



Bioclimatic Classifications in the Ecosystem of Dajt-Tirana, Albania.

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Abstract: Albania is located on the western part of the Balkan Peninsula, between 39° 38' and 42° 39' latitude and between 19° 16' and 21° 4' longitude. It is bordered by Greece in the East and South east, by Macedonia in the East-Northeast and by Kosovo in the northeast, North and Northwest: Adriatic and Joni and Seas from the west and southwest borders of the country. The country covers a surface of about 28.748 km². The coastal area is 7000 km² or 25% of the national territory; the Mediterranean watershed includes 28748 km². Country's protected area is app.162 529 ha which means 5.8% of the territory. Bio-climate is considered as a combination among the vegetation area and climatic elements with indexes: temperature and precipitations. This combination creates a complete, continued and stable view of an area or some ecologic areas in relation to indexes of bio-climate content elements. Dajt ecosystem is situated at "the heart" of Albania. From the sea level is situated Vora with altitude 50 m and the most altitude is the top of Dajt mountain with 1600 m. The eco-climatic indexes are obtained based on real measurements from observations on meteorological stations for some decades. The basic indexes are: month temperatures and precipitations. The study with title: "Bioclimatic classifications in the ecosystem of Dajt-Tirana", contribution for bioclimatic evaluations in Albanian ecosystems.

Key words: Ecosystem, Bioclimatic index, Micro zone, Classification, Vegetation

Introduction

The climatic elements that determined an eco-climate zone are connected with each-other. Their comprehensiveness and coactions give stable contours of eco-climatic indexes. The determination of an eco-climatic zone takes in consideration indexes that are repetitive and sustainable on time and space (*Hodo, P. & Dinga, L., 2000; Mankolli, H , et al.,2008*). These indexes have a biotic and biotic nature. In every case factors that condition eco-climatic of a macro zone or micro zone are geophysics as: latitude, altitude above sea level, atmospheric and biotic phenomena's and presence of natural or cultivated vegetation. The bioclimatic concept is wide and from ecologic viewpoint shows the combination of content elements that determine plant and animal life.

The bio-climate zone is considered as a combination among the vegetation area and climatic elements with indexes: temperature, precipitations, wind, air humidity etc. This combination creates a complete, continued and stable view of an area or some ecologic areas in relation to indexes of bio-climate content elements. On eco zones environment resources are in correlation with biotic resources (*Fremuth, W.,2000; Istituto Agronomico Per L'oltremare, 2002*). They present a special importance from the point of study, evaluation, usage, preservation and improvement of natural resources. In every ecologic zone biotic and a biotic component are combined (*Dishnica, T, et.al.,2006; Maracchi, G.,1983*) their interaction has an impact on evolution and balance ecosystem progress. Beside the factors that indicate on improvement or no on an ecosystem, anthropogenic factor has a great importance for ecosystem. The eco-climatic resources are considered decisive on plant cultivation, because they implicate growth plant, as a consequence, his production. These sources have a relation

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with eco-climatic cultivated zone. The climate components of an eco-zone react in an unseparation way and induce to each other revealing compensate effects.

The more important eco-climatic indicators for study aspects are: sun-light, precipitations, temperatures, relative air humidity, wind and other atmospheric phenomenon (Dako A, *et al.*, 2008; PPNEA-ASPBM., 1997). Case by case, the eco-climatic factors study on time and space give sufficient information for agro-ecosystem cultivation.

The vegetation of mountainous ecosystem in Dajt-Tirana

In the territory of mountainous ecosystem of Dajt-Tirana, Albania, there are all phytoclimatic zones:

The zone of bushes and Mediterranean bushes is located in the height 300-600 m above the sea level.

The vegetation of Dajt-Tirana, Albania as well as flora, is rich and diverse in species beginning with coastal communities plants *Zosterion maritima*, of wetlands, mainly of the coastal zone *Ruppion maritimae*, *Juncion maritima*, *Salicornion fruticosae* etc., up to pastures and meadows alpine of high latitudes-Nardion stricter, *Arrhenatheretalia*, *Molinetalia*, *Brometalia erecta* etc., when the dominant communities are woodlands of *Fagetalia sylvaticae*, *Populetalia alba*, *Quercetalia pubescentis*, *Alnetalia glutinosae*, *Erica* - *Pinedale*, *Vaccinio-Picetea* etc., and hedgerows-*Quercion ilicis*, *Oleo-Ceratonion*, *Paulirion adriaticum*, *Cisto-Micromerietalia*, *Juniperion nanae* etc.

The zone of oaks is located in the height 500- 1300 m and it has a variety of forests.

Forest & Mediterranean shrubs Belt. This belt, is mainly dominated by communities of *Quercetalia ilicis*, *Alnetalia glutinosa*, *Populetalia alba*, covers about 32 % of Dajt-Tirana territory surface. Mediterranean forest consist of Austrian Pine- *P. halepensis*, Stone Pine - *P. pinea*, and forest oases with oak: *Quercus ilex*, *Quercus robur*, *Quercus* (Q) pubescent or other oaks as *Populus alba*, *Alnus campestris*, *Alnus glutinosa* accompanied from grassland and hedgerows.

Mediterranean shrubs consist of evergreen shrubs of *Machia* type, such as Strawberry tree- *Arbutus unedo*, heath- *Erica arborea*, *Myrtus communis*, *Viburnum tines*, *Arbutus andrachne*, wild olive-*Olea europaea* var. *sylvestris* and *Pseudomacchia*, communities of *Buxus sempervirens*.

The other shrubs, mainly hedgerows, with thorns, that in natural conditions are grown in fresher than machia areas are named as Shibjaku such as: *Paliurus spina-christi*, *Cotynus coggygria*, *Forsythia europaea*, *Rhus coriaria*, willow - *Punica granatum*, *Colutea arborescens*, wild pear - *Pyrus amygdaliformis*, *Crataegus* sp. div), cornel - *Coronilla mass*, *Coronilla emerus*, *Pistacia terebinthus* etc. Friganat, short kserophyl shrubs, in general with small leathery leaflet, thorny branches, aromatic and gray, represented by communities of *Oleo-Ceratonion*, for example *Oleo-Lentiscetum*, *Oleo-Euphorbietum dendroides* etc, or *Cisto-Ericion*.

Close the seaside we can find specific communities of *Cakilo* - *Xanthietum italici*, *Ammophiletum arundinacea*, *Ephedretum distachia*, *Limonietum anfracti* as well as a lot of other halophytic, psamphytic and freshwater aquatic communities etc.

The zone of beeches is located 1000-1600 m the main kind is the beech

Oaks Belt. The dominant communicates are *Carpinion orientalis*, *Quercia petraea*, *Ostrya-Carpinion orientalis* etc). From the oaks more common are: *Quercus pubescentis*, *Q. frainetto*, *Q. petraea*, *Q. trojana*, turkey oak - *Q. cerris*, and from other trees: manna ash - *Fraxinus ornus*, *Ostrya carpinifolia*, hornbeam - *Carpinus betulus*, sweet chestnut - *Castanea sativa*, field maple - *Acer campestre*, large-leaved lime - *Tilia platyphyllos*, in the upper levels of this belt we can find forest with Austrian pine - *Pinus nigra* or silver fir - *Abies alba*, typical species of third belt.

The most popular shrubs here are: *Crataegus* sp. div., *Carpinus orientalis*, *Cotynus coggygria*, junipers - *Juniperus oxycedrus* e *J. communis*, *Colutea arborescens*, *Lembotropis nigricans*, *Genista tinctoria*, corne l- *Cornus mas*, *C. sanguinea*, *Paliurus spina-christi* etc. In the oak zone of central and south of Albania we can meet the endemic specie *Forsythia europaea*.

The oak zones are more populated and more endangered. This are used as plantations cultivated trees of apple, nut, chestnut, auburn etc.

The alpine zone has a limited territory and is located 1600 m height.

Pastures & Meadows alpine Belt. This lies in the upper level of forests. Consist of grassland and hedgerow. From the floristic point of view, the principal characteristic is the dominance of the family *Graminaceae*. More common here are the communities of species of genera *Festuca* (*F. bosniaca*, *F. adamovici*, *F. panciciana*, *F. paniculata*, etc.), *Poa* (*P. alpina*, *P. cenisae* etc), *Nardus* (*N. stricta*) etc., and few species of genera *Koeleria* (*K. splendens*, *K. eryostachia* etc.), *Sesleria* (*S. tenerrima*, *S. coerulans* etc.), *Trisetum* (*T. flavescens*), *Agrostis* (*A. capillaris*), *Phleum* (*P. alpinum*) etc.

Pastures of this belt are full of species of the family *Fabaceae*, such as: *Trifolium alpestre*, *T. badium*, *T. velenovski*, *Onobrychis alba*, *O. montana*, *Anthylis vulneraria*, *Astragalus angustifolius* etc.

In the pastures massifs of this belt we find shrubs and hedgerows of genera *Rosa*, *Daphne*, *Genista* etc. Going from the north and east to the south and west the plants are mainly Mediterranean's.

Material and Methods

The climatic data are a result of temperature and precipitation indexes obtained from observations on Dajt-Tirana eco-zone. Among these indexes is a significant relation. This data are gathered on Hydrometeorology Institute's stations in Dajt-Tirana. This data period is over than three decades from 1970 to 2000.

- The methodology used is been based on Emberger's and Rivas Martinez theory and comparative method (*Emberger, F., 1969; Martinez S.R, 1996*).
- As a supplied method is been used the statistic, table, graphic, map-maker and investigated one.

Classification Rivas Martines based on climatic index Ic, It, Io.

- (i) **Ic**, that is an annual thermal interval index calculated as

$$Ic = Tmax - Tmin$$

- (ii) **It**, that is a thermatic index (or termotipo) calculates as

(1)

$$It = (T + m + M) * 10$$

- (iii) **Io**, that is an ombrothermic index (or ombrotipo) calculated as

$$Io = 10 \times Pp / Tp$$

where: Tmax = average temperature of the hottest month of the year; Tmin = the average temperature of the coldest month of the year; Pp = sum of the monthly mean rainfall data (mm) of the months in which the average temperature is >0°C; Tp = sum of the mean temperature values for months with T>0°C; T = mean annual temperature; m = mean of the minimum temperature of the coldest month in the year; M = mean of the maximum temperature of the hottest month in the year.

Classification Emberger based on pluviometric index, Q is results (EMBERGER, F. 1969).

$$Q = \frac{2000 P}{(M - m)(M + m)} \quad (2)$$

Where: Q = coefficient index; P = annual precipitation; M = Mean of the maximum temperature of the coldest month in the year in °K (Calvin); m = mean of the minimum temperature of the coldest month in the year in °K (Calvin);

Table 1. Temperature and precipitation for Dajt - Tirana ecosystem

Climatic data	Average precipitation (mm)			Average air temperature °C			Maximal air temperature °C			Minimal air temperature °C		
Months	Fushë-Dajt	Rrëzë-Dajt	Linëz-Dajt	Fushë-Dajt	Rrëzë-Dajt	Linëz-Dajt	Fushë-Dajt	Rrëzë-Dajt	Linëz-Dajt	Fushë-Dajt	Rrëzë-Dajt	Linëz-Dajt
I	124.5	91	86	5.5	3.8	7.5	8.7	8.1	11.3	2.3	-1	3.7
II	165.8	191	152.3	2.7	1.5	5.2	6.4	5.5	9.6	-0.7	-2.6	0.8
III	101.7	81	60.1	8.6	6.1	10.7	12.6	10.4	17.8	4.7	1.7	3.7
IV	126.9	130.5	84.7	14	10.5	13.8	16.2	15.2	19.2	7.7	5.8	8.5
V	159.9	67.5	147.5	15.9	14.2	17.9	20.2	19.4	22.7	11.8	9.3	13.2
VI	142.3	192	251.7	16.2	15.7	19.6	20.8	19.6	23.8	11.8	11.2	15.4
VII	111.9	94	45.3	26.3	21.2	24.4	27.1	25.6	30.1	15.0	16.1	18.6
VIII	56.5	49.2	33.7	20	19.2	22.3	24.9	24.7	23.6	15.3	14.8	15.4
IX	123.8	147.1	112.4	17.4	16.8	20.2	22.7	21.9	26.9	12.5	11.6	13.6
X	159.6	126.9	119.7	13.5	12.9	16.8	18.5	17.4	22.0	8.8	8.4	11.6
XI	123.1	168	125.1	9.3	10.6	11.2	13	12.5	13.1	5.8	3.7	5.9
XII	162.9	123.2	109.2	7	8.6	9.3	9.7	8.7	13.0	3.8	1.6	5.6
Years total	1559	1461.4	1203									

Sources: (Hydrometeorological Institute of Albania, 1970-2000)

Results and Discussion

Climatic zone in Albania

Albania is a small country; there are important climatic differences, which are result of the very broken country's relief. Four climatic zones: Lowland-Mediterranean Zone, Hilly-Mediterranean Zone, Pre-mountain-Mediterranean Zone and Mountain-Mediterranean Zone; and 13 sub zones are identified inside the country. Typical Mediterranean climate characterizes the lowlands and the plains. The mountainous area has in principle typical continental climate with a slight Mediterranean influence. But there is a significant difference between the North and the South. In the South the summers are drier and the differences between summer and winter temperatures are not as big as in the North.

- In the interior part of Albania there is no balanced impact of the Mediterranean Sea climate anymore. Therefore the daily differences between maximum and minimum temperatures are considerably higher than at the coast. Also the annual precipitation is in the mountainous areas higher than in the lowlands at the coast

The Dajt ecosystem is located on North-East of Tirana zone in Albania. The relief is mainly mountain relief (the highest height 1613 m) with the mountainsides very sloping and divided by the hydro graphic network mainly with temporal flow. In the mountainous ecosystem of Dajt-Tirana, there are 4 main kinds of land: brown forest umber-gray, and pasture mountainous land. In the mountainous ecosystem of Dajt-Tirana has Mediterranean Climate, north counter mountain sub zones, with 1600 mm rain-fall per year, concentrated mainly in the second part of the year and very intensive (*Mankolli H.,2006*).Snow-falls long nearly 10 days.

- The data climatic for same year's period where minimal and maximal temperature and precipitation on micro zone in territorial areas Dajt-Tirana, Albania, take on study, we have value from coefficients of Q with small limits boundary.
- The indexes Q from applied method Emberger is on limits 142.2-205.7.

Eco zone in the mountainous ecosystem of Dajt-Tirana classification on bioclimatic model, humid with value (Q) over 90. In table no.2 we have coefficient Q for more micro zones of Tirana, Albania.

Table 2. Coefficient Q

No	Micro zones	M (Max)	m (Min)	Pm/year	Q
1	Dajt-Fushe	27.1	-0.7	1558	205.7
2	Dajt-Reze	25.6	-2.6	1461	182.1
3	Dajt-Linez	30.1	0.8	1202	142.2

Sources: Analyzing data from Emberger Method

The data climatic for same years period where minimal and maximal temperature and precipitation on micro zone in territorial areas Dajt-Tirana, Albania, take on study, we have value from coefficients Ic, It, Io with moderation limits boundary.

The indexes Ic from applied method Rivas Martine's is on limits 26.4-29.3.

The indexes It from applied method Rivas Martine's is on limits 332-456.

The indexes Io from applied method Rivas Martines is on limits 2.2-3.7.

Eco zone in the mountainous ecosystem of Dajt-Tirana, have more classification on bioclimatic models. In table no.3 we have coefficient Ic, It, Io.

Table 3. Coefficient Ic, It, Io

Micro zones	T	m	M	Tp	Pp	Ic	It	Io
Dajt-Fushe	10.3	-0.7	27.1	3759.5	1393	26.4	381	3.7
Dajt-Reze	10.2	-2.6	25.6	3723	1179	28.2	332	3.2
Dajt-Linez	14.7	0.8	30.1	5365.5	1202	29.3	456	2.2

Sources: Analyzing data from Rivas Martine's Method

Where: Tmax = average temperature of the hottest month of the year;

Tmin = the average temperature of the coldest month of the year;

Pp = .sum of the monthly mean rainfall data (mm) of the months in which the average temperature is 0°C;

Tp = .sum of the mean temperature values for months with T>0°C;

T = .mean annual temperature; m = .mean of the minimum temperature of the coldest month in the year;

M = mean of the maximum temperature of the hottest month in the year.

From the climatic point of view based on the applied methods in study we see that the values of climatic indicators have changes which are caused by the presence of vegetation. In order to show the connection between the values of climatic indicators and vegetation we need other studies but we refer to the correlation that exists between the vegetative mass and evapotranspiration in different types of plants.

Thus the greatest density and vegetative surface present in Dajt Linez gives us a special micro bioclimatic indexation. Another important factor that gives us the chance to discuss the values taken in study regarding their variability and the presence of microbioclimates is the height above the sea level. From the studies carried out by different authors the height above the sea level corrects the temperature values from 0.3-0.5 C°, for any 100 m of height.

The studies of microbioclimatic character in Albania are rare, but those in the conditions of variability of global climate, get a special importance also for the fact of the determination of their impact in bioclimatic indicators, of adaptation chances of cultivated and natural vegetation, for their conservation and use according to the ecological and economical logic.

Conclusions

Based on obtained results from the data processing according to Emberger F and Rivas S. Martinez's Method and the discussions about the study "Bioclimatic classifications in the mountainous ecosystem of Dajt-Tirana" are concluded:

The results taken from the processing of data classify Dajt-Tirana ecozone as bioclimatic Humid (with humidity) and the values of index Q are higher than 90. The ecosystem of Dajti based on the indicator Ic or continental index is evaluated in Subcontinental-Continental Macroclimate : Mediterranean. The changes between taken in the study result in small climatic changes and are classified in a type of bioclimate.

The ecozone of Tirana based on index It is considered in Microbioclimate Termotemplado where belong Dajt fushe, Dajt Rezë and infratemplado where Lineza belongs. The ecozone of Tirana based on the index Io is considered in Microbioclimate Semiarid, microbioclimate Seco 2.0-3.6, (dry) Dajt Fushë, Dajt Rezë, Linëz.

Climatic indicators minimal average monthly temperature results in Dajt Rëzë with minus – 2.6 C°, the minimal average annual temperature results in Dajt Rezë with 10.2 C°, maximal annual rain result in Dajt Fushë with 1558 mm. In the territory of this park are found four vegetation areas: the area of mediteranean shrubs, are of oak-plantation , area of beech and alpine area. The types of vegetation are represented by beechwoods/ *fagus sylvatica*, pine/ *Pinus leucodermis*, chestnut/ *Castanea sativa*, oak/ *Quercus trojana*, red juniper/ *Juniperus oxycedrus*, etc. the types of vegetation have an influence in the values of bioclimatic indexes.

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