

## Kula Volcano (Turkey)

The Kula Volcano (Turkey, 38,58° N and 28,52° E) was active in the Quaternary period and recently it is inactive. The site is located 12 km west of the town of Kula and 1,5 km north of the the Izmir-Ankara highway at altitude of 750 m. This area covers about 400 km<sup>2</sup> and is generally bare. However there is plant cover in some areas. It consists of three basins and the schistose ridges separating them are covered with volcanic cones and lava streams and fields. The vegetation occurring on the volcanic cone and its surrounding area where this survey was performed displays some difference depending on the altitude and aspect. The following successional stages were observed on the Kula Volcano and the surrounding area: 1. Crustose-lichen stage 2. Foliose lichen stage 3. Moss stage 4. Herbaceous stage 5. Shrub stage 6. Climax. *Pinus brutia* is dominant in the climax stage. In this contribution, the developmental stages of succession and their floristic composition is given according the Braun-Blanquet method (Braun-Blanquet 1964), plant taxa names according to Davis (1965-1988).



The general process of vegetation change is called the succession. It is the gradual change which occurs in vegetation of a given area of the earth surface on which one population succeeds the other (Tansley, 1920). Kula Volcano is very appropriate region for studying succession. It may seem that the slopes of the volcano remained bare for a long time as they were not fit initially for the occurring of vegetation. But later migrating plants were able to settle there. At the same time, there is also a direct relationship between the age of volcanism and soil forming. These stages are also clearly seen on the Kula volcanic area, E of study area. Here a soil with depth of 30-40 cm is found on the old flat basaltic lava and smoothly volcanic cone in which agricultural activities are carried out, whereas a shallower soil cover is

common on the young volcanic cone which was formed 10-1200 B.P. On the other hand, soil forming is directly determined by the slope factor. Namely a soil 15-20 cm deep has been formed on north-facing slopes under the *Pinus brutia* communities in the young volcanic cone named Sandal tepe while on the south-facing slopes there is a thin soil cover 3-5 cm deep.

### Climate

The study area covers approximately 400 km<sup>2</sup> and has a typical mediterranean climate, with dry, hot rainless summers and mild and wet winters. The average annual temperature is 14.3°C and total annual rainfall is 584.7mm. Most rainfall is in January and average annual relative humidity is 54 % in Kula town of the Manisa. Also in the Salihli which is in the vicinity of the study area the average annual temperature is 16.2 °C and total annual rainfall is 490.6 mm. Most rainfall is in December and annual relative humidity is 63 %. On the other hand, the lowest temperature recorded in January was -11.0 °C in Kula and -8 °C in Salihli.

### Geology

The investigated area lies between Kula and Salihli towns of in the province of Manisa, the basement rocks consist mainly of gneisses schists and quartzites with Permo Triassic marbles in the uppermost section. Mesozoic units consists of dolomitic limestones of Jurassic and ophiolitic melange of Upper Cretaceous age. Senozoic units consists of fluvial sediments of Pliocene age overlain by andezitic lava flows with interfingering lacustrine limestones towards the top. Kula volcanics of Quaternary age flowed in three main periods; the initial products being ejected 1,1 million years ago. The last period of volcanism lasted until historic times. According to petrographic and petrochemical investigations, Kula lavas are alkali basalts. Their alkali content increases becoming potassichrich first to the third period. Most of the rock types are trachybasalts, alkali olivine basalts and hawaiites with minor mugearites and tephrites. Kula volcanism has a mantle origin derived from an initial magma rise through plums, and it is a rift volcanism (Ercan 1984).

### Succession

As the main goal was to investigate the species of vascular plants of the succession, the cryptogams of

the above stages were not collected and identified. They can be considered as typical elements of the Aegean Region. The characteristics of individual stages are below.

### Herbaceous stage

In this stage herbaceous species cover 40-60 % of the area. *Poa bulbosa*, *Bromus rigidus*, *Arrhenatherum elatius* are dominant. Representative table is below.

<i>Poa bulbosa</i>	22323
<i>Bromus rigidus</i>	11131
<i>Arrhenatherum elatius</i>	12+12
<i>Briza minor</i>	+1+++
<i>Moenchia mantica</i>	1++.+
<i>Bromus tomentollus</i>	++.+1
<i>Trifolium campestre</i>	+++.+
<i>Galium erectum</i>	.++++
<i>Geranium purpureum</i>	.+++.
<i>Lolium multiflorum</i>	+...+
<i>Veronica hederifolia</i>	+...+
<i>Cionura erecta</i>	.+++.
<i>Rumex acetosella</i>	..+++

### Shrub stage

In this stage scrubby species cover 70-100 % of the area. *Quercus coccifera* is dominant .

<i>Quercus coccifera</i>	45444
<i>Quercus infectoria</i>	1+111
<i>Lonicera etrusca</i>	11+++
<i>Rhus coriaria</i>	1++1+
<i>Ephedra major</i>	1..+1
<i>Jasminum fruticans</i>	11+..
<i>Rosa canina</i>	1..++
<i>Prunus spinosa</i>	++++.
<i>Calligonum aphyllum</i>	.++++
<i>Origanum spyleum</i>	++++.



*Nepeta cadmea* Boiss. Photo: E. Ugurlu.



*Gypsophyia tubulosa* (Jaub. et Spach) Boiss. Photo: E. Ugurlu.

### Climax forest

*Pinus brutia* is dominant in the climax stage (Gokceoglu 1988, Oner & Oflas 1977). Cover is 75-100 % of the area.

<i>Pinus brutia</i>	55443
<i>Quercus coccifera</i>	+++11
<i>Quercus infectoria</i>	1++++
<i>Juniperus oxycedrus</i>	1+...+
<i>Salvia fruticosa</i>	..1++
<i>Origanum spyleum</i>	.1+..
<i>Trifolium campestre</i>	+++++
<i>Galium caudatum</i>	+++++
<i>Geranium lucidum</i>	+++++
<i>Anthemis cretica</i>	..+++.

The distribution of plants according to aspect is as follows:

**North:** *Pinus brutia*, *Rosa canina*, *Pistacia terebinthus*, *Quercus infectoria*, *Juniperus oxycedrus*, *Hypericum orientale*, *Dianthus calocephalus*, *Poa bulbosa*, *Potentilla recta*.

**South:** *Picnoman acarna*, *Myosotis stricta*, *Tordylum apulum*, *Torilis nodosa*, *Avena sterilis*, *Poa bulbosa*, *Centaurea urvillei*, *Jurinea mollis*, *Onosma isaurica*, *Scrophularia lucida*, *Ferula communis*, *Rhus coriaria*, *Phlomis armeniaca*, *Gypsophila tubulosa*, *Saponaria mesogitana*, *Anthemis tinctoria*, *Isatis tinctoria*, *Papaver rhoeas*, *Umbilicus horizontalis*, *Dianthus zonatus*, *Calligonum aphyllum*, *Campanula lyrata*.

**East:** *Cionura erecta*, *Silene chlorifolia*, *Isatis tinctoria*, *Ziziphora taurica*, *Quercus coccifera*, *Cynodon dactylon*, *Vicia cracca*, *Euphorbia taurinensis*.



*Alkanna tubulosa* Boiss. Photo: E. Ugurlu.

**West:** *Hippomarathrum cristatum*, *Trifolium affine*, *Dianthus zonatus*, *Anthemis tinctoria* var. *discoidea*, *Rubus ideaus*.

The distribution of plants on the cone according to altitude is as follows:

**0-20 m a.s.l.:** *Medicago orbicularis*, *Saponaria mesogitana*, *Tordylum apulum*, *Torilis nodosa*, *Picnoman acarna*, *Bromus tectorum*, *Filago vulgaris*, *Minuartia hybrida* subsp. *hybrida*, *Myosotis stricta*.

**20-200 m a.s.l.:** *Calligonum aphyllum*, *Rhus coriaria*, *Ferula communis*, *Dianthus zonatus*, *Silene chlorifolia*, *Avena sterilis*, *Cionura erecta*, *Phlomis armeniaca*, *Quercus coccifera*, *Quercus infectoria*, *Legousia speculum veneris*.

**200-400 m a.s.l.:** *Pinus brutia*, *Dianthus zonatus*, *Silene chlorifolia*, *Verbascum splendiddum*, *Holoschoenus vulgaris*, *Papaver rhoeas*, *Onosma stellatum*,

*Geranium pyrenaicum*, *Calligonum aphyllum*, *Hypericum orientale*, *Alcea pallida*, *Crepis foetida*.

The pioneer vegetation on Kula Volcano and the surrounding area is formed basically of the representatives of indigenous flora. There are some endemic plants on the volcanic lavas. These plants are *Colutea melanocalyx*, *Phlomis armeniaca*, *Onosma isauricum*, *Trigonella cretica*, *Anthemis dipsacea*, *Asperula lilaciflora*, *Campanula lyrata*, *Acanthus hirsutus*, *Alkanna tubulosa*, *Gypsophila tubulosa*, *Nepeta cadmea*, *Stachys tmolea*, *Crepis macropus*, *Stachys cretica* subsp. *anatolica*, *Linaria corifolia*, *Scrophularia floribunda*, *Echinophora trichopylla*.

#### References

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*Emin Ugurlu, Manisa, Turkey*  
*Ozcan Secmen, Izmir, Turkey*

Pictures below: *Alkanna tubulosa* and *Colutea melonocalyx*. Photo: E. Ugurlu.

