

# The Latest on Mediterranean Forests

N°15 September 2009



## Editorial

I am very happy for a number of reasons to have received an invitation to write this editorial. I am a firm believer in the IAMF's role in the interplay of institutions and people interested in **Mediterranean forests**: the IAMF has taken the right track in working to define guidelines best suited to enhancing management of natural areas in an environment as difficult as the Mediterranean context.

This edition of our Bulletin features an article by Henri-Nöel Le Houérou on a much debated subject: the delimitation of the Mediterranean isoclimatic area. The author presents a method, inspired by the work of Emberger and Gaussan, which makes numerous original proposals for defining certain indices whose relevance is closely connected to the naturally self-seeding plant cover and prevailing methods of cultivation. On this basis, he has drawn up a phytogeographic classification based on real conditions. I do want to emphasise just how much the reorganisation and enhanced investigation of themes crucial for a definition of exactly what "Mediterranean" means, can contribute to the efforts towards a better understanding of the diversity of the environment in which we operate. Management models involving forests but designed for other environments are often not amenable for adapting to the realities of a Mediterranean context: this, in my opinion, is a fundamental point and I think making people aware of it should be encouraged in every way possible. And it is here precisely that the IAMF plays such an important role, raising the awareness of those involved in this issue, not only at the technical but also the political level, locally, nationally and internationally. Our vegetation is the manifestation of an environment that is unquestionably complex and apparently fragile but which, nevertheless, survives shocks of the worst kind, be it wildfire, human depredation, or all the rest that we all know about. Indeed, it is the resilience of **Mediterranean forests**, understood in the broadest sense, that is the most precious feature for research scientists and technicians working to restore these woodlands: such restoration must be carried out in the light of plant dynamics which are so sensitive to the Mediterranean nature of climate as shown by Le Houérou.

This edition of the Bulletin also pays tribute to a man of great political acumen, André Werpin, self-confessed Mediterranean and one of the founders of the IAMF. One of his friends described him as *un type bien*\* which seems to me to sum up the view of those who knew him. We share the sadness of his family; he was a model to us all.

**Patrizia TARTARINO**  
**IAMF Administrative Board Member**

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\* In French in the (Italian) original: a really good guy

## Recently, IAMF took part in...

**Marseille (France)**  
July 1 2009

David Gasc, Project Manager, attended the seminar "Governance tools in favour of the territorial development" held by MED European project "Model Forests".

**Montpellier (France)**  
July 17 2009

David Gasc participated in an interregional information meeting on the ENPI CBC Med programme.

**Paris (France)**  
September 22 2009

David Gasc took part in the training day on the MED programme's PRESAGE system.

**Rabat (Morocco)**  
8-9 July 2009

Mohamed Benzyane, member of our network, represented the IAMF at the workshop "Sustainable management of Mediterranean forests and their biodiversity in a context of climate evolution".



Participants in the workshop - Rabat (8-9 July 2009)

## Membership and/or subscription form

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# The isoclimatic Mediterranean biomes: bioclimatology, diversity and phyto-geography

by Henri-Noël Le Houérou

Biomes are defined as large continental zones of relatively homogenous natural environments such as: Tundra, Taïga, Boreal Forest, Temperate Forest, Prairie, Mediterranean-type Sclerophyll Forest and Shrubland, Steppe, Desert, Savanna, Woodland, Dry Tropical Forest, Rainforest, Inter-Tropical Montane Forest, etc. These Biomes (and others) are characterized by a distinct climate, geomorphology, soil, flora, vegetation, land-use and human habitat. They are kinds of “super ecosystems” at a continental scale, so to speak. The climate of the Mediterranean Biomes is characterized by winter precipitation and summer drought. Vegetation is made up of sclerophyllic trees and shrubs in the semi-arid to humid zones, open steppe in the arid zone and contracted desert vegetation in the hyper-arid zone.

Difficulty arises when trying to find an accurate definition of winter precipitation and summer drought.

In order to solve this problem in an objective and rational manner, the author has set up very simple **Indices of Mediterraneanity**. MI 1 is the ratio between Winter Trimester (quarterly) Precipitation and Summer Trimester (quarterly) Precipitation (WTP / STP). MI 2, in turn, is the ratio between Winter Semester (half-yearly) Precipitation and Summer Semester (half-yearly) Precipitation (WSP / SSP). Winter Trimester

Precipitation is that of DJF in the North hemisphere and JJA in the South hemisphere. Winter Semester Precipitation (short days season) is that of ONDJFM in the North hemisphere and Summer Semester Precipitation (long days season) that of AMJJAS in the South hemisphere and vice-versa. By running empiric approximations the author comes up with the following rules: for any area to qualify as Mediterranean, WTP / STP should be equal to or greater than 2.0 (there are very few exceptions). This index reaches infinite when summer precipitation is totally missing as in many low-land areas of the Eastern Mediterranean and South-West Asia which, for that reason, are called “Hyper-Mediterranean”. For similar reasons MI 2 should be equal to or greater than 1.5. Another method is the utilization of the percentage ratios of WTP to Total Annual Precipitation. (WTP / TAP). By definition, WTP / TAP is equal or superior to 25%. Similarly one may use the ratio WSP / TAP, which, by definition, should be equal to or greater than 50% for any area to qualify as “**Mediterranean**”. Thus, by running approximations, based on the geographic distribution of these indices on the one hand and the distribution of flora, vegetation, crops, fauna and wildlife, agricultural and livestock production systems on the other, the author has come up with the above-mentioned index-based definitions. The author was inspired to adopt this approach by his teacher

Emberger, but he uses many more criteria than Emberger. Doubtful cases are resolved through the detailed analysis of the criteria mentioned above. Naturally, there are areas of transition called either Sub-Mediterranean or Attenuate-Mediterranean. This is the case for the Causse plateaus in South France, most of the Appennines in Italy, the Eastern Pyrenees of Spain and France, large parts of Anatolia in Turkey, etc. Specialists will notice that the author has by and large followed his teachers and mentors L. Emberger, H. Gaussen and H. Walter, but adding new criteria to their approach, such as Potential Evapotranspiration (ETP) and Reference Potential Evapotranspiration (ETo) which allow for the computation of climatic water balance and budget. Thus defined, the Isoclimatic Mediterranean Zone covers an area of nearly 15 Million km<sup>2</sup>, which is a little over 11% of the land mass of the planet, distributed over 60 countries and states having a partly or totally Mediterranean type of climate.

Mediterranean climates present two features that have an essential impact on the distribution of living organisms: the aridity index (water offer and demand balance) and the thermal stress from winter temperature. The first trait is measured by the ratio between Precipitation and Reference Potential Evapotranspiration (ETo), on any time scale. Precipitation does not exhibit

## The main file

any long-term trend over the period of instrumental records (ca. 170 years), but short- (10 years) and medium-term (25-50 years) fluctuations and trends appear, both positive and negative.

The **aridity index** ( $P / ETo$  or  $ETPp$ ) distinguishes 7 major Mediterranean zones as a function of aridity, according to the Emberger and UNESCO terminologies :

- ✓ **Hyper-humid:**  $P > ETo$
- ✓ **Humid:**  $ETo > P / ETo > 0.70$
- ✓ **Sub-humid:**  $0.70 > P / ETo > 0.45$
- ✓ **Semi-arid:**  $0.45 > P / ETo > 0.28$
- ✓ **Arid:**  $0.28 > P / ETo > 0.07$
- ✓ **Hyper-arid:**  $0.07 > P / ETo > 0.03$
- ✓ **Eremitic:**  $0.03 > P / ETo$

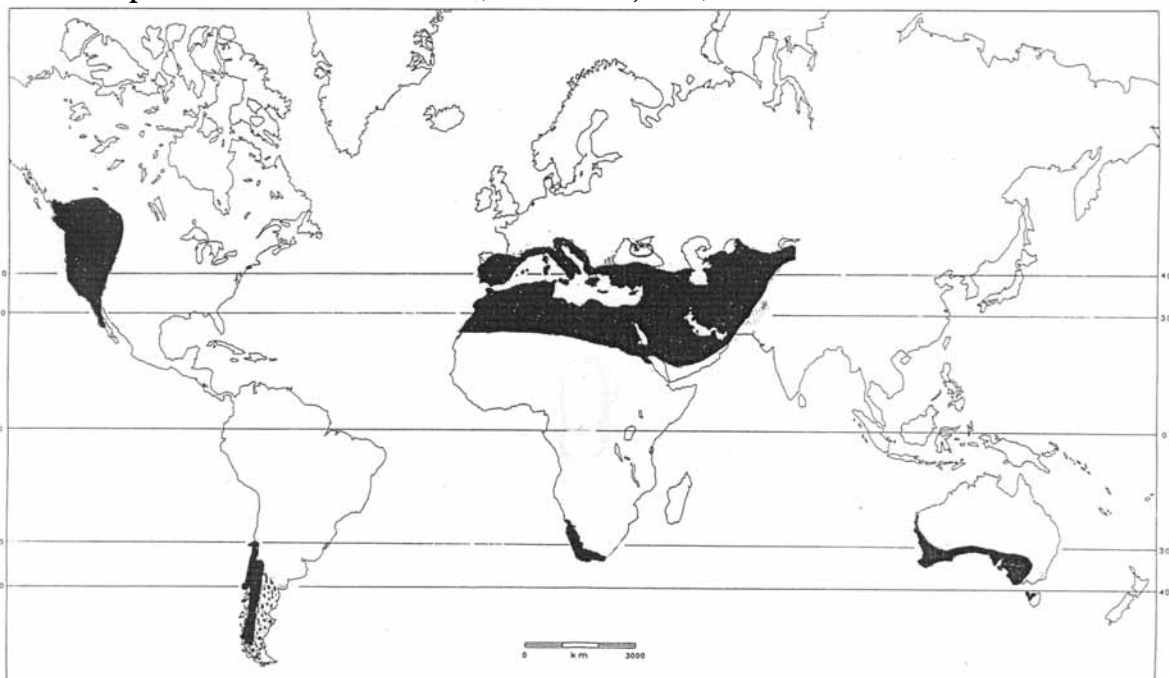
The limit between semi-arid and sub-humid zones corres-

ponds to the feasibility of summer crops in the latter but not in the former. The limit between arid and semi-arid zones corresponds to the transition from steppe vegetation (Arid) to forest and shrubland vegetation (semi-arid upward) and / or to the transition from commercial to subsistence dry farming. The limit between arid and hyper-arid zones corresponds to the transition from diffuse steppe vegetation (arid) to contracted vegetation (hyper-arid) and / or between subsistence farming and no dry farming at all. In Mediterranean deserts, the scanty rainfall always occurs in the cool season, contrary to tropical and temperate deserts.

The second major feature, winter cold, is evaluated via the daily mean minimum temperature of the coldest month ("m"): January in the Northern Hemisphere, July in the Southern. The criterion of sea-

sonal winter cold, as used by some authors without any specifications, is not envisaged at this level of the classification but it is crucial in a further step. The temperature of the earth has increased globally by  $0.5^{\circ}\text{C}$  over the past 100 years. But this does not clearly show up in the Mediterranean latitudes where a roughly  $0.2^{\circ}\text{C}$  increase has occurred over the same period, which is the order of magnitude resulting from urbanization. But at higher latitudes, the increase is sharper:  $1.0$  to  $1.5^{\circ}\text{C}$  at latitudes of  $50^{\circ}$  and  $60^{\circ}$  North and South. The index of winter thermal stress ("m") is closely correlated to the annual number of freezing days. In the present classification, "m" is divided into 8 slices of  $2^{\circ}\text{C}$  each from  $-5^{\circ}\text{C}$  to  $+9^{\circ}\text{C}$ . The value of "m" =  $-5^{\circ}\text{C}$  corresponds to the upper tree limit in Mediterranean high mountains and  $+9^{\circ}\text{C}$  to frost-free zones, hence the feasibility of tropical crops as long as water is available. These two limits correspond approximately to

**World map of Mediterranean Biomes (Le Houérou, 1985)**



mean annual temperatures of 0.0 and 15.0°C, respectively. But the relation is not very precise: these 2°C slices correspond to the presence / absence of key plant species and crops.

We have thus as a first approximation (8 x 7) of 56 principal combinations of aridity indices with temperature thresholds. Variations and shades within these combinations may be introduced using other criteria when more precision is required: number of freezing days, dates of first and last freeze, maximum winter and summer temperature, humidity, detailed seasonality of precipitation, windiness, hot spells, continentality (temperature range), etc. This classification is thus open-ended and amenable to adjustments as locally required to meet the needs.

The different kinds of climate may be visualised at a glance using the ombrothermal graphs and ombrodiapneic curves showing the monthly patterns of precipitation, temperature, and potential evapotranspiration, thus indicating the distribution, duration and intensity of dry and rainy seasons and the climatic water balance. This method was first set up by A. de Gasparin, a leading agronomist of the mid-19<sup>th</sup> century, up-dated by Bagnouls and Gaussen in the mid-1950s and popularized by Walter and Lieth in the 1960s. The author has only added the Reference Potential Evapotranspiration (ET<sub>o</sub>) to the system, in order to keep pace with progress in bioclimatology. Significant progress was made when it was shown (1981) that the value of 2 t (P =

2 t) corresponds statistically to P = 0.35 ET<sub>o</sub> as the threshold between dry and rainy seasons, except in areas subjected to persistent strong winds (WS > 5 ms<sup>-1</sup>). The latter represent only some 2% of the 3,500 weather stations analysed. From these statistical studies one may infer that the 2 t threshold corresponds to 0.19°C on a daily time frame and 70 t on an annual time frame. Hence, ET<sub>o</sub> or ETP<sub>p</sub> ~> 0.19 t and ~> 70 t, respectively. But in windy locations, such as in Patagonia or the Sahara, these values may rise to 85-125 t due to the high incidence on the final ETP<sub>p</sub> value of the aerodynamic term (wind speed and lateral advective energy flux from differential albedo) in Penman's equation .

The Mediterranean Biomes possess a flora of some 75,000 vascular species with a 54% rate of local and regional endemism. This number includes an overall 5% regional aliens, most of Mediterranean origin. These Mediterranean species represent some 25% of the planet's flora on 11% of its territory. Some regions are particularly rich: the Greater Cape Flora includes 12,000 spp (the Fynbos alone 9,000), South-West Australia has some 10,000 spp; in both cases endemism is ca. 80%. The Irano-Turanian flora encompasses about 17,000 spp and the Mediterranean Basin some 25,000 spp with, respectively, a 30 and 60% rate of endemism, etc. Specific area richness may reach up to 1,000 spp per 10,000 km<sup>2</sup> as in the Cape's Fynbos, 600 in the Greater Cape, etc. Just to give an idea of such richness, the 5% most learned plant taxonomists can instantly identify and name

from memory no more than 5,000 spp. Some particularly rich zones, e.g. South-West Australia and the Fynbos, exhibit extreme soil oligotrophy, with pH occasionally dropping to 3.0. These have developed a high endemism together with particular ways and means of survival through specialised rooting systems and other adaptive strategies, including carnivorous behavior and parasitism.

At the level of Family in taxonomy, the overall 75,000 species of the Mediterranean flora divide up into the following proportions (%), which are roughly similar in the distinct biomes: *Asteraceae* 11, *Fabaceae* 10, *Poaceae* 4, *Scrophulariaceae* 4, *Liliaceae* 3, *Boraginaceae* 2, *Brassicaceae* 2, *Caryophyllaceae* 2, *Chenopodiaceae* 2, *Cyperaceae* 2, *Lamiaceae* 2, *Polygonaceae* 2, *Rosaceae* 2, *Apiaceae* 1.5. These 14 families thus represent some 50% of the overall Mediterranean flora.

It is to be noted that Mediterranean Biomes extend much further to the east of the Mediterranean Basin than usually admitted, in fact reaching the western border of China in Xinjiang on the 76°E Meridian. This extension also reaches the South-West valleys of the Himalayas and the Hindu Kush, the Upper- and Mid-Indus Valley and West Pakistan (Baluchistan) West of the Indus.

Besides climate, natural vegetation and flora, the book summed up here studies in a fairly detailed way Mediterranean crops and ornamentals, weeds and invasive

**Countries or zones totally or partly Mediterranean**

Zones	Geograph. area 10 <sup>3</sup> km <sup>2</sup>	% Mediter-ranean	Mediter-ranean area 10 <sup>3</sup> km <sup>2</sup>	Notes
<b>Europe</b>	<b>1 870</b>	<b>47</b>	<b>887</b>	<b>S 46° parallel</b>
Albania	29	21	6	Adriatic coastal region
Balkans	251	10	25	Adriatic coastal region
Cyprus / Malta	10	100	10	Mediterranean Islands
Spain	505	82	412	Except NW corner
France	551	16	87	Mediterranean coastal region
Greece	131	82	107	Except NW and Macedonia
Italy	301	59	174	Islands and peninsula S of Florence
Portugal	92	72	66	2/3 S
<b>Non-tropical Africa</b>	<b>8 562</b>	<b>62</b>	<b>5 327</b>	<b>N and S of tropics</b>
South Africa	1 320	14	207	Fynbos, Nama and Succulent Karoos
Algeria	2 381	80	1 905	Except Central and Southern Sahara
Egypt	1 060	80	845	Except Southern Sahara
Libya	1 760	60	1 056	Except Central Sahara
Mauritania	1 000	20	200	20% in N
Morocco	712	100	712	Entirely Mediterranean
Tunisia	163	100	163	Entirely Mediterranean
W Sahara	266	90	239	Except S end
<b>Continental Asia</b>	<b>10 836</b>	<b>56</b>	<b>6 021</b>	<b>S of 47° N, W of 75° E</b>
<b>SW Asia</b>	<b>3 747</b>	<b>79</b>	<b>3 053</b>	<b>W of Tigris river</b>
Iraq	434	100	434	Entirely Mediterranean
Israel	20	100	20	Entirely Mediterranean
Jordan / Palestine	97	100	97	Entirely Mediterranean
Lebanon	10	100	10	Entirely Mediterranean
Arab. Peninsula	2 263	76	1 725	N of line Jeddah-Masqat
Syria	144	100	144	Entirely Mediterranean
Turkey	779	80	623	Except Black Sea zone
<b>Middle East</b>	<b>3 096</b>	<b>63</b>	<b>1 938</b>	
Afghanistan	652	50	264	Except Pamir and Karakoum Mts
Iran	1 648	90	1 460	Except zone between Caspian and Alborz
Pakistan	796	37	214	Belouchistan, W of Indus
<b>Central Asia</b>	<b>3 993</b>	<b>26</b>	<b>809</b>	<b>S of 45°, SW and W of Caspian</b>
Azerbaijan	87	53	46	SW coast of Caspian Sea
India (Kachmir)	223	10	22	Indus Valley: upper rim
Kazakhstan	2 717	10	271	1/3 part of country SW of Aral Sea
Kirghyzstan	116	30	35	E of Osch upto Chinese border
Uzbekistan	447	60	270	Except Kopet Dag Mts
Tajikistan	138	18	25	Between Kazakhstan and Afghanistan borders
Turkmenistan	488	60	390	Between Caspian and Aral Seas
<b>Australia</b>	<b>4 474</b>	<b>21</b>	<b>959</b>	<b>S of line Carnarvon-Melbourne</b>
New South Wales	787	16	126	S of Broken Hill and W of Wagga-Wagga
S Australia	1 000	24	240	S of 31° S
W Australia	2 460	18	443	S of line Carnarvon-Esperance
Victoria	227	66	150	W of Melbourne
<b>North America</b>	<b>1 625</b>	<b>48</b>	<b>778</b>	<b>W of meridian 105° W</b>
Baja California, Norte California (Mexico)	70	70	50	W of Sierras de Juarez, S of Pedro Martyr and N of 29° parallel
California (USA)	411	95	390	Except upper Sierra Nevada
Idaho	213	15	32	Boise, Spokane Idaho Falls
Nevada	288	40	115	Except 1/4 S and chain of mountains
Oregon	253	60	152	Portland, Burns, Canyon City
Utah	228	10	22	Salt Lake City, Great Plains
Washington	170	10	17	Seattle, Dayton, Yakima, Goldendale
Brit. Columbia (Canada)	148	5	7	Vancouver and extreme S of State
<b>South America</b>	<b>3 475</b>	<b>28</b>	<b>977</b>	<b>Central Chili and part of Argentina Patagonia</b>
Chili	760	23	177	Between 25 and 36° S
Argentina	2 660	30	800	Andean Piedmont between 35 and 45° S and W of meridian 70°
<b>TOTAL</b>	<b>24 592</b>	<b>60</b>	<b>14 806</b>	

aliens (exotics or xenophytes) in local floras, and the trans-continental transfer of plants from one Mediterranean Region to another, whether successful or not. The numerical importance of the exotics in local floras is ca. 10%, varying little from one zone to another; the same aliens often occur in the various Biomes, many originating in the Mediterranean Basin. These represent an overall 5% of Mediterranean flora (ca. 3,500 spp).

The phytogeographic classification proposed takes into account climatic, floristic, growth and agronomic criteria. It raises the Isoclimatic Mediterranean Zone to the rank of a Kingdom within the Holarctic / Antarctic Empires. The Mediterranean Kingdom, in turn, includes 7 Regions: Mediterranean Basin, Irano-Turanian, Saharan-Arabian, Cape, South and South-West Australian, Chilean-Argentinian, Californian-Great Basin. These are distinct from, but compatible with, Takhtajan's classification.

**Henri-Noël LE HOUEROU**

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Analysis of the book written by Henri-Noël Le Houérou: *The isoclimatic Mediterranean biomes: Bioclimatology, Diversity and Phytogeography*. It contains some 765 pp in 2 Vols including the text, a reference list of 1,600 entries, the acknowledgements, 103 tables, 118 figures, a glossary of 1,900 terms and a subject matter index of 650 items. ISBN 2-9523965-1-5. The book is available from the author: 327, rue de Jussieu, F-34090, Montpellier, France. Sale price: 65 Euros + priority mailing cost.

## ***André Werpin, elected representative and forester (1929-2009)***



**André Werpin in Bizerte (Tunisia), 1993. Photo: JB**

Doctor **André Werpin**, our founding vice-president, died last July 18, aged 80.

For twenty four years, until 2008, he was mayor of La Garde-Freinet, a beautiful village in the Maures Mountains along the French Riviera.

He was vice-president of the Association of Forest Municipalities in the Var département (S.E. France) and founding president of the Provence-Alpes-Côte d'Azur Regional Association of Forest Municipalities.

As an elected representative with a forestry commitment, he was just the kind we need at every level of local and regional government:

- ✓ municipal councillor and then mayor
- ✓ departmental Government Councillor for the Var
- ✓ Regional Government Councillor for Provence-Alpes-Côte d'Azur.

Will there ever be another like him?

A man of dialogue, he was able to foster consideration of the issues involving Mediterranean woodlands and forests well beyond political differences.

In every sphere where he played a part, he developed key action. Even up to very recently: he was co-president of the Observatory for Mediterranean Forests, which he co-founded along with the Provence-Alpes-Côte d'Azur Regional Government Council.

In just this way, as founding vice-president of the French association *Fôret Méditerranéenne* or as founding vice-president of the International Association for Mediterranean Forests (IAMF), he was unstinting in his contribution through his competence, kindly attention and willingness to help at every chance. He was doctor to his patients, elected

representative for those he helped govern and forester committed to Mediterranean forests.

Despite what his surname might suggest, André Werpin was a true man of the Mediterranean.

Born in Tunis, where his father was an engineer in a mining company, he spent his early childhood in Iglesias, in Sardinia (Italy); he spoke fluent Italian. And after his medical studies, he returned to Provence in the South of France.

Thus, when we went on study trips to Tunisia, to Portugal, he was "at home" and whenever he welcomed to the forests of the Var visitors from Spain or Portugal, North Africa or elsewhere, he knew just how to show them the similarities between the cork oak stands of Gallura, Tabarka or the Rif.

So it was that when we were setting up the IAMF he, along with other friends from around the Mediterranean, did not hesitate to "join the gang"; and up to 2003, when his other activities and then his health forced him to "rein in", he was our vice-president.

We miss him here, but we will try to go on as though he were still among us, benefiting as ever from his wisdom and kindness.

***Jean BONNIER***

# Mediterranean forests, the talk of the town!

For more details and the latest updated information, don't forget to check the diary on our website ([www.aifm.org](http://www.aifm.org)).  
And don't forget: tell us about any event that doesn't appear in the diary - it will make it that much better!

## 19<sup>th</sup> Regional Meeting on the Environment

1-3 October 2009 - Château-Arnoux / Saint-Auban (France)

Website: <http://www.arpe-paca.org/infos.asp?ThNum=Th00000275>

## 6<sup>th</sup> National Forestry Congress "Forests in a globalized world"

6-9 October 2009 - Ponta Delgada (Portugal)

Website: <http://www.spcf.pt>

## 32<sup>nd</sup> Annual General Meeting of Forêt Méditerranéenne

10 October 2009 - Domaine de Saint-Pons (France)

Website: <http://foret-mediterraneenne.org/evts.htm>

## UNECE/FAO Timber Committee Week

12-16 October 2009 - Genova (Switzerland)

Website: <http://timber.unece.org/index.php?id=125>

## 13<sup>th</sup> World Forestry Congress on the topic "Forests in Development: a Vital Balance"

18-25 October 2009 - Buenos Aires (Argentina)

e-mail: [info@cfm2009.org](mailto:info@cfm2009.org)

Website: [www.wfc2009.org](http://www.wfc2009.org)

## Seminar "Cork oak management and quality"

19-21 October 2009 - Tlemcen (Algeria)

Website: <http://www.univ-tlemcen.dz/site%20vert/index.html>

## COST E53 Conference "Quality control for wood and wood products"

22-23 October 2009 - Lisbon (Portugal)

Website: <http://www.coste53.net>

## 2<sup>nd</sup> Seminar of the European co-operation project Qualigouv

18-20 November 2009 - Alpillles/Luberon (France)

Contact Alpillles: [s.jaulmes@parc-arpilles.fr](mailto:s.jaulmes@parc-arpilles.fr)

Contact Luberon: [aline.salvaudon@parcduluberon.fr](mailto:aline.salvaudon@parcduluberon.fr)

## Conference "Energy - Forest - Territories"

26-27 November 2009 - Le Luc-en-Provence

e-mail: [contact@foret-mediterraneenne.org](mailto:contact@foret-mediterraneenne.org)

Website: <http://www.foret-mediterraneenne.org/evts2.htm>

## 4<sup>th</sup> International Congress "Fire ecology and management"

30 November-4 December 2009 - Savannah (USA)

Website: <http://www.fireecology.net/Congress09/Home.html>

## 6<sup>th</sup> International Conference on Forest Fire Research

15-18 November 2010 - Coimbra (Portugal)

Website: <http://www.adai.pt/icffr>

## 5<sup>th</sup> International Wildland Fire Conference

9-13 May 2011 - Sun City (South Africa)

Website: <http://www.wildfire2011.org>

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