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Effects of climate and land-use change scenarios on surface runoff in highly managed basins of northeastern Spain

Javier Zabalza-Martínez (1), Sergio Vicente-Serrano (1), Juan Ignacio López-Moreno (1), Gabriel Borràs-Calvo (2), Diana Pascual (3), Eduard Pla (3), Fernando Domínguez-Castro (1), and Christina L. Tague (4)

(1) Instituto Pirenaico de Ecología (IPE-CSIC), CSIC, Avda. Montañana 1005, Zaragoza 50.059, Spain, (2) Oficina Catalana del Canvi Climàtic (OCCC), Generalitat de Catalunya, Barcelona, Spain, (3) Centre de Reserca Ecològica i Aplicacions Forestals (CREAF), Bellaterra, Barcelona, Spain, (4) University of Santa Barbara, Bren School of Environmental Science & Management, CA, USA

The streamflow of three basins of NE Spain has been analysed under climate conditions included in the Third Report of Climate Change in Catalonia (TCCC) and under three possible future land-use change scenarios defined in the Life Project MEDACC: AFOR, which implies an increment in the forest area of the headwaters, FIREFOR foresees a less forested headwaters as a result of an increased incidence of forest fires and MANAGEFOR which determines a change in forest structure due mainly to forest management and the replacement of species. We have simulated Darnius-Boadella reservoir inflow (Muga basin) and streamflow in Roda de Ter (Ter basin) and Organyà (Segre basin) gauge stations using the Regional Hydro-Ecologic Simulation System (RHESsys) for the period 2021-2050. The objectives were twofold: i) to determine the impact of climate change and land-use scenarios and its combined action on the water resources and ii) to check if land-use management might mitigate the forecasted reduction of water resources associated to climate trends. Results with climate change conditions reveal a clear negative trend in the annual streamflow in the three basins for 2010: -15.1% in Darnius-Boadella reservoir inflow, -13% in Roda de Ter and -10% in Organyà gauge stations. The combined action of climate and land-use change shows differences between the basins, mainly dependent on the percentage of forest coverage. However, all the basins show a clear attenuation of the negative streamflow trends when the MANAGEFOR scenario is considered. This suggest a that land-use management can be an effective measure to mitigate the forecasted reduction of streamflow in mountain Mediterranean region under future climate change conditions.
Keywords: RHESsys, modelling, streamflow, Climate change, Land-use changes.