

SPAIN – 2009 INVENTORY RESULTS

RESULTS

General results show that in 2009, 82, 3% of the sampled trees looked healthy: they correspond to defoliation classes “0” and” 1 (between 0 and 25% of leaf volume loss). A 15, 7% of the trees pertain to classes” 2” and” 3”, with defoliation levels higher than 25%. These values show a decline process if compared to the results of the previous years.

Regarding the evolution of defoliation and discolouration levels for conifers, broadleaves and for the whole group of species between 1987 (1st Inventory) and 2009 for Iberian Peninsula and Balearic Islands (since 1994 including data from Canary Islands), results in 2009 show a decline process either for conifers and for broadleaves, this decline is more noticeable in the case of broadleaves, although values are very similar.

Throughout the Mediterranean area, parameter defoliation is much more useful than discolouration for indicating the health condition of forests, as discolouration is in many times influenced by the local conditions of the forest site.

Spain results can have a certain geographical interpretation. The observed variations show some regional differences which can not be attributed to methodological errors, as the results have been generated by field teams which have been trained in the same way, and whose works have been carried out in the same period of year, with an homogenised methodology, and with continuous intercalibration routines.

Looking at the percentages of damaged trees in the IDF – 2007 and IDF – 2008, and considering the differences between these two inventories (it is assumed that changes lower than 5% are not indicating a real modification in forest condition) we can notice, through the values obtained, a slight worsening in most of the regions, highlighting Canary Islands, Asturias and Andalusia. On the other side are Navarra and Cantabria. However, these first results should be object of a more in-depth analysis, relating it with the presence of damages in every region and with the percentage of dead trees and causes of death at regional level.

ANALYSIS OF THE MAIN TREE SPECIES

The analysis of the four forest species more represented in the inventories (two conifers and two broadleaves: *Pinus sylvestris*, *Pinus halepensis*, *Quercus ilex* and *Quercus pyrenaica*) and the evolution of their defoliation levels, shows the following results:

During year 2009, most of the species show certain worsening of results comparing to previous year, except for *Quercus pyrenaica*. In the case of conifers, *Pinus halepensis* is the one which has reacted more

favourably, whilst *Pinus sylvestris* shows a more acute worsening. As for broadleaves, *Quercus ilex* has inverted its recovery process, which had been initiated in 2006 whereas in the case of *Quercus pyrenaica*, its evolution seems to be kind of erratic during the last years.

MAIN DAMAGES REPORTED DURING THE ASSESSMENTS

These are the main damages, biotic or abiotic, recorded during the field assessments carried out in all the large scale plots (Level I) located in all regions in Spain, between 6th of July and 8th of September 2009, together with a shallow indication of their location. This list does not imply in any case a characterization of the intensity or the distribution of processes of forests decline is only fruit of the assessments carried out by the field teams:

Biotic damages (pests, diseases and parasitic phanerogams)

Insects

- Pine processionary caterpillar, *Thaumetopoea pityocampa* continues being more extended in the Eastern part of Spain, and *Pinus nigra* is, as usual, the most affected tree species. In general lines, damages caused by this lepidopteron in 2009 are higher to the ones registered in the previous years.

- Regarding *Escolitidae*, this year a sometimes higher sometimes lower proliferation is noticed in some locations, associated to the presence of wood and debris in pine forests. There are *Ips acuminatus* and *Ips sexdentatus* damages in forests stands of main tree species *Pinus sylvestris*, only *Ips sexdentatus* in *Pinus pinaster* stands, and *Tomicus destruens* & *Orthotomicus erosus* in *Pinus halepensis* stands.

- There are some damages (similar intensity as previous years) of *Dioryctria splendidella* affecting weakened (due to previous attacks or to the fact of not living under the best possible conditions) *Pinus pinaster* trees located in the northwest of Spain (Galicia).

- Some slight – moderate defoliations have been noticed (though in any case lower levels than the ones recorded previous years), caused by caterpillars of *Tortricidae*, *Noctuidae*, and *Lymantridae* families affecting *Quercus* stands (mostly *Quercus ilex*). Remarkable species are: *Lymantria dispar*, *Catocala* sp. and *Lymantria dispar* associated with *Malacosoma neustria*, *Euproctis crysorrhoea*, *Tortrix viridana*, etc.

- Similar damages to previous years of dead branches, branchlets caused by branch borer *Coroebus florentinus* and/or *agrilus* sp.

- Damages caused by *Cerambyx* sp. and *Oryctes nasicornis* are frequent in *Quercus* stands (specially *Quercus ilex* and *Quercus suber*) distributed mainly in the Southern half of Spain giving as a result the presence of decaying trees, with variable infestation levels depending on the locations and forest stands (for example, in Majorca affecting *Quercus ilex* stands in Sierra de Tramontana).

- The gall maker *Dryomyia lichtensteini* is frequent in all types of holm oak stands, but in lower levels if compared to previous years. On the other hand, *Asterodiapsis ilicicola* is starting to be noticed, more frequently each time, generally associated to *D. lichtensteini*, being the levels of infestation similar to the ones of last year.
- Defoliator *Gonipterus scutellatus* is present in almost all *Eucalyptus globulus* stands located in Galicia, Asturias and Cantabria being the damages important (similar intensity as in 2008).
- The levels of wood borer *Phoracantha semipunctata* have experimented a slight descent, due to the fact that most eucalyptus stands are recovering little by little from the weakening caused by the drought suffered during last years.
- Presence of miner *Rhyngaenus fagi* and *Phyllaphis fagi* in *Fagus sylvatica* stands located in the north of Spain
- On alder-trees (*Agnus glutinosa*), field teams have continued noticing damages caused by defoliator *Agelastica alni*, which are this year of similar intensity to the ones observed in 2008, although damages are more intense in scattered trees in the middle of forests than in trees forming galleries in river shores. This insect causes also severe defoliations in *Corylus avellana* trees
- This year there have been detected punctual defoliations in *Crataegus monogyna* trees, distributed in punctual zones throughout Iberian Peninsula, caused by defoliator *Aglaope infausta*, in higher levels than previous years.
- On *Salix* sp. and *Corylus avellana* trees (alignments or groups) moderate defoliations have been noticed again in some locations in the North of Spain, caused by *Phrathora laticolis*.
- Frequent defoliations by *Xanthogaleruca luteola* registered in several areas of Iberian Peninsula in elms (*Ulmus minor* and *U. pumila*).

Fungi

- Damages caused by *Sirococcus conigenus* on *Pinus halepensis* trees are this year light and not very important, in locations like water-courses and hillsides with favourable exposure (and which show old damages), being the damages occasional and less severe than other years, located in the lower part of the crown.
- The existence of circles of dead trees due to *Armillaria mellea* infestation is relatively frequent in many pine stands. Although this year the appearance of new circles and the expansion of the already existing ones has been slightly lower than the records of 2008.
- The damages caused by defoliator fungus *Thyriopsis halepensis* that occurred with higher or lower intensity in *Pinus pinea* and *P. halepensis* stands located in the centre and south of Spain, are maintained in low levels, managing to be practically non-existent in most of the areas. They are of higher intensity in areas of Valencia region.
- Needle fungi as *Scirrhia* sp., *Mycosphaerella pini*, *Naemacyclus* sp., and *Lophodermium pinastri* or branchlet fungi, like *Sphaeropsis*

sapinea frequently cause “flash” shaped damages and death of needles in *Pinus radiata* crowns, being the levels this year similar to the ones in 2008.

- The presence of oidium (*Microsphaera alphitoides*) affects in general to *Quercus petraea* *Q. robur* and *Q. pyrenaica* stands located in the north of Spain (Galicia, Asturias, Basque country and Cantabria), being detected more extensively (in the case of *Q. robur* and *Q. petraea*) in the new shoots under mature trees. In some cases, it is accompanied by anthracnose (*Apiognomonina errabunda*), sucking insects whose effects are visible in leaves as well as various defoliators, generally *Lepidoptera*.

- The presence of canker of chestnut-tree (*Cryphonectria parasitica*) on *Castanea sativa* trees continues being generalized. It is rare to find trees of certain size not showing symptoms and frequent the number of trees which have already lost most of their crown (in the north of Spain).

- In beech stands, branch fungi as *Nectria coccinea*, are detected, though in lower levels than previous years. Some beech stands maintain the decline observed in previous years probably caused by the stem decay fungus *Nectria sp.*

- Some young *Eucalyptus* reforestations in the north of Spain (Galicia) have been found affected by the foliar fungus *Harknessia sp.* They mainly affect the lower part of the crown and manage to cause, in some trees, important defoliations.

- The damages caused by the Dutch elm disease (*Ceratocystis novo-ulmi*), are generalized year after year throughout the Iberian Peninsula and Balearic islands. In 2009 there has been an important and generalized increase in the frequency and intensity of damages.

Parasitic phanerogams

- Important infestations by *Viscum album* are still found in several areas of Iberian Peninsula. They are responsible for the weakening of the colonized trees and favour the entry of other pathogen agents which in some cases can cause the death of the tree.

- *Juniperus oxycedrus* and *J. thurifera* stands in Aragón region, are affected by the combined action of branchlet fungi (*Gymnosporangium sp.*) and dwarf mistletoe (*Arceuthobium oxycedri*).

Meteorological agents

The agent which affected most to defoliation levels of Mediterranean tree species during 2005 and 2006 surveys, drought (causing microfilia and low growth levels) caused little damage in 2007 and in 2008, due to the fact that there were enough precipitations in spring, before trees started their vegetative period. However, during 2009 a lower than usual develop of needles has been noticed throughout the southern part of Spain. This is due to the fact that, even if rain and snow have been frequent and abundant in most regions of Spain, in the south the precipitations have been scarce in March and April. The lack of

precipitations (together with periods of high temperatures and dry winds) have worsened the situation even more.

In *Quercus* stands is frequent to notice the existence of dry branches caused by former droughts or because of being located on poor soils, sunny exposures and rocks.

Among the group of deciduous broadleaves (ash tree, poplar, *Q. pyrenaica*, *Q. faginea*), there has been an early autumn, presenting the trees the crowns practically dry and without leaves already in mid August.

Vertebrates

Though the damages in stem and branches caused by different game and cattle species are frequent in most of the Iberian Peninsula forests, they are especially significant in the case of young reforestations. The most important as for extension and level of damage have been observed in different areas of the North of Spain by the increase of the populations of roe deer.

Other damages

- The symptomatology known as "Seca of *Quercus*", continues being noticed, specially in those locations which were more affected in previous years, of Holm oak and cork oak
- There are continuously frequent *Alnus glutinosa* trees with branches, part of the crown or the whole tree dead (decay symptomatology), presumably because of a vascular disease which causes a sudden death of the affected part, remaining in many cases the leaves still on the tree. These damages have been observed more frequently in alder stands situated in mountain areas, though also has been noticed (even more than in 2008) in alder stands in river banks.
- The high mortality of fir trees (*Abies alba*) in the Pyrenees noticed during last four years, continues increasing slightly. This is the case of really weakened stands due to high levels of mistletoe infestation (*Viscum album abietis*) which together with the high slope and rocky locations as well as the hydric stress situations suffered during last years, cause an important loss o trees.
- The decline process of vegetation at Garajonay's National Park remains happening gradually. Due to the similarity of symptoms with the action of some vascular fungi, there exists a theory of a possible fungi origin of the problem (*Phytophthora* type), although this is not confirmed. Nowadays, apart from the fungi origin, it is thought that may be anyway related to the hydric stress, because in dry years the extension of the infestation has been higher. This affection which in origin had a local character has been spreading over the areas of laurisilva and in minor degree in areas of "fayal-brezal".
- Still there is a certain decline of *Juniperus thurifera* trees (defoliation, dead branches) located in different places of Soria province. This situation has been maintained during last years, without being

able to identify clearly the causal agents, except for the detection of *Gimnosporangium sabiniae* in some trees showing part of the crown dead.

- There are certain symptoms of reddening and needle loss in *Pinus sylvestris* and *Pinus nigra* plantations in Almería.

- The decline process of evergreen oaks (Holm oak and cork oak) is still noticed in Extremadura region.

CONCLUSSIONS

Results obtained after 2009 Inventory show a certain decline process if compared to 2008. A percentage of 82,3% of surveyed trees looked healthy (comparing to the 84,4% of previous year). A percentage of 15,7% of the trees were included in classes "2" and "3", indicating defoliation levels higher than 25%, with clear devitalisation whereas in 2008 this percentage was 14,2%. The number of damaged trees increases slightly and the number of dead ones increases to a larger extent.

This general worsening is slightly less noticeable in conifers, with a percentage of 85,1% of healthy trees (87,1% the previous year) than in broadleaves (79,3% in 2009 and 81,6% in 2008).

Most of death trees (2,0% of total, compared to 1,4% last year) are due to decline processes related to drought and felling operations (frequently sanitary cuts).

Apart from hydric shortages, the causal agents which are most frequently quoted are broadleaves spring defoliators as well as the continuous increase in levels of pine processionary caterpillar, followed by bark beetles (*Escolitidae*) broadleaves borers, insects present in Eucalyptus stands (*Gonypterus*, *Ophelimus*, *Glycopsis*...) as well as defoliating fungi infestations in Eucalyptus stands also; apart from decline processes in *Pinus radiata* stands near the Cantabrian coasts and the generalized presence of chestnut blight and chestnut ink disease in chestnut stands.

Mistletoe infestations continue being relevant in certain areas affecting pines and juniper trees, as well as a new decline process of still not known origin that seems to affect alder forest stands near the Cantabrian coasts.

Last but not least we have to mention punctual decline processes in fir stands in the Pyrenees. There is not a noticeable increment in damages due to "Seca" syndrome in Holm and cork oak stands.

The importance of atmospheric pollution in the evolution of forest condition is a factor which can not be quantified directly, as it is frequently disguised by other kind of processes which are more apparent. However, its role (in combination with other agents), contributing to the degradation processes of the forests falling under their influence, can't be denied.