

## **Riparian Vegetation Encroachment Ratios in rivers below large Dams**

Diego Garcia de Jalón, Vanesa Martínez-Fernández, and Marta González del Tánago

E.T.S. Ingeniería de Montes, Forestal y del Medio Natural, UPM, Spain (marta.gtanago@upm.es)

Large Dams and reservoirs change the natural flow regime and consequently cause many alterations in riparian vegetation dynamics which may be assessed at different spatial and temporal scales. In Mediterranean regions flow regulation is frequently associated with irrigation. Regulated rivers with this purpose very often show reduced discharges during the wet season when the reservoir is being filled and increased discharges during the dry season when irrigation takes place. This type of regulation frequently promotes riparian vegetation growth as soil moisture levels are increased during summer when a natural drought would otherwise limit its growth. Additionally, flow regulation by large dams promotes the aging of late seral riparian vegetation reducing the frequency of flood disturbance and consequently, the potential recruitment of pioneer species.

In this work we study the response of woody riparian vegetation to flow regulation by large dams in four rivers from Central Spain: Jarama, Manzanares, Guadalix and Alberche. The aim is to quantify the annual vegetation encroachment ratios and to develop a model to understand the main controlling factors, such as floodplain and channel traits; flow regulation intensity; type of regulation; present vegetation canopy; distance to the dam; and time since dam commissioning.

A temporal comparison using aerial photographs from 1956, 1966, 1972, 1991, 2011 and 2014 was done in thirteen river reaches downstream from large dams, to evaluate their morphological evolution.. Floodplain dimensions and channel and riparian vegetation changes were assessed by comparing different pre-dam and post-dam conditions. Recent coloured photographs with 0.5 m spatial resolution and older black-and-white photographs at 1:33 000 spatial scale were supplied by the National Geographic Institute of Spain ([www.ign.es](http://www.ign.es)) and the Statistical Institute ([www.madrid.org/nomecalles/Inicio.icm](http://www.madrid.org/nomecalles/Inicio.icm)) from Madrid Community. Similar visual scales were used to cope with different air photographs resolution.

Results show a generalized natural vegetation encroachment process. Two exceptions were found associated with farming (Jarama 3) and poplar plantation (Alberche 1) that occupied riparian soils.. Annual encroachment ratios, range from 1 to 55 Ha/km, with a mean value of 12 Ha per km of river length. Higher values are found in the lowest reaches, which are far from the dam (5 cases), and also in the years following the beginning of dam operation. However, other reaches showed a delay of several years in the encroaching process, likely associated to scarcity or absence of initial woody vegetation at the time when dam started working.