

# **Deposition and Soil Solution Chemistry in two Adjacent Mountainous Forest Ecosystems in Greece**

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## *Abstract*

The deposition chemistry has been monitored in the area of the mountain Ossa in two adjacent forest ecosystems, beech and oak, in central Greece since 1997. Low pH values ( $\text{pH} < 5.65$ ) in the bulk deposition were found mainly during winter months due to fuel combustion in the nearby area or neighboring countries. The origin of pollution sources has not been so far identified. The pH values of soil solution were found to be higher than those in bulk deposition. The concentrations of dissolved organic carbon in throughfall deposition were far greater in the oak forest (32.2 mg/L) than those in the beech forest (5.5 mg/l). It was also found that the Mg concentration in the leaves of both tree species followed a declining trend. The phenomenon needs further monitoring.

## *Characteristics of the experimental plots*

- Location: Mountain of Ossa
- Altitudes: oak plot :740 m, beech plot: 890 m
- Approximate area of both plots: 0.27 ha
- Climate: Mountainous Mediterranean with an average rain height of 1,626 mm
- Soil parent material: mica schist

Oak plot. The main forest species is *Quercus frainetto*, forming even aged stand of 20 years with an approximate tree height of 20 years and canopy closure 0.9-1. In the ground vegetation *Sorbus torminalis* is the dominant species. There are also ferns (*Pteridium aquilinum*) and among herbs there is a variety of species like *Melitis melissophyllum*, *Hieracium bracteolatum*, *Galium laconicum* and others. In grasses there are the species *Melitis melissophyllum*, *Hieracium bracteolatum*, *Galium laconicum* and others.

The ground vegetation is dense and covers about the 80% of the soil surface

Beech plot: The dominant forest species is *Fagus sylvatica*. The stand is even aged (91-130 years old) with an average tree height of 30 m and canopy closure 0.8-1). The ground vegetation is very sparse occupying only 5% of the soil surface. It consists mainly from *Ilex aquifolium*, and *Galium rotundifolium*, *Doronicum orientale* και *Cyclamen graecum*.



Forest floors in the oak plot (left) and beech plot (right). The difference in the density of ground vegetation is visible





## Bulk deposition collectors in the area





## Throughfall deposition collectors in the oak plot





## Throughfall deposition collectors in the beech plot





## Zero tension lysimeters in the oak plot





## Zero tension lysimeters in the beech plot



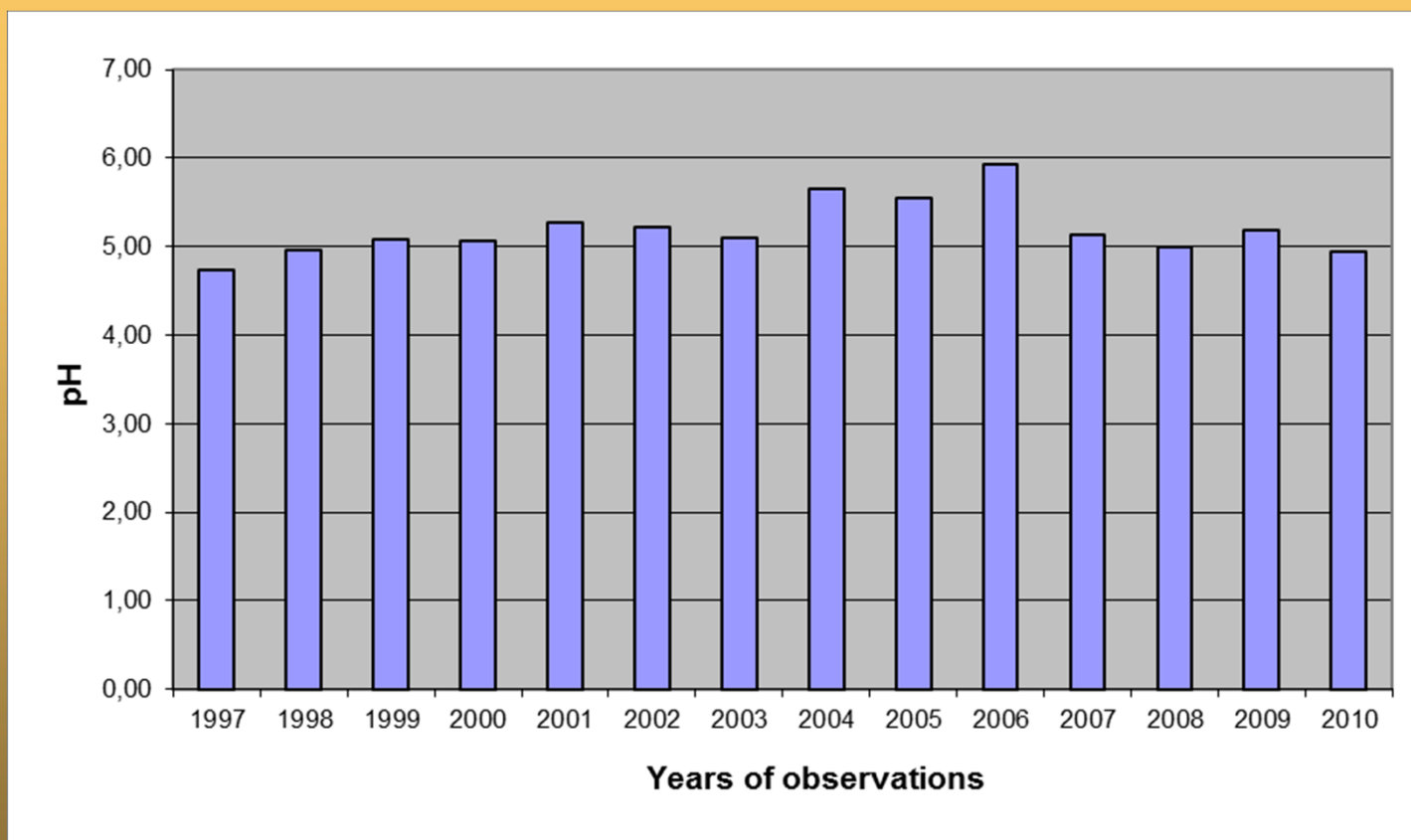


## Collection of soil solution from the zero tension lysimeters

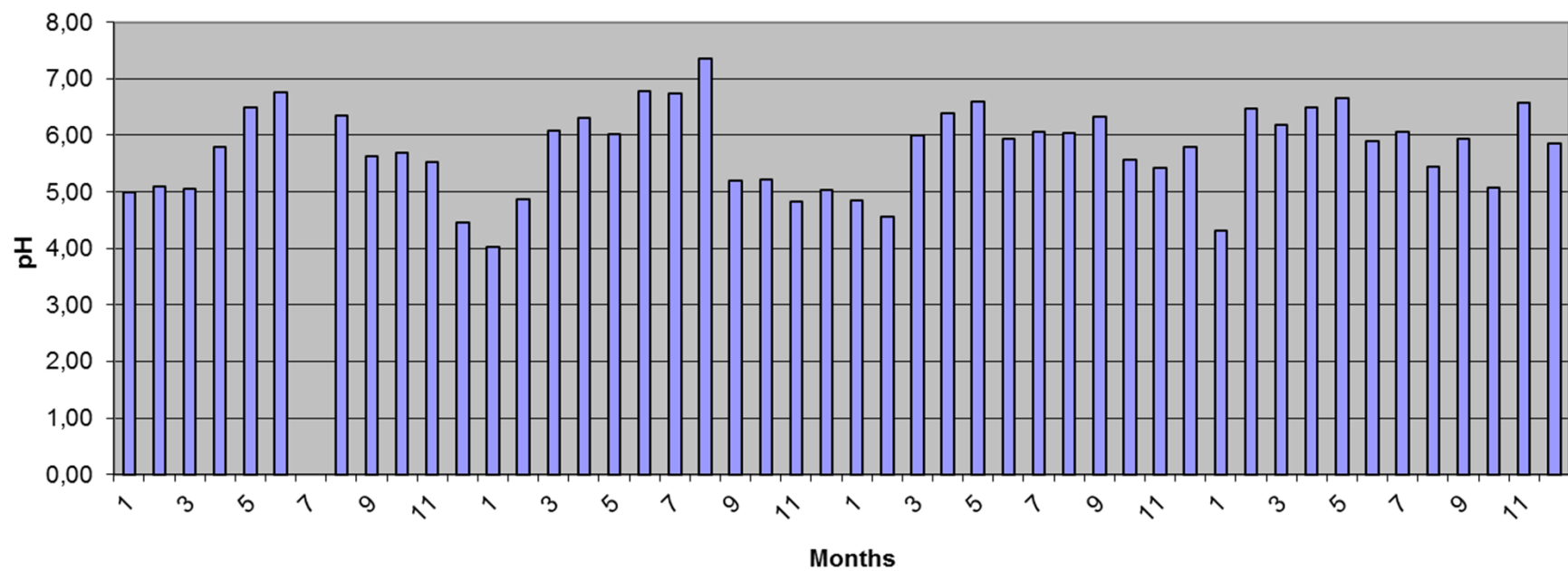




## Average pH values in bulk deposition in the area of Ossa

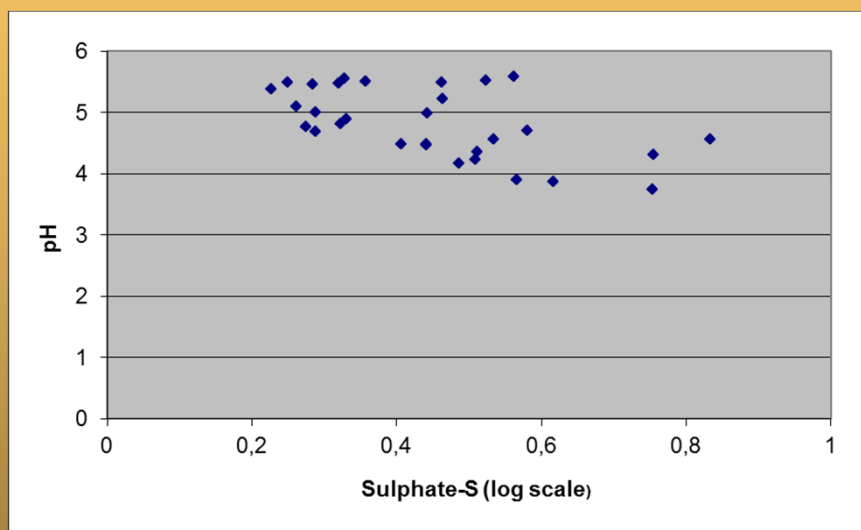


## Average pH values of bulk deposition in the years 2007, 2008, 2009 and 2010

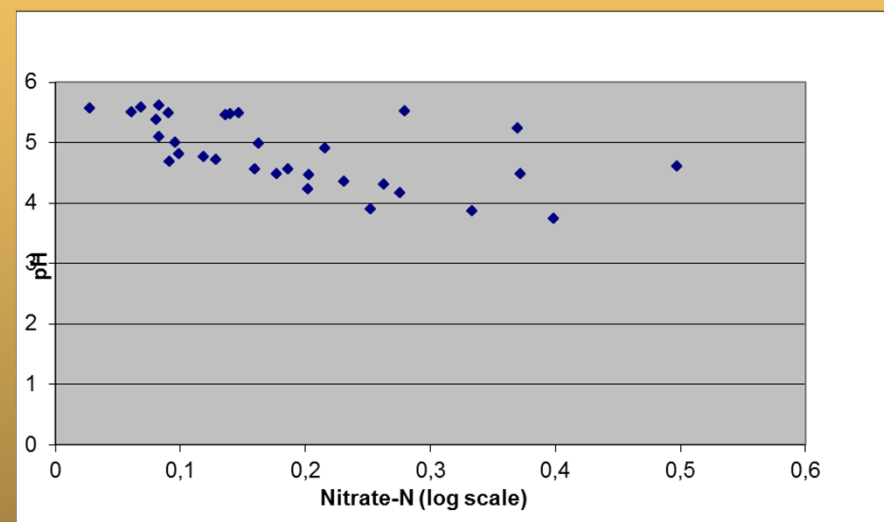




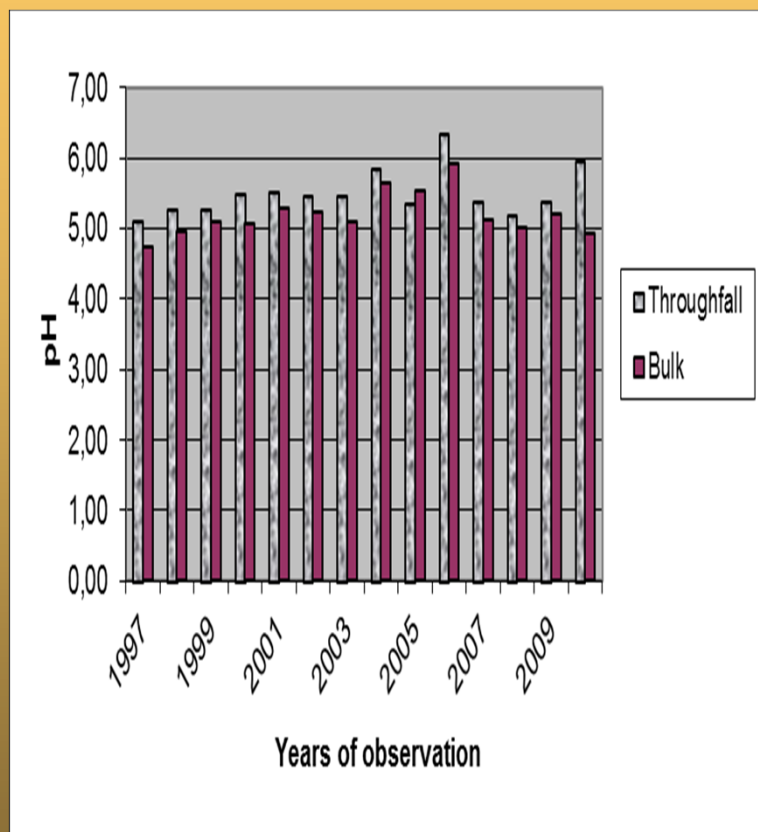
Correlation of pH values (<5.6) in bulk deposition with the sulphate concentrations



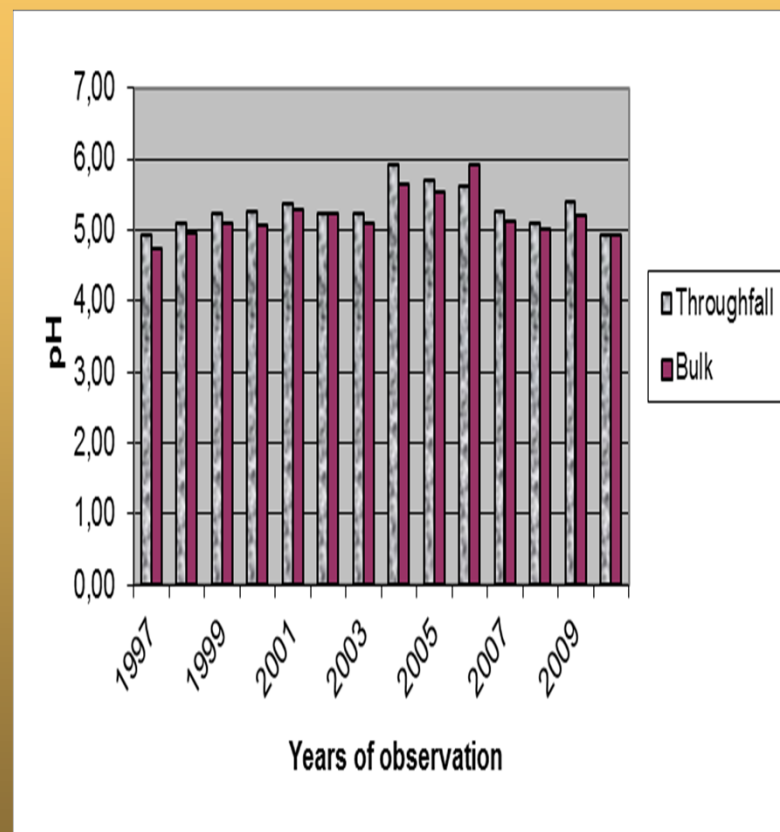
Correlation of pH values (<5.6) in bulk deposition with nitrate concentrations



## Average pH values in throughfall and bulk deposition in the oak plot over time



## Average pH values in throughfall and bulk deposition in the beech plot over time





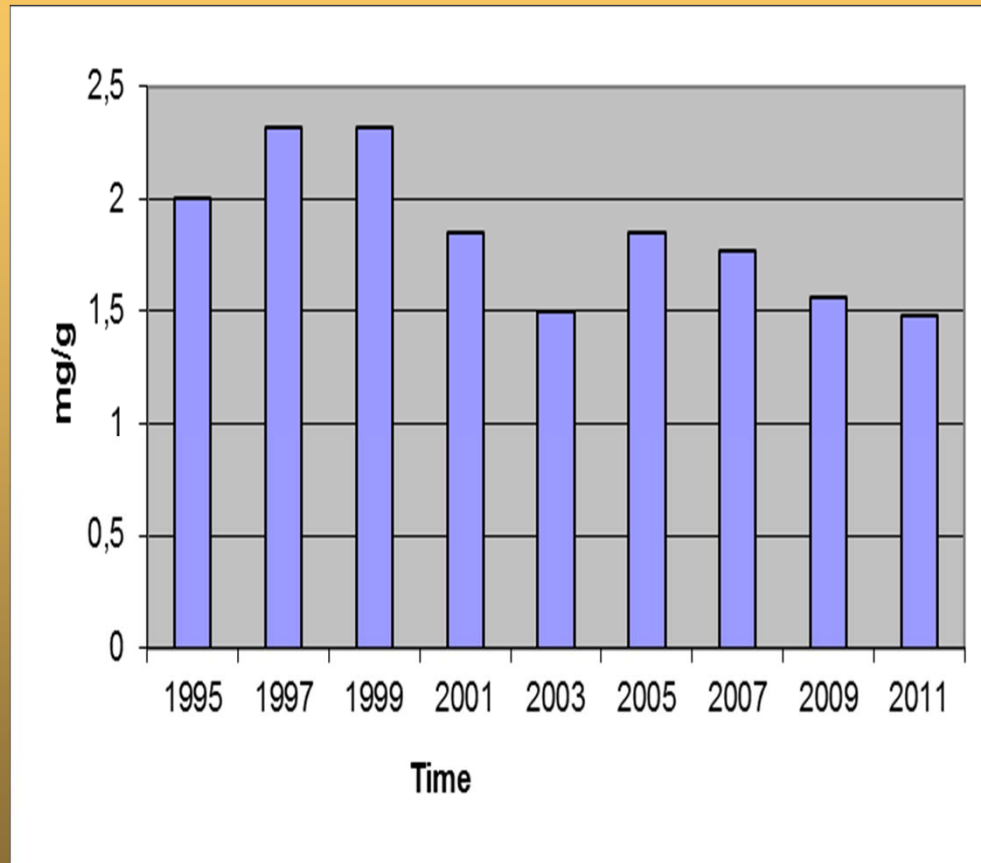
Average concentrations values (mg/L) of organic C (DOC) in throughfall deposition of the two plots

<b>Oak</b>	<b>Beech</b>
32,2	5,5

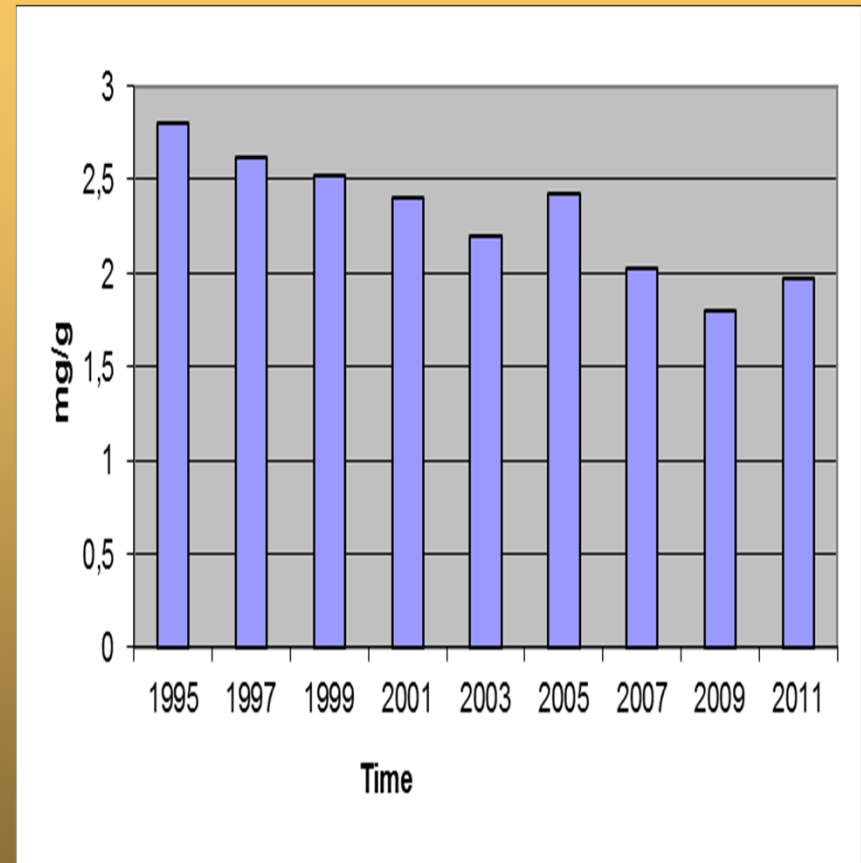
Average concentrations of chemical parameters in soil solution of the two plots at 65 cm depth in 2010. Conductivity is expressed in  $\mu\text{S}/\text{cm}$ , alkalinity in  $\mu\text{eq}/\text{L}$  and the others in  $\text{mg}/\text{L}$

	<b>pH</b>	<b>Cond.</b>	<b>Ca</b>	<b>Mg</b>	<b>K</b>	<b>Na</b>	<b>NH<sub>4</sub>-N</b>	<b>NO<sub>3</sub>-N</b>	<b>Total N</b>	<b>SO<sub>4</sub>-S</b>	<b>Alkal.</b>	<b>DOC</b>
Oak	6.7	57	2.90	1.08	2.00	3.22	0.25	0.21	1.25	1.44	192	7.98
Beech	5.6	39	1.18	0.79	2.08	1.63	0.20	0.28	1.03	1.27	25	10.5

Concentrations (mg/g) of Mg in oak leaves over time



Concentrations (mg/g) of Mg in beech leaves over time





## *Conclusions*

In the area of Ossa low pH values have been observed during winter months probably due to fossil fuel combustion

Far higher DOC concentrations were observed in the throughfall deposition in the oak plot

The soil solution in the beech plot was more acidic than that in the oak plot

In both plots the Mg concentrations in leaves (in oak and beech) have declined over time

*Thank you for your  
attention*

