3192	1.05	1.55	0.90	10.0
## 104	1	2012	SOUTH	2	TOTAL	S2TOTAL	3193	1.18	1.20	1.00	7.0
## 105	1	2012	SOUTH	2	TOTAL	S2TOTAL	3194	1.4	1.30	1.85	13.0
## 106	1	2012	SOUTH	2	TOTAL	S2TOTAL	3195	1.37	2.67	2.19	19.0
## 107	1	2012	SOUTH	2	TOTAL	S2TOTAL	3196	1.32	2.15	1.55	11.0
## 108	1	2012	SOUTH	2	MEGA	S2MEGA	182	1.55	2.20	1.20	20.0
## 109	1	2012	SOUTH	2	MEGA	S2MEGA	183	1.3	1.80	0.90	8.0
## 110	1	2012	SOUTH	2	MEGA	S2MEGA	184	1.24	1.20	1.20	25.0
## 111	1	2012	SOUTH	2	MEGA	S2MEGA	185	1.5	2.10	1.75	16.0
## 112	1	2012	SOUTH	2	MEGA	S2MEGA	186	1.65	2.50	2.20	15.0
## 113	1	2012	SOUTH	2	MEGA	S2MEGA	187	2.17	2.00	1.20	15.0
## 114	1	2012	SOUTH	2	MEGA	S2MEGA	188	1.28	1.60	1.50	10.0

## 115	1	2012	SOUTH	2	MEGA	S2MEGA	189	1.07	1.50	1.50	10.0
## 116	1	2012	SOUTH	2	MEGA	S2MEGA	190	0.67	1.00	0.80	8.0
## 117	1	2012	SOUTH	2	MEGA	S2MEGA	191	0.68	0.70	0.60	4.0
## 118	1	2012	SOUTH	2	MEGA	S2MEGA	192	1.87	1.60	1.40	9.0
## 119	1	2012	SOUTH	2	MEGA	S2MEGA	193	1.35	1.90	1.50	14.0
## 120	1	2012	SOUTH	2	MEGA	S2MEGA	194	1.75	2.10	2.10	15.0
## 121	1	2012	SOUTH	2	MESO	S2MESO	462	1.75	3.30	2.50	23.0
## 122	1	2012	SOUTH	2	MESO	S2MESO	463	1.64	2.30	2.00	14.0
## 123	1	2012	SOUTH	2	MESO	S2MESO	2138	1.42	0.90	0.80	10.0
## 124	1	2012	SOUTH	3	OPEN	S3OPEN	1301	dead	NA	NA	NA
## 125	1	2012	SOUTH	3	OPEN	S3OPEN	1302	0.9	1.30	1.10	11.0
## 126	1	2012	SOUTH	3	TOTAL	S3TOTAL	1061	dead	NA	NA	NA
## 127	1	2012	SOUTH	3	TOTAL	S3TOTAL	1062	1.8	2.60	2.60	15.0
## 128	1	2012	SOUTH	3	TOTAL	S3TOTAL	1063	2.47	3.10	2.20	18.0
## 129	1	2012	SOUTH	3	TOTAL	S3TOTAL	1064	2.15	1.60	1.10	17.0
## 130	1	2012	SOUTH	3	TOTAL	S3TOTAL	1066	1.7	2.50	2.15	15.0
## 131	1	2012	SOUTH	3	TOTAL	S3TOTAL	1066	1.9	1.80	1.50	20.0
## 132	1	2012	SOUTH	3	TOTAL	S3TOTAL	1067	1.95	2.10	1.90	13.0
## 133	1	2012	SOUTH	3	TOTAL	S3TOTAL	1068	1.8	1.70	1.40	13.0
## 134	1	2012	SOUTH	3	TOTAL	S3TOTAL	1069	1.4	2.00	1.60	14.0
## 135	1	2012	SOUTH	3	TOTAL	S3TOTAL	1070	1	1.30	1.20	7.0
## 136	1	2012	SOUTH	3	TOTAL	S3TOTAL	2139	1.75	1.20	1.10	13.0
## 137	1	2012	SOUTH	3	TOTAL	S3TOTAL	2140	1.28	1.50	0.95	4.0
## 138	1	2012	SOUTH	3	TOTAL	S3TOTAL	2151	1	1.40	1.20	4.0
## 139	1	2012	SOUTH	3	TOTAL	S3TOTAL	2152	1.45	1.50	1.30	10.0
## 140	1	2012	SOUTH	3	TOTAL	S3TOTAL	2153	1	1.00	0.75	8.0
## 141	1	2012	SOUTH	3	TOTAL	S3TOTAL	2154	1.03	1.00	0.90	6.0
## 142	1	2012	SOUTH	3	TOTAL	S3TOTAL	2155	1.51	2.00	1.80	12.0
## 143	1	2012	SOUTH	3	TOTAL	S3TOTAL	2156	1.17	1.10	0.90	10.0
## 144	1	2012	SOUTH	3	TOTAL	S3TOTAL	2157	1.33	1.90	1.85	14.0
## 145	1	2012	SOUTH	3	TOTAL	S3TOTAL	2158	1.3	1.10	0.85	8.0
## 146	1	2012	SOUTH	3	TOTAL	S3TOTAL	2159	1.13	1.10	0.90	10.0
## 147	1	2012	SOUTH	3	TOTAL	S3TOTAL	2160	1.58	1.40	1.40	13.0
## 148	1	2012	SOUTH	3	TOTAL	S3TOTAL	2171	1.06	1.40	1.00	5.0
## 149	1	2012	SOUTH	3	TOTAL	S3TOTAL	2172	1.05	1.40	0.95	7.0
## 150	1	2012	SOUTH	3	TOTAL	S3TOTAL	2173	1.45	1.60	1.10	6.0
## 151	1	2012	SOUTH	3	TOTAL	S3TOTAL	2174	1.15	1.10	0.90	5.0
## 152	1	2012	SOUTH	3	TOTAL	S3TOTAL	2175	1.42	1.45	1.30	13.0
## 153	1	2012	SOUTH	3	TOTAL	S3TOTAL	2176	1.02	1.20	1.00	8.0
## 154	1	2012	SOUTH	3	TOTAL	S3TOTAL	2177	1.4	1.20	1.00	9.0
## 155	1	2012	SOUTH	3	TOTAL	S3TOTAL	2178	1.45	2.10	2.05	15.0
## 156	1	2012	SOUTH	3	MESO	S3MESO	1421	1.95	2.20	1.60	13.0
## 157	1	2012	SOUTH	3	MESO	S3MESO	1422	dead	NA	NA	NA
##	FLOWERS	BUDS	FRUITS	ANT							
## 1	0	0	10	CS							
## 2	0	0	150	TP							
## 3	2	1	50	TP							
## 4	0	0	75	CS							
## 5	0	0	20	CS							
## 6	0	0	0	E							
## 7	0	0	0	CS							
## 8	0	0	25	CS							
## 9	0	0	0	TP							
## 10	0	0	50	TP							

## 11	0	0	5	CS
## 12	0	0	60	TP
## 13	0	0	60	TP
## 14	2	0	60	CS
## 15	2	0	0	CS
## 16	0	0	0	TP
## 17	0	0	0	TP
## 18	0	0	0	CS
## 19	0	0	0	CM
## 20	0	0	0	TP
## 21	NA	NA	NA	
## 22	0	0	5	CS
## 23	0	0	45	CS
## 24	40	50	35	CS
## 25	8	2	65	CS
## 26	0	0	20	TP
## 27	0	0	70	CS
## 28	0	0	125	CM
## 29	0	0	200	CM
## 30	0	0	10	CS
## 31	0	0	0	CS
## 32	0	0	35	TP
## 33	0	0	300	CM
## 34	2	2	100	CS
## 35	0	0	30	CM
## 36	0	0	50	TP
## 37	0	0	10	CM
## 38	0	0	25	CS
## 39	0	0	15	TP
## 40	0	0	0	TP
## 41	0	0	15	TP
## 42	0	0	0	TP
## 43	0	0	40	TP
## 44	0	0	0	TP
## 45	0	0	15	CM
## 46	0	0	0	CM
## 47	0	0	0	TP
## 48	0	0	0	TP
## 49	0	0	1	TP
## 50	0	0	20	TP
## 51	0	0	0	TP
## 52	0	0	0	TP
## 53	0	0	20	TP
## 54	0	0	0	TP
## 55	0	0	0	CN
## 56	0	0	0	CN
## 57	0	0	0	TP
## 58	0	0	5	TP
## 59	0	0	0	TP
## 60	0	0	25	TP
## 61	0	0	25	TP
## 62	0	0	20	TP
## 63	0	0	0	TP
## 64	0	0	10	CS

## 65	1	0	25	CS
## 66	0	0	0	TP
## 67	0	0	10	TP
## 68	0	0	0	TP
## 69	0	0	0	TP
## 70	0	0	0	TP
## 71	0	0	0	TP
## 72	0	0	0	CS
## 73	0	0	0	CS
## 74	0	0	25	AB_TP
## 75	0	0	0	TP
## 76	0	0	0	TP
## 77	0	0	0	TP
## 78	0	0	0	CS
## 79	0	0	0	CS
## 80	0	0	0	CS
## 81	0	0	0	CS
## 82	0	0	5	CS
## 83	6	0	0	CS
## 84	0	0	0	CS
## 85	0	0	1	CS
## 86	0	0	25	CS
## 87	0	0	0	CS
## 88	0	0	0	CS
## 89	0	0	10	CS
## 90	0	0	0	CS
## 91	0	0	35	CS
## 92	0	0	0	CS
## 93	0	0	0	CS
## 94	0	0	0	CS
## 95	0	0	0	CS
## 96	0	0	20	CS
## 97	0	0	0	CS
## 98	0	0	0	CM
## 99	0	0	100	CM
## 100	0	0	0	CS
## 101	0	0	0	CS
## 102	0	0	0	CS
## 103	0	0	0	CM
## 104	0	0	0	TP
## 105	0	0	30	CS
## 106	0	0	50	TP
## 107	0	0	10	CS
## 108	0	0	0	CS
## 109	0	0	15	CS
## 110	0	0	10	CS
## 111	5	0	200	CS
## 112	0	0	80	CS
## 113	0	0	150	TP
## 114	0	0	40	TP
## 115	0	0	60	TP
## 116	0	0	0	CS
## 117	0	0	0	TP
## 118	0	0	40	CS

```
## 119      0      0      20      CS
## 120      0      0      75      TP
## 121      0      0      20      CM
## 122      0      0       0      TP
## 123      0      0       0       E
## 124     NA     NA      NA
## 125      0      0       0      TP
## 126     NA     NA      NA
## 127      0      0      50      TP
## 128      0      0       0      TP
## 129      0      0       0      TP
## 130      0      0       2      TP
## 131      0      0      25      TP
## 132      0      0       0      TP
## 133      0      0       0      TP
## 134      0      0       0      TP
## 135      0      0       0      TP
## 136      0      0       0      TP
## 137      0      0       0      TP
## 138      0      0       0      TP
## 139      0      0       0      TP
## 140      0      0       0      TP
## 141      0      0       0      TP
## 142      0      0       0      TP
## 143      0      0       0      TP
## 144      0      0       0      TP
## 145      0      0       0      TP
## 146      0      0       0      TP
## 147      0      0       0      TP
## 148      0      0       8      TP
## 149      0      0       0      TP
## 150      0      0       0      TP
## 151      0      0       0      TP
## 152      0      0       0      TP
## 153      0      0       0      TP
## 154      0      0       0      TP
## 155      0      0      20      TP
## 156      0      0       2      CS
## 157     NA     NA      NA
```

Assign the data to a variable so we can work with it

```
acacia <- read.csv(file = "../data raw/ACACIA_DREPANOLOBIUM_SURVEY.txt", sep = "\t")
```

### Accessing elements of a `data.frame`

It is similar to what we do for vectors, but we have two dimensions

```
acacia[,6]
```

```
##      [1] "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL"
##      [8] "S1TOTAL" "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"
##     [15] "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S1MESO"  "S2OPEN"
```

```
## [22] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [29] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [36] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [43] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [50] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [57] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [64] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [71] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [78] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [85] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [92] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [99] "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL" "S2TOTAL"
## [106] "S2TOTAL" "S2TOTAL" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA"
## [113] "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA" "S2MEGA"
## [120] "S2MEGA" "S2MESO" "S2MESO" "S2MESO" "S3OPEN" "S3OPEN" "S3TOTAL" "S3TOTAL"
## [127] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [134] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [141] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [148] "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL" "S3TOTAL"
## [155] "S3TOTAL" "S3MESO" "S3MESO"
```

```
str(acacia)
```

```
## 'data.frame': 157 obs. of 15 variables:
## $ SURVEY : int 1 1 1 1 1 1 1 1 1 1 ...
## $ YEAR : int 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
## $ SITE : chr "SOUTH" "SOUTH" "SOUTH" "SOUTH" ...
## $ BLOCK : int 1 1 1 1 1 1 1 1 1 1 ...
## $ TREATMENT: chr "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
## $ PLOT : chr "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" ...
## $ ID : int 581 582 3111 3112 3113 3114 3115 3199 941 942 ...
## $ HEIGHT : chr "2.25" "2.65" "1.5" "2.01" ...
## $ AXIS1 : num 2.75 4.1 1.7 1.8 1.84 1.62 1.95 2 2.15 5.55 ...
## $ AXIS2 : num 2.15 3.9 0.85 1.6 1.42 0.85 0.9 1.75 1.82 4.82 ...
## $ CIRC : num 20 28 17 12 13 15 9 12.2 13 35 ...
## $ FLOWERS : int 0 0 2 0 0 0 0 0 0 0 ...
## $ BUDS : int 0 0 1 0 0 0 0 0 0 0 ...
## $ FRUITS : int 10 150 50 75 20 0 0 25 0 50 ...
## $ ANT : chr "CS" "TP" "TP" "CS" ...
```

```
numbers <- 1:10
numbers
```

```
## [1] 1 2 3 4 5 6 7 8 9 10
```

```
numbers[3:6]
```

```
## [1] 3 4 5 6
```

```
numbers[c(1,5,7,3)]
```

```
## [1] 1 5 7 3
```



```
acacia$SURVEY
```

```
acacia[,1]
```

```
acacia[, "SURVEY"]
```

#Replacing elements in a data. frame First we locate the elements

```
numbers[5] <- 100
```

Check that everything is the correct class

```
head(acacia)
```

9

```
str(acacia)
```

```
## 'data.frame': 157 obs. of 15 variables:
## $ SURVEY : int 1 1 1 1 1 1 1 1 1 1 ...
## $ YEAR : int 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 ...
## $ SITE : chr "SOUTH" "SOUTH" "SOUTH" "SOUTH" ...
## $ BLOCK : int 1 1 1 1 1 1 1 1 1 1 ...
## $ TREATMENT: chr "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
## $ PLOT : chr "S1TOTAL" "S1TOTAL" "S1TOTAL" "S1TOTAL" ...
## $ ID : int 581 582 3111 3112 3113 3114 3115 3199 941 942 ...
## $ HEIGHT : chr "2.25" "2.65" "1.5" "2.01" ...
## $ AXIS1 : num 2.75 4.1 1.7 1.8 1.84 1.62 1.95 2 2.15 5.55 ...
## $ AXIS2 : num 2.15 3.9 0.85 1.6 1.42 0.85 0.9 1.75 1.82 4.82 ...
## $ CIRC : num 20 28 17 12 13 15 9 12.2 13 35 ...
## $ FLOWERS : int 0 0 2 0 0 0 0 0 0 0 ...
## $ BUDS : int 0 0 1 0 0 0 0 0 0 0 ...
## $ FRUITS : int 10 150 50 75 20 0 0 25 0 50 ...
## $ ANT : chr "CS" "TP" "TP" "CS" ...
```

```
acacia
```

	SURVEY	YEAR	SITE	BLOCK	TREATMENT	PLOT	ID	HEIGHT	AXIS1	AXIS2	CIRC
## 1	1	2012	SOUTH	1	TOTAL	S1TOTAL	581	2.25	2.75	2.15	20.0
## 2	1	2012	SOUTH	1	TOTAL	S1TOTAL	582	2.65	4.10	3.90	28.0
## 3	1	2012	SOUTH	1	TOTAL	S1TOTAL	3111	1.5	1.70	0.85	17.0
## 4	1	2012	SOUTH	1	TOTAL	S1TOTAL	3112	2.01	1.80	1.60	12.0
## 5	1	2012	SOUTH	1	TOTAL	S1TOTAL	3113	1.75	1.84	1.42	13.0
## 6	1	2012	SOUTH	1	TOTAL	S1TOTAL	3114	1.65	1.62	0.85	15.0
## 7	1	2012	SOUTH	1	TOTAL	S1TOTAL	3115	1.2	1.95	0.90	9.0
## 8	1	2012	SOUTH	1	TOTAL	S1TOTAL	3199	1.45	2.00	1.75	12.2
## 9	1	2012	SOUTH	1	MESO	S1MESO	941	1.87	2.15	1.82	13.0
## 10	1	2012	SOUTH	1	MESO	S1MESO	942	2.38	5.55	4.82	35.0
## 11	1	2012	SOUTH	1	MESO	S1MESO	943	2.58	4.90	4.24	24.0
## 12	1	2012	SOUTH	1	MESO	S1MESO	944	2.65	3.75	3.10	27.0
## 13	1	2012	SOUTH	1	MESO	S1MESO	946	2.35	2.34	2.05	20.0
## 14	1	2012	SOUTH	1	MESO	S1MESO	947	1.88	2.10	1.85	28.0
## 15	1	2012	SOUTH	1	MESO	S1MESO	3116	2.32	3.05	2.63	30.0
## 16	1	2012	SOUTH	1	MESO	S1MESO	3117	2.39	2.21	2.10	13.0
## 17	1	2012	SOUTH	1	MESO	S1MESO	3118	2.2	1.80	1.50	10.0
## 18	1	2012	SOUTH	1	MESO	S1MESO	3119	1.05	0.90	0.55	8.0
## 19	1	2012	SOUTH	1	MESO	S1MESO	3120	2	1.25	1.20	10.0
## 20	1	2012	SOUTH	1	MESO	S1MESO	3131	1.28	1.14	1.00	10.0
## 21	1	2012	SOUTH	2	OPEN	S2OPEN	341	dead	NA	NA	NA
## 22	1	2012	SOUTH	2	TOTAL	S2TOTAL	3178	1.4	2.50	2.15	18.0
## 23	1	2012	SOUTH	2	TOTAL	S2TOTAL	101	1.9	3.31	2.65	15.0
## 24	1	2012	SOUTH	2	TOTAL	S2TOTAL	102	1.75	2.70	2.55	16.0
## 25	1	2012	SOUTH	2	TOTAL	S2TOTAL	103	1.8	2.75	2.30	16.0
## 26	1	2012	SOUTH	2	TOTAL	S2TOTAL	104	2.7	4.05	4.00	35.2
## 27	1	2012	SOUTH	2	TOTAL	S2TOTAL	105	2.02	2.85	1.49	17.0
## 28	1	2012	SOUTH	2	TOTAL	S2TOTAL	108	1.9	3.10	2.85	19.0
## 29	1	2012	SOUTH	2	TOTAL	S2TOTAL	109	1.85	2.45	1.90	19.0
## 30	1	2012	SOUTH	2	TOTAL	S2TOTAL	110	1.65	1.90	1.54	17.0
## 31	1	2012	SOUTH	2	TOTAL	S2TOTAL	111	1.4	2.35	1.45	14.0

## 32	1	2012	SOUTH	2	TOTAL S2TOTAL	113	2.5	3.25	2.30	22.0
## 33	1	2012	SOUTH	2	TOTAL S2TOTAL	115	2.05	5.40	4.50	33.0
## 34	1	2012	SOUTH	2	TOTAL S2TOTAL	116	2.26	3.50	3.10	33.0
## 35	1	2012	SOUTH	2	TOTAL S2TOTAL	117	2.13	2.40	2.30	20.0
## 36	1	2012	SOUTH	2	TOTAL S2TOTAL	118	1.8	3.15	2.55	22.0
## 37	1	2012	SOUTH	2	TOTAL S2TOTAL	1211	1.85	2.00	2.27	20.0
## 38	1	2012	SOUTH	2	TOTAL S2TOTAL	1212	1.5	2.15	1.80	15.0
## 39	1	2012	SOUTH	2	TOTAL S2TOTAL	1213	1.87	2.34	2.05	13.0
## 40	1	2012	SOUTH	2	TOTAL S2TOTAL	1214	1.58	1.28	0.75	11.0
## 41	1	2012	SOUTH	2	TOTAL S2TOTAL	1215	2.05	2.10	1.75	17.0
## 42	1	2012	SOUTH	2	TOTAL S2TOTAL	1216	1.75	2.45	3.28	16.0
## 43	1	2012	SOUTH	2	TOTAL S2TOTAL	1217	1.49	1.50	1.45	13.0
## 44	1	2012	SOUTH	2	TOTAL S2TOTAL	1218	1.28	2.00	0.90	10.0
## 45	1	2012	SOUTH	2	TOTAL S2TOTAL	1219	1.49	2.35	1.65	13.0
## 46	1	2012	SOUTH	2	TOTAL S2TOTAL	1220	1.07	1.20	0.95	11.0
## 47	1	2012	SOUTH	2	TOTAL S2TOTAL	1231	1.48	1.25	1.20	9.0
## 48	1	2012	SOUTH	2	TOTAL S2TOTAL	1232	1.25	1.25	0.90	10.0
## 49	1	2012	SOUTH	2	TOTAL S2TOTAL	1233	1.41	1.41	1.40	14.0
## 50	1	2012	SOUTH	2	TOTAL S2TOTAL	1234	1.6	1.60	1.30	13.0
## 51	1	2012	SOUTH	2	TOTAL S2TOTAL	1235	1.2	1.20	1.30	14.0
## 52	1	2012	SOUTH	2	TOTAL S2TOTAL	1236	1.49	1.49	1.20	8.0
## 53	1	2012	SOUTH	2	TOTAL S2TOTAL	1237	1.5	1.50	1.50	14.0
## 54	1	2012	SOUTH	2	TOTAL S2TOTAL	1238	1.65	1.65	2.00	20.0
## 55	1	2012	SOUTH	2	TOTAL S2TOTAL	1239	1.13	1.13	1.20	10.0
## 56	1	2012	SOUTH	2	TOTAL S2TOTAL	1240	1.25	1.25	0.90	10.0
## 57	1	2012	SOUTH	2	TOTAL S2TOTAL	1251	1.1	1.20	1.10	10.0
## 58	1	2012	SOUTH	2	TOTAL S2TOTAL	1252	2.2	2.70	2.40	25.0
## 59	1	2012	SOUTH	2	TOTAL S2TOTAL	1253	1.45	1.65	1.25	10.0
## 60	1	2012	SOUTH	2	TOTAL S2TOTAL	1254	1.6	2.45	2.10	13.0
## 61	1	2012	SOUTH	2	TOTAL S2TOTAL	1255	1.55	2.40	1.80	13.0
## 62	1	2012	SOUTH	2	TOTAL S2TOTAL	1256	1.5	2.40	2.15	13.0
## 63	1	2012	SOUTH	2	TOTAL S2TOTAL	1257	1.03	1.20	1.00	10.0
## 64	1	2012	SOUTH	2	TOTAL S2TOTAL	1258	2.14	1.90	1.70	13.0
## 65	1	2012	SOUTH	2	TOTAL S2TOTAL	1259	1.2	1.90	1.65	12.0
## 66	1	2012	SOUTH	2	TOTAL S2TOTAL	1260	1.05	1.10	1.00	9.0
## 67	1	2012	SOUTH	2	TOTAL S2TOTAL	2131	1.8	2.60	2.40	15.0
## 68	1	2012	SOUTH	2	TOTAL S2TOTAL	2132	1.2	1.00	0.95	7.0
## 69	1	2012	SOUTH	2	TOTAL S2TOTAL	2133	1.75	1.40	1.10	10.0
## 70	1	2012	SOUTH	2	TOTAL S2TOTAL	2134	1.45	3.10	1.80	10.0
## 71	1	2012	SOUTH	2	TOTAL S2TOTAL	2135	1.17	1.20	1.10	5.0
## 72	1	2012	SOUTH	2	TOTAL S2TOTAL	2136	2.15	3.10	2.58	22.0
## 73	1	2012	SOUTH	2	TOTAL S2TOTAL	2137	1.7	1.70	1.40	12.0
## 74	1	2012	SOUTH	2	TOTAL S2TOTAL	3132	1.98	2.85	2.70	12.0
## 75	1	2012	SOUTH	2	TOTAL S2TOTAL	3133	1.26	1.95	1.75	17.0
## 76	1	2012	SOUTH	2	TOTAL S2TOTAL	3134	1.11	1.95	1.50	10.0
## 77	1	2012	SOUTH	2	TOTAL S2TOTAL	3135	1.14	1.32	1.05	10.0
## 78	1	2012	SOUTH	2	TOTAL S2TOTAL	3136	1.26	1.60	1.40	10.0
## 79	1	2012	SOUTH	2	TOTAL S2TOTAL	3137	1.3	1.40	0.80	10.0
## 80	1	2012	SOUTH	2	TOTAL S2TOTAL	3138	1.29	1.44	1.35	13.0
## 81	1	2012	SOUTH	2	TOTAL S2TOTAL	3139	1.31	1.35	1.15	7.0
## 82	1	2012	SOUTH	2	TOTAL S2TOTAL	3140	1.15	1.70	1.28	10.0
## 83	1	2012	SOUTH	2	TOTAL S2TOTAL	3151	1.87	3.40	1.85	15.0
## 84	1	2012	SOUTH	2	TOTAL S2TOTAL	3152	1.47	2.10	1.61	8.0
## 85	1	2012	SOUTH	2	TOTAL S2TOTAL	3153	1.05	1.79	1.50	10.0

## 86	1	2012	SOUTH	2	TOTAL S2TOTAL	3154	2.1	4.90	3.75	25.0
## 87	1	2012	SOUTH	2	TOTAL S2TOTAL	3155	1.99	1.80	1.35	13.0
## 88	1	2012	SOUTH	2	TOTAL S2TOTAL	3156	1.42	1.90	1.80	14.0
## 89	1	2012	SOUTH	2	TOTAL S2TOTAL	3157	1.5	2.11	1.75	12.0
## 90	1	2012	SOUTH	2	TOTAL S2TOTAL	3158	1.06	1.05	0.85	4.0
## 91	1	2012	SOUTH	2	TOTAL S2TOTAL	3159	1.49	1.50	1.15	13.0
## 92	1	2012	SOUTH	2	TOTAL S2TOTAL	3160	1.8	1.60	1.50	14.0
## 93	1	2012	SOUTH	2	TOTAL S2TOTAL	3171	1.93	1.74	1.20	14.0
## 94	1	2012	SOUTH	2	TOTAL S2TOTAL	3172	1.2	1.60	1.30	10.0
## 95	1	2012	SOUTH	2	TOTAL S2TOTAL	3173	1.65	1.25	1.10	11.0
## 96	1	2012	SOUTH	2	TOTAL S2TOTAL	3174	1.52	1.49	1.10	12.0
## 97	1	2012	SOUTH	2	TOTAL S2TOTAL	3175	1.43	2.05	1.54	13.0
## 98	1	2012	SOUTH	2	TOTAL S2TOTAL	3176	1.25	1.40	1.25	13.0
## 99	1	2012	SOUTH	2	TOTAL S2TOTAL	3177	1.88	2.65	2.64	20.0
## 100	1	2012	SOUTH	2	TOTAL S2TOTAL	3179	1.03	1.40	0.60	13.0
## 101	1	2012	SOUTH	2	TOTAL S2TOTAL	3180	1.1	1.30	1.20	10.0
## 102	1	2012	SOUTH	2	TOTAL S2TOTAL	3191	1.4	1.05	1.00	10.0
## 103	1	2012	SOUTH	2	TOTAL S2TOTAL	3192	1.05	1.55	0.90	10.0
## 104	1	2012	SOUTH	2	TOTAL S2TOTAL	3193	1.18	1.20	1.00	7.0
## 105	1	2012	SOUTH	2	TOTAL S2TOTAL	3194	1.4	1.30	1.85	13.0
## 106	1	2012	SOUTH	2	TOTAL S2TOTAL	3195	1.37	2.67	2.19	19.0
## 107	1	2012	SOUTH	2	TOTAL S2TOTAL	3196	1.32	2.15	1.55	11.0
## 108	1	2012	SOUTH	2	MEGA S2MEGA	182	1.55	2.20	1.20	20.0
## 109	1	2012	SOUTH	2	MEGA S2MEGA	183	1.3	1.80	0.90	8.0
## 110	1	2012	SOUTH	2	MEGA S2MEGA	184	1.24	1.20	1.20	25.0
## 111	1	2012	SOUTH	2	MEGA S2MEGA	185	1.5	2.10	1.75	16.0
## 112	1	2012	SOUTH	2	MEGA S2MEGA	186	1.65	2.50	2.20	15.0
## 113	1	2012	SOUTH	2	MEGA S2MEGA	187	2.17	2.00	1.20	15.0
## 114	1	2012	SOUTH	2	MEGA S2MEGA	188	1.28	1.60	1.50	10.0
## 115	1	2012	SOUTH	2	MEGA S2MEGA	189	1.07	1.50	1.50	10.0
## 116	1	2012	SOUTH	2	MEGA S2MEGA	190	0.67	1.00	0.80	8.0
## 117	1	2012	SOUTH	2	MEGA S2MEGA	191	0.68	0.70	0.60	4.0
## 118	1	2012	SOUTH	2	MEGA S2MEGA	192	1.87	1.60	1.40	9.0
## 119	1	2012	SOUTH	2	MEGA S2MEGA	193	1.35	1.90	1.50	14.0
## 120	1	2012	SOUTH	2	MEGA S2MEGA	194	1.75	2.10	2.10	15.0
## 121	1	2012	SOUTH	2	MESO S2MESO	462	1.75	3.30	2.50	23.0
## 122	1	2012	SOUTH	2	MESO S2MESO	463	1.64	2.30	2.00	14.0
## 123	1	2012	SOUTH	2	MESO S2MESO	2138	1.42	0.90	0.80	10.0
## 124	1	2012	SOUTH	3	OPEN S3OPEN	1301	dead	NA	NA	NA
## 125	1	2012	SOUTH	3	OPEN S3OPEN	1302	0.9	1.30	1.10	11.0
## 126	1	2012	SOUTH	3	TOTAL S3TOTAL	1061	dead	NA	NA	NA
## 127	1	2012	SOUTH	3	TOTAL S3TOTAL	1062	1.8	2.60	2.60	15.0
## 128	1	2012	SOUTH	3	TOTAL S3TOTAL	1063	2.47	3.10	2.20	18.0
## 129	1	2012	SOUTH	3	TOTAL S3TOTAL	1064	2.15	1.60	1.10	17.0
## 130	1	2012	SOUTH	3	TOTAL S3TOTAL	1066	1.7	2.50	2.15	15.0
## 131	1	2012	SOUTH	3	TOTAL S3TOTAL	1066	1.9	1.80	1.50	20.0
## 132	1	2012	SOUTH	3	TOTAL S3TOTAL	1067	1.95	2.10	1.90	13.0
## 133	1	2012	SOUTH	3	TOTAL S3TOTAL	1068	1.8	1.70	1.40	13.0
## 134	1	2012	SOUTH	3	TOTAL S3TOTAL	1069	1.4	2.00	1.60	14.0
## 135	1	2012	SOUTH	3	TOTAL S3TOTAL	1070	1	1.30	1.20	7.0
## 136	1	2012	SOUTH	3	TOTAL S3TOTAL	2139	1.75	1.20	1.10	13.0
## 137	1	2012	SOUTH	3	TOTAL S3TOTAL	2140	1.28	1.50	0.95	4.0
## 138	1	2012	SOUTH	3	TOTAL S3TOTAL	2151	1	1.40	1.20	4.0
## 139	1	2012	SOUTH	3	TOTAL S3TOTAL	2152	1.45	1.50	1.30	10.0

## 140	1 2012 SOUTH	3	TOTAL S3TOTAL 2153	1	1.00	0.75	8.0
## 141	1 2012 SOUTH	3	TOTAL S3TOTAL 2154	1.03	1.00	0.90	6.0
## 142	1 2012 SOUTH	3	TOTAL S3TOTAL 2155	1.51	2.00	1.80	12.0
## 143	1 2012 SOUTH	3	TOTAL S3TOTAL 2156	1.17	1.10	0.90	10.0
## 144	1 2012 SOUTH	3	TOTAL S3TOTAL 2157	1.33	1.90	1.85	14.0
## 145	1 2012 SOUTH	3	TOTAL S3TOTAL 2158	1.3	1.10	0.85	8.0
## 146	1 2012 SOUTH	3	TOTAL S3TOTAL 2159	1.13	1.10	0.90	10.0
## 147	1 2012 SOUTH	3	TOTAL S3TOTAL 2160	1.58	1.40	1.40	13.0
## 148	1 2012 SOUTH	3	TOTAL S3TOTAL 2171	1.06	1.40	1.00	5.0
## 149	1 2012 SOUTH	3	TOTAL S3TOTAL 2172	1.05	1.40	0.95	7.0
## 150	1 2012 SOUTH	3	TOTAL S3TOTAL 2173	1.45	1.60	1.10	6.0
## 151	1 2012 SOUTH	3	TOTAL S3TOTAL 2174	1.15	1.10	0.90	5.0
## 152	1 2012 SOUTH	3	TOTAL S3TOTAL 2175	1.42	1.45	1.30	13.0
## 153	1 2012 SOUTH	3	TOTAL S3TOTAL 2176	1.02	1.20	1.00	8.0
## 154	1 2012 SOUTH	3	TOTAL S3TOTAL 2177	1.4	1.20	1.00	9.0
## 155	1 2012 SOUTH	3	TOTAL S3TOTAL 2178	1.45	2.10	2.05	15.0
## 156	1 2012 SOUTH	3	MESO S3MESO 1421	1.95	2.20	1.60	13.0
## 157	1 2012 SOUTH	3	MESO S3MESO 1422	dead	NA	NA	NA
##	FLOWERS	BUDS	FRUITS	ANT			
## 1	0	0	10	CS			
## 2	0	0	150	TP			
## 3	2	1	50	TP			
## 4	0	0	75	CS			
## 5	0	0	20	CS			
## 6	0	0	0	E			
## 7	0	0	0	CS			
## 8	0	0	25	CS			
## 9	0	0	0	TP			
## 10	0	0	50	TP			
## 11	0	0	5	CS			
## 12	0	0	60	TP			
## 13	0	0	60	TP			
## 14	2	0	60	CS			
## 15	2	0	0	CS			
## 16	0	0	0	TP			
## 17	0	0	0	TP			
## 18	0	0	0	CS			
## 19	0	0	0	CM			
## 20	0	0	0	TP			
## 21	NA	NA	NA				
## 22	0	0	5	CS			
## 23	0	0	45	CS			
## 24	40	50	35	CS			
## 25	8	2	65	CS			
## 26	0	0	20	TP			
## 27	0	0	70	CS			
## 28	0	0	125	CM			
## 29	0	0	200	CM			
## 30	0	0	10	CS			
## 31	0	0	0	CS			
## 32	0	0	35	TP			
## 33	0	0	300	CM			
## 34	2	2	100	CS			
## 35	0	0	30	CM			

## 36	0	0	50	TP
## 37	0	0	10	CM
## 38	0	0	25	CS
## 39	0	0	15	TP
## 40	0	0	0	TP
## 41	0	0	15	TP
## 42	0	0	0	TP
## 43	0	0	40	TP
## 44	0	0	0	TP
## 45	0	0	15	CM
## 46	0	0	0	CM
## 47	0	0	0	TP
## 48	0	0	0	TP
## 49	0	0	1	TP
## 50	0	0	20	TP
## 51	0	0	0	TP
## 52	0	0	0	TP
## 53	0	0	20	TP
## 54	0	0	0	TP
## 55	0	0	0	CN
## 56	0	0	0	CN
## 57	0	0	0	TP
## 58	0	0	5	TP
## 59	0	0	0	TP
## 60	0	0	25	TP
## 61	0	0	25	TP
## 62	0	0	20	TP
## 63	0	0	0	TP
## 64	0	0	10	CS
## 65	1	0	25	CS
## 66	0	0	0	TP
## 67	0	0	10	TP
## 68	0	0	0	TP
## 69	0	0	0	TP
## 70	0	0	0	TP
## 71	0	0	0	TP
## 72	0	0	0	CS
## 73	0	0	0	CS
## 74	0	0	25	AB_TP
## 75	0	0	0	TP
## 76	0	0	0	TP
## 77	0	0	0	TP
## 78	0	0	0	CS
## 79	0	0	0	CS
## 80	0	0	0	CS
## 81	0	0	0	CS
## 82	0	0	5	CS
## 83	6	0	0	CS
## 84	0	0	0	CS
## 85	0	0	1	CS
## 86	0	0	25	CS
## 87	0	0	0	CS
## 88	0	0	0	CS
## 89	0	0	10	CS

## 90	0	0	0	CS
## 91	0	0	35	CS
## 92	0	0	0	CS
## 93	0	0	0	CS
## 94	0	0	0	CS
## 95	0	0	0	CS
## 96	0	0	20	CS
## 97	0	0	0	CS
## 98	0	0	0	CM
## 99	0	0	100	CM
## 100	0	0	0	CS
## 101	0	0	0	CS
## 102	0	0	0	CS
## 103	0	0	0	CM
## 104	0	0	0	TP
## 105	0	0	30	CS
## 106	0	0	50	TP
## 107	0	0	10	CS
## 108	0	0	0	CS
## 109	0	0	15	CS
## 110	0	0	10	CS
## 111	5	0	200	CS
## 112	0	0	80	CS
## 113	0	0	150	TP
## 114	0	0	40	TP
## 115	0	0	60	TP
## 116	0	0	0	CS
## 117	0	0	0	TP
## 118	0	0	40	CS
## 119	0	0	20	CS
## 120	0	0	75	TP
## 121	0	0	20	CM
## 122	0	0	0	TP
## 123	0	0	0	E
## 124	NA	NA	NA	
## 125	0	0	0	TP
## 126	NA	NA	NA	
## 127	0	0	50	TP
## 128	0	0	0	TP
## 129	0	0	0	TP
## 130	0	0	2	TP
## 131	0	0	25	TP
## 132	0	0	0	TP
## 133	0	0	0	TP
## 134	0	0	0	TP
## 135	0	0	0	TP
## 136	0	0	0	TP
## 137	0	0	0	TP
## 138	0	0	0	TP
## 139	0	0	0	TP
## 140	0	0	0	TP
## 141	0	0	0	TP
## 142	0	0	0	TP
## 143	0	0	0	TP

```
## 144      0      0      0      TP
## 145      0      0      0      TP
## 146      0      0      0      TP
## 147      0      0      0      TP
## 148      0      0      8      TP
## 149      0      0      0      TP
## 150      0      0      0      TP
## 151      0      0      0      TP
## 152      0      0      0      TP
## 153      0      0      0      TP
## 154      0      0      0      TP
## 155      0      0     20      TP
## 156      0      0      2      CS
## 157     NA     NA     NA
```

```
class(acacia$HEIGHT)
```

```
## [1] "character"
```

```
is.numeric(acacia$HEIGHT)
```

```
## [1] FALSE
```

```
acacia$HEIGHT
```

```
## [1] "2.25" "2.65" "1.5"  "2.01" "1.75" "1.65" "1.2"  "1.45" "1.87" "2.38"
## [11] "2.58" "2.65" "2.35" "1.88" "2.32" "2.39" "2.2"  "1.05" "2"    "1.28"
## [21] "dead" "1.4"  "1.9"  "1.75" "1.8"  "2.7"  "2.02" "1.9"  "1.85" "1.65"
## [31] "1.4"  "2.5"  "2.05" "2.26" "2.13" "1.8"  "1.85" "1.5"  "1.87" "1.58"
## [41] "2.05" "1.75" "1.49" "1.28" "1.49" "1.07" "1.48" "1.25" "1.41" "1.6"
## [51] "1.2"  "1.49" "1.5"  "1.65" "1.13" "1.25" "1.1"  "2.2"  "1.45" "1.6"
## [61] "1.55" "1.5"  "1.03" "2.14" "1.2"  "1.05" "1.8"  "1.2"  "1.75" "1.45"
## [71] "1.17" "2.15" "1.7"  "1.98" "1.26" "1.11" "1.14" "1.26" "1.3"  "1.29"
## [81] "1.31" "1.15" "1.87" "1.47" "1.05" "2.1"  "1.99" "1.42" "1.5"  "1.06"
## [91] "1.49" "1.8"  "1.93" "1.2"  "1.65" "1.52" "1.43" "1.25" "1.88" "1.03"
## [101] "1.1"  "1.4"  "1.05" "1.18" "1.4"  "1.37" "1.32" "1.55" "1.3"  "1.24"
## [111] "1.5"  "1.65" "2.17" "1.28" "1.07" "0.67" "0.68" "1.87" "1.35" "1.75"
## [121] "1.75" "1.64" "1.42" "dead" "0.9"  "dead" "1.8"  "2.47" "2.15" "1.7"
## [131] "1.9"  "1.95" "1.8"  "1.4"  "1"    "1.75" "1.28" "1"    "1.45" "1"
## [141] "1.03" "1.51" "1.17" "1.33" "1.3"  "1.13" "1.58" "1.06" "1.05" "1.45"
## [151] "1.15" "1.42" "1.02" "1.4"  "1.45" "1.95" "dead"
```

```
as.numeric(acacia$HEIGHT)
```

```
## Warning: NAs introduced by coercion
```

```
## [1] 2.25 2.65 1.50 2.01 1.75 1.65 1.20 1.45 1.87 2.38 2.58 2.65 2.35 1.88 2.32
## [16] 2.39 2.20 1.05 2.00 1.28 NA 1.40 1.90 1.75 1.80 2.70 2.02 1.90 1.85 1.65
## [31] 1.40 2.50 2.05 2.26 2.13 1.80 1.85 1.50 1.87 1.58 2.05 1.75 1.49 1.28 1.49
## [46] 1.07 1.48 1.25 1.41 1.60 1.20 1.49 1.50 1.65 1.13 1.25 1.10 2.20 1.45 1.60
## [61] 1.55 1.50 1.03 2.14 1.20 1.05 1.80 1.20 1.75 1.45 1.17 2.15 1.70 1.98 1.26
```



```
## [76] 1.11 1.14 1.26 1.30 1.29 1.31 1.15 1.87 1.47 1.05 2.10 1.99 1.42 1.50 1.06
## [91] 1.49 1.80 1.93 1.20 1.65 1.52 1.43 1.25 1.88 1.03 1.10 1.40 1.05 1.18 1.40
## [106] 1.37 1.32 1.55 1.30 1.24 1.50 1.65 2.17 1.28 1.07 0.67 0.68 1.87 1.35 1.75
## [121] 1.75 1.64 1.42 NA 0.90 NA 1.80 2.47 2.15 1.70 1.90 1.95 1.80 1.40 1.00
## [136] 1.75 1.28 1.00 1.45 1.00 1.03 1.51 1.17 1.33 1.30 1.13 1.58 1.06 1.05 1.45
## [151] 1.15 1.42 1.02 1.40 1.45 1.95 NA
```

Coercion in R computer language means that a value was forced to be a type.

We identified that height should be numeric and is instead character

```
acacia$HEIGHT <- as.numeric(acacia$HEIGHT)
```

```
## Warning: NAs introduced by coercion
```

```
acacia$HEIGHT
```

```
## [1] 2.25 2.65 1.50 2.01 1.75 1.65 1.20 1.45 1.87 2.38 2.58 2.65 2.35 1.88 2.32
## [16] 2.39 2.20 1.05 2.00 1.28 NA 1.40 1.90 1.75 1.80 2.70 2.02 1.90 1.85 1.65
## [31] 1.40 2.50 2.05 2.26 2.13 1.80 1.85 1.50 1.87 1.58 2.05 1.75 1.49 1.28 1.49
## [46] 1.07 1.48 1.25 1.41 1.60 1.20 1.49 1.50 1.65 1.13 1.25 1.10 2.20 1.45 1.60
## [61] 1.55 1.50 1.03 2.14 1.20 1.05 1.80 1.20 1.75 1.45 1.17 2.15 1.70 1.98 1.26
## [76] 1.11 1.14 1.26 1.30 1.29 1.31 1.15 1.87 1.47 1.05 2.10 1.99 1.42 1.50 1.06
## [91] 1.49 1.80 1.93 1.20 1.65 1.52 1.43 1.25 1.88 1.03 1.10 1.40 1.05 1.18 1.40
## [106] 1.37 1.32 1.55 1.30 1.24 1.50 1.65 2.17 1.28 1.07 0.67 0.68 1.87 1.35 1.75
## [121] 1.75 1.64 1.42 NA 0.90 NA 1.80 2.47 2.15 1.70 1.90 1.95 1.80 1.40 1.00
## [136] 1.75 1.28 1.00 1.45 1.00 1.03 1.51 1.17 1.33 1.30 1.13 1.58 1.06 1.05 1.45
## [151] 1.15 1.42 1.02 1.40 1.45 1.95 NA
```

```
acacia <- read.csv(file = "../data raw/ACACIA_DREPANOLOBIUM_SURVEY.txt",
  sep = "\t",
  na.strings = "dead")
is.numeric(acacia$HEIGHT)
```

```
## [1] TRUE
```

```
head(acacia)
```

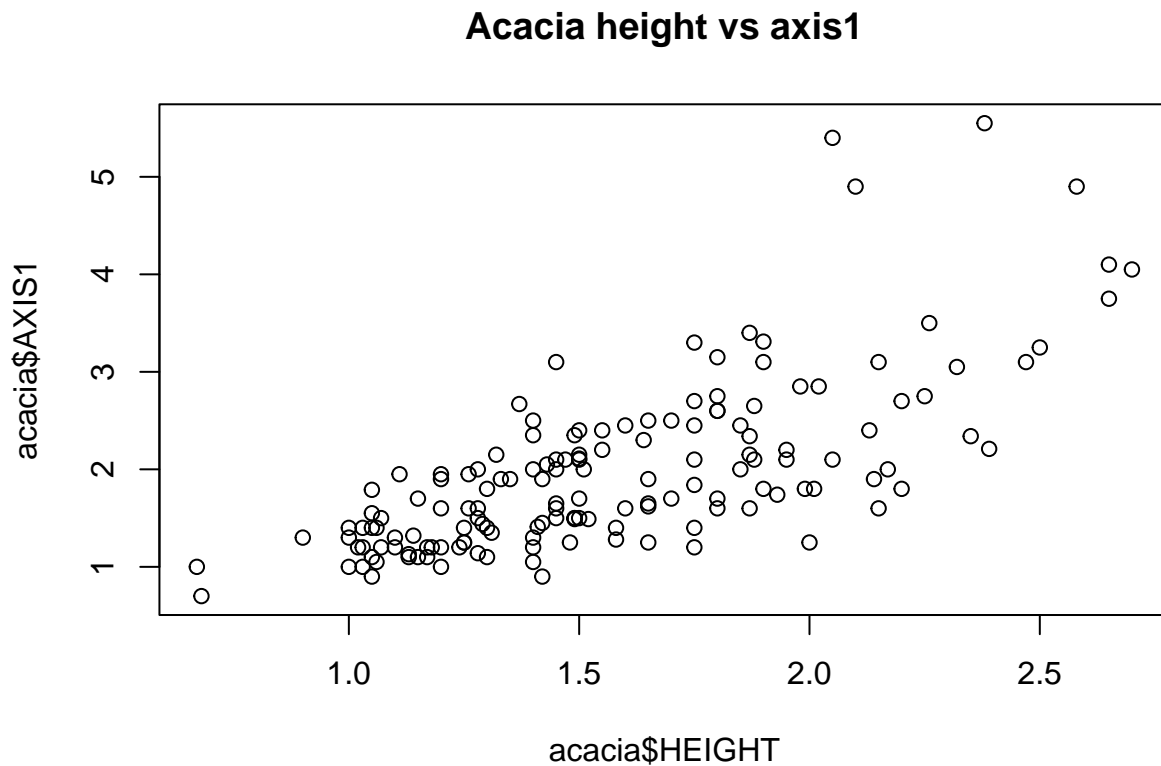
```
## SURVEY YEAR SITE BLOCK TREATMENT PLOT ID HEIGHT AXIS1 AXIS2 CIRC
## 1 1 2012 SOUTH 1 TOTAL S1TOTAL 581 2.25 2.75 2.15 20
## 2 1 2012 SOUTH 1 TOTAL S1TOTAL 582 2.65 4.10 3.90 28
## 3 1 2012 SOUTH 1 TOTAL S1TOTAL 3111 1.50 1.70 0.85 17
## 4 1 2012 SOUTH 1 TOTAL S1TOTAL 3112 2.01 1.80 1.60 12
## 5 1 2012 SOUTH 1 TOTAL S1TOTAL 3113 1.75 1.84 1.42 13
## 6 1 2012 SOUTH 1 TOTAL S1TOTAL 3114 1.65 1.62 0.85 15
## FLOWERS BUDS FRUITS ANT
## 1 0 0 10 CS
## 2 0 0 150 TP
## 3 2 1 50 TP
## 4 0 0 75 CS
## 5 0 0 20 CS
## 6 0 0 0 E
```

```
#View(acacia)
```

## 5 Plotting data with ggplot2

Regular way to plot in R

```
plot(x = acacia$HEIGHT, y=acacia$AXIS1, main = "Acacia height vs axis1")
```



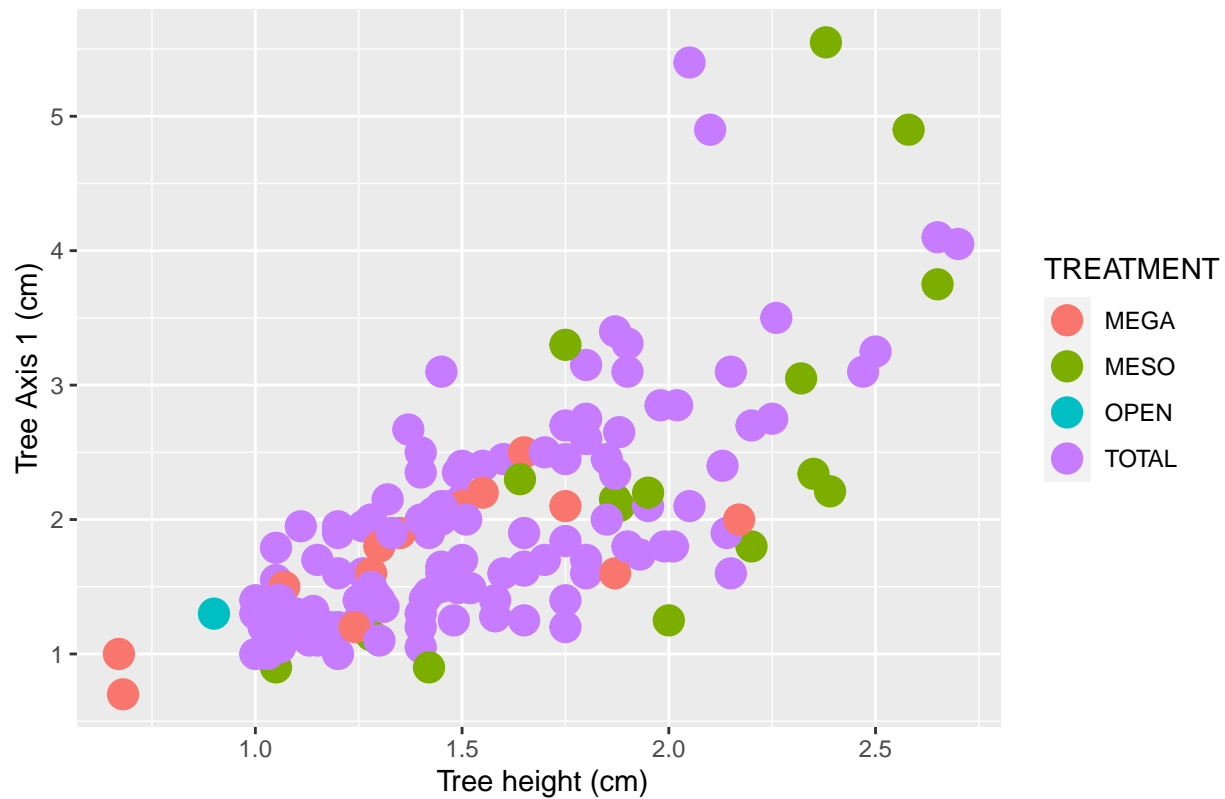
```
?legend
```

With ggplot, we create layers

```
library(ggplot2)
ggplot(data = acacia, mapping = aes(x = HEIGHT, y = AXIS1, color = TREATMENT)) +
  geom_point(size = 5) +
  labs(x = "Tree height (cm)", y = "Tree Axis 1 (cm)", title = "Acacia trees size relationships")
```

```
## Warning: Removed 4 rows containing missing values ('geom_point()').
```

## Acacia trees size relationships



colors()

```
## [1] "white" "aliceblue" "antiquewhite"
## [4] "antiquewhite1" "antiquewhite2" "antiquewhite3"
## [7] "antiquewhite4" "aquamarine" "aquamarine1"
## [10] "aquamarine2" "aquamarine3" "aquamarine4"
## [13] "azure" "azure1" "azure2"
## [16] "azure3" "azure4" "beige"
## [19] "bisque" "bisque1" "bisque2"
## [22] "bisque3" "bisque4" "black"
## [25] "blanchedalmond" "blue" "blue1"
## [28] "blue2" "blue3" "blue4"
## [31] "blueviolet" "brown" "brown1"
## [34] "brown2" "brown3" "brown4"
## [37] "burlywood" "burlywood1" "burlywood2"
## [40] "burlywood3" "burlywood4" "cadetblue"
## [43] "cadetblue1" "cadetblue2" "cadetblue3"
## [46] "cadetblue4" "chartreuse" "chartreuse1"
## [49] "chartreuse2" "chartreuse3" "chartreuse4"
## [52] "chocolate" "chocolate1" "chocolate2"
## [55] "chocolate3" "chocolate4" "coral"
## [58] "coral1" "coral2" "coral3"
## [61] "coral4" "cornflowerblue" "cornsilk"
## [64] "cornsilk1" "cornsilk2" "cornsilk3"
## [67] "cornsilk4" "cyan" "cyan1"
## [70] "cyan2" "cyan3" "cyan4"
```

## [73]	"darkblue"	"darkcyan"	"darkgoldenrod"
## [76]	"darkgoldenrod1"	"darkgoldenrod2"	"darkgoldenrod3"
## [79]	"darkgoldenrod4"	"darkgray"	"darkgreen"
## [82]	"darkgrey"	"darkkhaki"	"darkmagenta"
## [85]	"darkolivegreen"	"darkolivegreen1"	"darkolivegreen2"
## [88]	"darkolivegreen3"	"darkolivegreen4"	"darkorange"
## [91]	"darkorange1"	"darkorange2"	"darkorange3"
## [94]	"darkorange4"	"darkorchid"	"darkorchid1"
## [97]	"darkorchid2"	"darkorchid3"	"darkorchid4"
## [100]	"darkred"	"darksalmon"	"darkseagreen"
## [103]	"darkseagreen1"	"darkseagreen2"	"darkseagreen3"
## [106]	"darkseagreen4"	"darkslateblue"	"darkslategray"
## [109]	"darkslategray1"	"darkslategray2"	"darkslategray3"
## [112]	"darkslategray4"	"darkslategrey"	"darkturquoise"
## [115]	"darkviolet"	"deeppink"	"deeppink1"
## [118]	"deeppink2"	"deeppink3"	"deeppink4"
## [121]	"deepskyblue"	"deepskyblue1"	"deepskyblue2"
## [124]	"deepskyblue3"	"deepskyblue4"	"dimgray"
## [127]	"dimgrey"	"dodgerblue"	"dodgerblue1"
## [130]	"dodgerblue2"	"dodgerblue3"	"dodgerblue4"
## [133]	"firebrick"	"firebrick1"	"firebrick2"
## [136]	"firebrick3"	"firebrick4"	"floralwhite"
## [139]	"forestgreen"	"gainsboro"	"ghostwhite"
## [142]	"gold"	"gold1"	"gold2"
## [145]	"gold3"	"gold4"	"goldenrod"
## [148]	"goldenrod1"	"goldenrod2"	"goldenrod3"
## [151]	"goldenrod4"	"gray"	"gray0"
## [154]	"gray1"	"gray2"	"gray3"
## [157]	"gray4"	"gray5"	"gray6"
## [160]	"gray7"	"gray8"	"gray9"
## [163]	"gray10"	"gray11"	"gray12"
## [166]	"gray13"	"gray14"	"gray15"
## [169]	"gray16"	"gray17"	"gray18"
## [172]	"gray19"	"gray20"	"gray21"
## [175]	"gray22"	"gray23"	"gray24"
## [178]	"gray25"	"gray26"	"gray27"
## [181]	"gray28"	"gray29"	"gray30"
## [184]	"gray31"	"gray32"	"gray33"
## [187]	"gray34"	"gray35"	"gray36"
## [190]	"gray37"	"gray38"	"gray39"
## [193]	"gray40"	"gray41"	"gray42"
## [196]	"gray43"	"gray44"	"gray45"
## [199]	"gray46"	"gray47"	"gray48"
## [202]	"gray49"	"gray50"	"gray51"
## [205]	"gray52"	"gray53"	"gray54"
## [208]	"gray55"	"gray56"	"gray57"
## [211]	"gray58"	"gray59"	"gray60"
## [214]	"gray61"	"gray62"	"gray63"
## [217]	"gray64"	"gray65"	"gray66"
## [220]	"gray67"	"gray68"	"gray69"
## [223]	"gray70"	"gray71"	"gray72"
## [226]	"gray73"	"gray74"	"gray75"
## [229]	"gray76"	"gray77"	"gray78"
## [232]	"gray79"	"gray80"	"gray81"

## [235]	"gray82"	"gray83"	"gray84"
## [238]	"gray85"	"gray86"	"gray87"
## [241]	"gray88"	"gray89"	"gray90"
## [244]	"gray91"	"gray92"	"gray93"
## [247]	"gray94"	"gray95"	"gray96"
## [250]	"gray97"	"gray98"	"gray99"
## [253]	"gray100"	"green"	"green1"
## [256]	"green2"	"green3"	"green4"
## [259]	"greenyellow"	"grey"	"grey0"
## [262]	"grey1"	"grey2"	"grey3"
## [265]	"grey4"	"grey5"	"grey6"
## [268]	"grey7"	"grey8"	"grey9"
## [271]	"grey10"	"grey11"	"grey12"
## [274]	"grey13"	"grey14"	"grey15"
## [277]	"grey16"	"grey17"	"grey18"
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## [286]	"grey25"	"grey26"	"grey27"
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## [292]	"grey31"	"grey32"	"grey33"
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## [298]	"grey37"	"grey38"	"grey39"
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## [307]	"grey46"	"grey47"	"grey48"
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## [337]	"grey76"	"grey77"	"grey78"
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## [343]	"grey82"	"grey83"	"grey84"
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## [358]	"grey97"	"grey98"	"grey99"
## [361]	"grey100"	"honeydew"	"honeydew1"
## [364]	"honeydew2"	"honeydew3"	"honeydew4"
## [367]	"hotpink"	"hotpink1"	"hotpink2"
## [370]	"hotpink3"	"hotpink4"	"indianred"
## [373]	"indianred1"	"indianred2"	"indianred3"
## [376]	"indianred4"	"ivory"	"ivory1"
## [379]	"ivory2"	"ivory3"	"ivory4"
## [382]	"khaki"	"khaki1"	"khaki2"
## [385]	"khaki3"	"khaki4"	"lavender"
## [388]	"lavenderblush"	"lavenderblush1"	"lavenderblush2"
## [391]	"lavenderblush3"	"lavenderblush4"	"lawngreen"
## [394]	"lemonchiffon"	"lemonchiffon1"	"lemonchiffon2"

## [397]	"lemonchiffon3"	"lemonchiffon4"	"lightblue"
## [400]	"lightblue1"	"lightblue2"	"lightblue3"
## [403]	"lightblue4"	"lightcoral"	"lightcyan"
## [406]	"lightcyan1"	"lightcyan2"	"lightcyan3"
## [409]	"lightcyan4"	"lightgoldenrod"	"lightgoldenrod1"
## [412]	"lightgoldenrod2"	"lightgoldenrod3"	"lightgoldenrod4"
## [415]	"lightgoldenrodyellow"	"lightgray"	"lightgreen"
## [418]	"lightgrey"	"lightpink"	"lightpink1"
## [421]	"lightpink2"	"lightpink3"	"lightpink4"
## [424]	"lightsalmon"	"lightsalmon1"	"lightsalmon2"
## [427]	"lightsalmon3"	"lightsalmon4"	"lightseagreen"
## [430]	"lightskyblue"	"lightskyblue1"	"lightskyblue2"
## [433]	"lightskyblue3"	"lightskyblue4"	"lightslateblue"
## [436]	"lightslategray"	"lightslategrey"	"lightsteelblue"
## [439]	"lightsteelblue1"	"lightsteelblue2"	"lightsteelblue3"
## [442]	"lightsteelblue4"	"lightyellow"	"lightyellow1"
## [445]	"lightyellow2"	"lightyellow3"	"lightyellow4"
## [448]	"limegreen"	"linen"	"magenta"
## [451]	"magenta1"	"magenta2"	"magenta3"
## [454]	"magenta4"	"maroon"	"maroon1"
## [457]	"maroon2"	"maroon3"	"maroon4"
## [460]	"mediumaquamarine"	"mediumblue"	"mediumorchid"
## [463]	"mediumorchid1"	"mediumorchid2"	"mediumorchid3"
## [466]	"mediumorchid4"	"mediumpurple"	"mediumpurple1"
## [469]	"mediumpurple2"	"mediumpurple3"	"mediumpurple4"
## [472]	"mediumseagreen"	"mediumslateblue"	"mediumspringgreen"
## [475]	"mediumturquoise"	"mediumvioletred"	"midnightblue"
## [478]	"mintcream"	"mistyrose"	"mistyrose1"
## [481]	"mistyrose2"	"mistyrose3"	"mistyrose4"
## [484]	"moccasin"	"navajowhite"	"navajowhite1"
## [487]	"navajowhite2"	"navajowhite3"	"navajowhite4"
## [490]	"navy"	"navyblue"	"oldlace"
## [493]	"olivedrab"	"olivedrab1"	"olivedrab2"
## [496]	"olivedrab3"	"olivedrab4"	"orange"
## [499]	"orange1"	"orange2"	"orange3"
## [502]	"orange4"	"orangered"	"orangered1"
## [505]	"orangered2"	"orangered3"	"orangered4"
## [508]	"orchid"	"orchid1"	"orchid2"
## [511]	"orchid3"	"orchid4"	"palegoldenrod"
## [514]	"palegreen"	"palegreen1"	"palegreen2"
## [517]	"palegreen3"	"palegreen4"	"paleturquoise"
## [520]	"paleturquoise1"	"paleturquoise2"	"paleturquoise3"
## [523]	"paleturquoise4"	"palevioletred"	"palevioletred1"
## [526]	"palevioletred2"	"palevioletred3"	"palevioletred4"
## [529]	"papayawhip"	"peachpuff"	"peachpuff1"
## [532]	"peachpuff2"	"peachpuff3"	"peachpuff4"
## [535]	"peru"	"pink"	"pink1"
## [538]	"pink2"	"pink3"	"pink4"
## [541]	"plum"	"plum1"	"plum2"
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## [547]	"purple"	"purple1"	"purple2"
## [550]	"purple3"	"purple4"	"red"
## [553]	"red1"	"red2"	"red3"
## [556]	"red4"	"rosybrown"	"rosybrown1"

## [559]	"rosybrown2"	"rosybrown3"	"rosybrown4"
## [562]	"royalblue"	"royalblue1"	"royalblue2"
## [565]	"royalblue3"	"royalblue4"	"saddlebrown"
## [568]	"salmon"	"salmon1"	"salmon2"
## [571]	"salmon3"	"salmon4"	"sandybrown"
## [574]	"seagreen"	"seagreen1"	"seagreen2"
## [577]	"seagreen3"	"seagreen4"	"seashell"
## [580]	"seashell1"	"seashell2"	"seashell3"
## [583]	"seashell4"	"sienna"	"sienna1"
## [586]	"sienna2"	"sienna3"	"sienna4"
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## [592]	"skyblue3"	"skyblue4"	"slateblue"
## [595]	"slateblue1"	"slateblue2"	"slateblue3"
## [598]	"slateblue4"	"slategray"	"slategray1"
## [601]	"slategray2"	"slategray3"	"slategray4"
## [604]	"slategrey"	"snow"	"snow1"
## [607]	"snow2"	"snow3"	"snow4"
## [610]	"springgreen"	"springgreen1"	"springgreen2"
## [613]	"springgreen3"	"springgreen4"	"steelblue"
## [616]	"steelblue1"	"steelblue2"	"steelblue3"
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## [622]	"tan2"	"tan3"	"tan4"
## [625]	"thistle"	"thistle1"	"thistle2"
## [628]	"thistle3"	"thistle4"	"tomato"
## [631]	"tomato1"	"tomato2"	"tomato3"
## [634]	"tomato4"	"turquoise"	"turquoise1"
## [637]	"turquoise2"	"turquoise3"	"turquoise4"
## [640]	"violet"	"violetred"	"violetred1"
## [643]	"violetred2"	"violetred3"	"violetred4"
## [646]	"wheat"	"wheat1"	"wheat2"
## [649]	"wheat3"	"wheat4"	"whitesmoke"
## [652]	"yellow"	"yellow1"	"yellow2"
## [655]	"yellow3"	"yellow4"	"yellowgreen"