Annex 2

Report on National ICP IM Activities in Spain

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The ICP IM activities in ES02 - Bertiz catchment have continued uninterrupted since 2007. Additionally, the following complementary activities were completed or started during 2012:

1 Ecological processes that determine the spatial structure of *Carex remota* and other species in forest riparian environments

The spatial structure of plant populations results from the combined effect of abiotic and biotic interactions that their individuals and their ancestors have been exposed to in the past. Therefore, the study of the spatial structure of populations and environment becomes crucial in the understanding and management of the ecological processes that define it.

This study focused in three different forest stream areas (P1, P2, and P3) within ES02 Bertiz catchment, which bear a number of populations of sedge (*Carex remota*), hard fern (*Blechnum spicant*) and wood sorrel (*Oxalis acetosella*). In order to understand the dependence of the three species on abiotic factors and biotic processes, their spatial patterns were modelled by means of hierarchical spatial point process models of growing complexity. The bivariate Ripley's function was used to analyse the spatial relationships between the different species present in the studied areas.

Our results showed that the importance of the different factors that determine the spatial distribution of the studied plant species varies according to the scale and heterogeneity of the environment. Thus, abiotic factors play a major role in the spatial distribution of individuals as long as they remain heterogeneous within a given area (Figure 1c and d). When abiotic factors are homogeneous, the biotic interspecific and intraspecific interactions between individuals that become decisive (Figure 1e and f). Even so, both types of factors act together to a greater or lesser extent.

Soil moisture was identified as the key abiotic factor conditioning the spatial distribution of *Carex remota* and *Blechnum spicant*, which favour high (Figure 1a, c and e) and low (Figure 1d) soil moisture respectively. Intraspecific competition was identified as the major biotic factor influencing the distribution of *Carex remota* individuals. Finally, the distribution of *Oxalis acetosella* was chiefly mediated by facilitation processes from *Carex remota* (Figure 2).

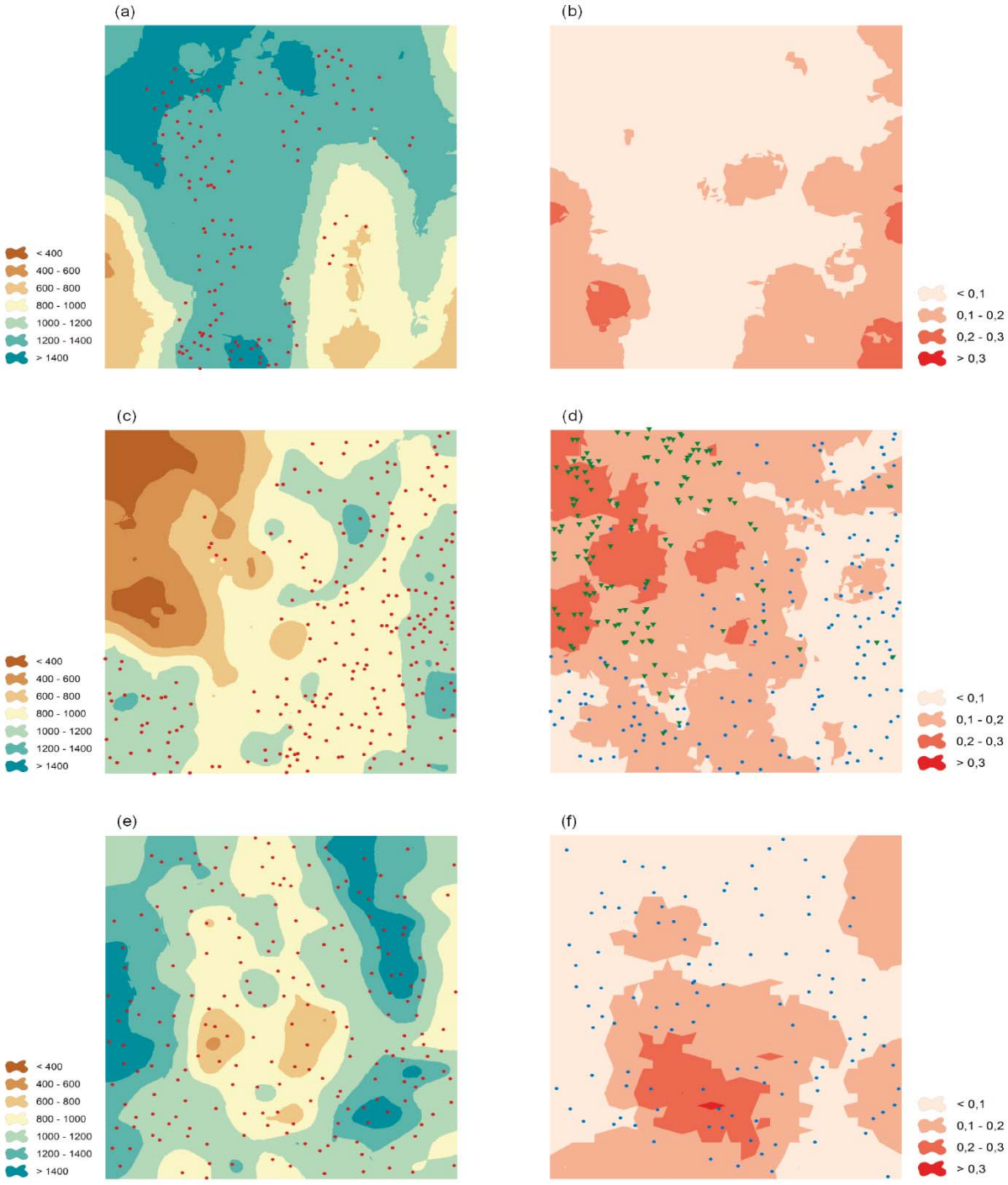

Figure 1 Soil moisture map (mV) and soil moisture variation coefficient, respectively, in plots P1 (a and b), P2 (c and d), and P3 (e and f). Point patterns are also represented for the three studied species: *Carex remota* in P1 (a), P2 (c) P3 (e) (left column); *Blechnum spicant* (green triangles) and *Oxalis acetosella* (blue points) in P2 (d); and *O. acetosella* en P3 (f).

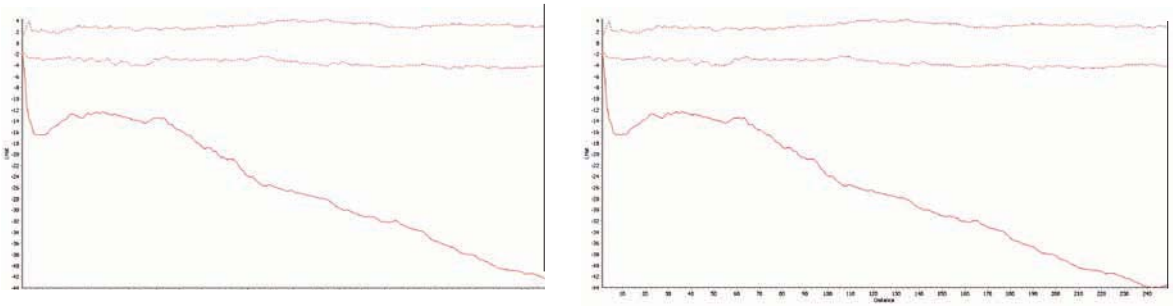

Figure 2 Bivariate Ripley $L_{12}(r)$ function between *C. remota* and *O. acetosella*, in P2 (left) and P3 (right).

2 Fish and amphibian populations monitoring and ecological status assessment in ES02 stream waters

Since 2007 fish and amphibian populations are being monitored in the Suspiro stream, which drains the ES02 catchment and constitutes a typical example of a headwaters brook within the Atlantic valleys of the Pyrenees. Its ecological status is also being assessed, based on the composition of its macroinvertebrate community. What follows is the summary of 5 years of activity in the two control areas (upper/lower sections) that was presented in 2012.

All the species found in the stream are native of the region. The upper, lower-flow section is characterised by the absence of fish species and the presence of stable populations of the amphibian species *Salamandra salamandra* (fire salamander) and endemic *Calotriton asper* (Pyrenean brook salamander/newt), which are listed as vulnerable and near threatened species in Spain, respectively (Pleguezuelos et al. 2002). Both are very sensitive to disturbances and their presence is considered as a good indicative of habitat quality. The lower section presents a stable and well established population of *Salmo trutta* (brown trout), plus presence of the IUCN critically endangered *Anguilla anguilla* (European eel) and *Cottus aturi*, a bullhead species described as endemic of the Pyrenean Adour and Nivelle river catchments (Freyjofh et al. 2005), which is listed as endangered in Spain and whose presence constitutes a good indicator of undisturbed mountain brooks.

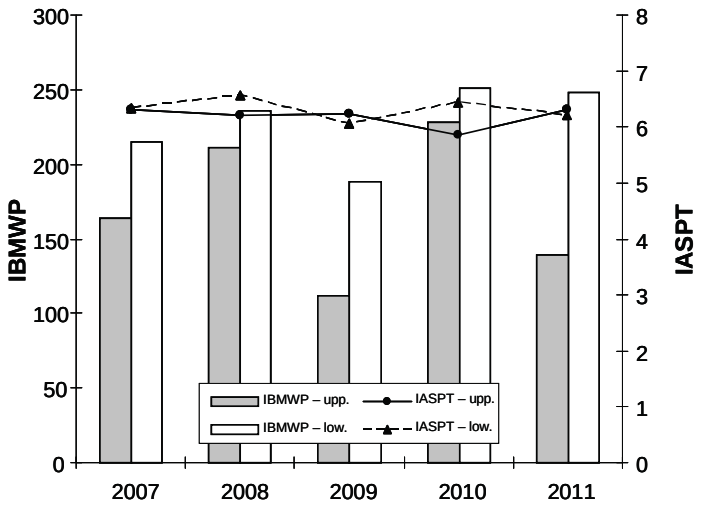

Figure 3 Values of IBMWP and IASPT indexes in ES02 stream water.

The ecological status of the stream was assessed using the Iberian Biological Monitoring Work Party (IBMWP; Alba-Tercedor & Sánchez-Ortega 1988) and the Iberian Average Score Per Taxon (IASPT) indexes; their recorded values during the period reported are shown in figure 3. The IBMWP values of both sections have consistently ranked as Category I 'very good', which corresponds to unpolluted/unimpacted sites. The observed oscillations correspond to lower runoff levels, lower availability of suitable habitats, and sampling issues related with those factors -specially true in the case of the upper stream section. Despite these minor differences, the IASPT values indicate a consistent, major presence of taxa sensitive to pollution in both cases, fact which again remarks the optimal quality of the stream.

3 Ozone uptake assessment in a Pyrenean beech (*Fagus sylvatica* L.) stand

Widespread evidence on the deleterious effects of O_3 on vegetation and crops in Europe has been extensively documented during the last decades. The DO_3SE model constitutes a feasible tool for the estimation of the dose absorbed by plants and is thus extensively used for the assessment of O_3 risk to vegetation and crops within the framework of the LRTAP Convention (Mills et al. 2011). The study aims at inferring the O_3 dose absorbed by the trees and providing data from old-growth trees growing in field conditions to contrast with DO_3SE estimations.

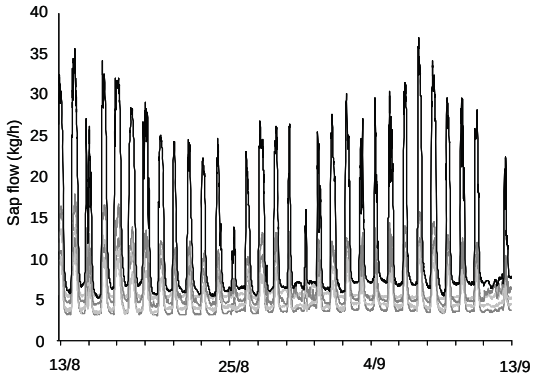

Figure 4 Raw sap flow data in beech trees at Bertiz ES02.

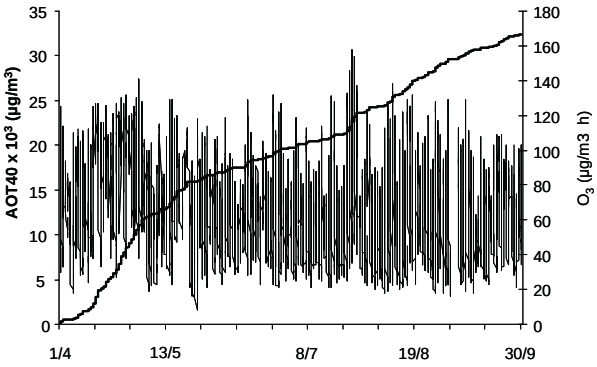

Figure.5 Evolution of O_3 levels and AOT40 at Bertiz ES02.

Sap flow was estimated at ES02 Bertiz using the THB approach (Čermák et al. 2004, Figure 4) from the leaf sprout in April to the leaf drop in mid November during 2012. Soil water content, meteorological parameters and O_3 concentrations are also registered at the site. The AOT40 critical level for the protection of forests was exceeded as early as in May; the O_3 levels scored an hourly maximum of 158 µg m^{-3} (Figure 5). Mean temperature was 17.5ºC and ranged from 0ºC to 41ºC. There were 89 days of rainfall that totalled 828 mm of precipitation. Maximum solar radiation values were over 1200 W m^{-2}. This field experience is being expanded into a second season during 2013.

References

Alba-Tercedor, J. & Sánchez-Ortega, A. 1988. Un método rápido y simple para evaluar la calidad biológica de las aguas corrientes basado en el de Hellawell (1978). Limnetica, 4: 51-56.

Čermák, J., Kučera, J., Nadezhina, N. 2004. Sap flow measurements with some thermodynamic methods, flow integration within trees and scaling up from sample trees to entire forest stands. Trees 18, 529-546.

Freyhof, J., Kottelat, M., and Nolte, A. 2005. Taxonomic diversity of European Cottus with description of eight new species (Teleostei: Cottidae). Ichthyol. Explor. Freshwat. 16 (2):107-172.

Mills, G., Pleijel, H., Brau, S., Büker, P., Bermejo, V., Calvo, E., Danielsson, H., Emberson, L., González Fernández, I., Grünhage, L., Harmens, H., Hayes, F., Karlsson, P.E., Simpson, D. 2011. New stomatal flux-based critical levels for ozone effects on vegetation. Atmospheric Environment 45, 5064-5068.

Pleguezuelos, J.M., Márquez, R. Y., Lizana, M. 2002. Atlas y libro rojo de los anfibios y reptiles de España. Dirección General de Conservación de la Naturaleza - AHE. 587 p.