



## **Unraveling the impact of humans versus climate on the morphological evolution of the Ebro Delta, Spain.**

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There is no doubt that present-day human interferences are affecting deltas, and the Ebro Delta forms no exception. As of today, the ~85,000 km<sup>2</sup> large Ebro River basin contains over 180 dams, mostly built after the 1950's, retaining sediment that otherwise would have found its way to the delta. Presently, less than 1% of the fluvial sediment finds its way to the Ebro Delta, mainly due to the emplacement of these dams and reservoirs, making it a sediment-starved system, which may affect the morphology of the delta in the nearby future. However, under what conditions did the Ebro Delta evolve in the first place, and to what degree are humans and/or variations in climate accountable for the evolution of the delta? The Ebro Delta has developed since sea level stabilized around 6,000 years ago. Shoreline progradation rates since then have changed significantly. Historical charts, dating back to the Middle Ages, suggest that the Ebro delta prograded from the Roman epoch until the 10th century at rates 2-3 times faster than before. The Romans deforested significant parts of the hinterland, mainly to supply the ship industry, which induced severe erosion that probably has contributed to accelerated progradation rates. On the other hand, regional climate did change also significantly over the last few millennia, including periods of significantly increased precipitation which could have also increased erosion rates. For this study, two coupled numerical models are applied to explore the impact of climate change and human interference on the morphology of the Ebro Delta. HydroTrend, a climate-driven hydrological transport model is applied to unravel the impact of climate change and human impact on the sediment flux over the last 2,000 years, subsequently the Coastline Evolution Model (CEM) is applied to analyze the effect of these changes in the fluvial sediment flux on the morphology of the Ebro Delta. Preliminary simulations reveal that human interference may have had a significant impact on the size of the Ebro Delta.