



## PRESS RELEASE

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# The Doñana marshes are projected to be flooded with brackish water by the end of the century due to climate change

- This new study predicts that, without the Montaña del Río dike currently limiting tidal and river flooding, sea level rise would result in the inundation of the marshes with estuarine water during spring tides.
- These changes could have negative consequences, including the alteration of the aquatic plant community and the spread of invasive species, which would require a specific adaptation plan.



*Flamingos in the marshes of Doñana. Photo: Rubén Rodríguez Olivares / EBD-CSIC*

**Seville (Spain), 27<sup>th</sup> December 2024.** A Portuguese and Spanish scientific team has confirmed in a new study that the Doñana marshes would be completely flooded during spring tides at the end of the century due to sea level rise, if the existing dike at Montaña del Río will be removed. The study, published in the *Journal of Marine Science and Engineering*, involved researchers from the University of Aveiro and the GIS and Remote Sensing Laboratory of the Doñana Biological Station, and other institutions.

'We know that the rise in sea level will have global consequences, but it is essential to develop local models that enable decision-making to adapt to and mitigate climate change,' says Ricardo Díaz-Delgado, a researcher at the GIS and Remote Sensing Laboratory of the Doñana Biological Station and coordinator of the Environmental Monitoring of the ICTS Doñana.

"This study shows the insights from numerical model predictions, offering valuable perspectives on the potential responses of the Guadalquivir Estuary and Doñana marshes to specific environmental changes", explains Inês Couto, a researcher at the University of Aveiro and lead author of the study.

According to the forecasts of the IPCC (Intergovernmental Panel on Climate Change) the sea level could rise by up to 0.84 m at the mouth of the Guadalquivir River. To assess the potential effects of these changes on the hydrology of the Doñana marshes, the scientific team developed a hydrodynamic model to simulate various climate change scenarios. These simulations considered the marshes' hydrological dynamics and evaluated the potential impact of removing the Montaña del Río dike, which currently isolates the marshes from the Guadalquivir estuary.

The Montaña del Río dike was built in 1984 to limit tidal flooding and the increased flow of the river. Following the Aznalcóllar disaster in 1998, this infrastructure was extended to prevent toxic spills from the mining pond coming from the Guadiamar river from reaching the marshes. Today, this dike fully isolates the Doñana marshes from the Guadalquivir, Entremuros and Brazo de la Torre. Through a system of sluice gates, it regulates the inflow and outflow of water.

The Doñana 2005 restoration plan proposed removing this dike to restore natural flows in the marshes and promote biodiversity. However, this removal could also lead to significant ecological changes, such as altering the aquatic plant community due to the influx of brackish water and encouraging the spread of invasive species.

In the long term, the results indicated that, without the dike sea level rise by the end of the century would significantly impact the protected area and would end up inundating the marshes with brackish water during spring tides, which occur around the full moon and new moon. These changes would alter salinity gradients and the movement of sediments within the estuary, leading to morphological transformations.

Conversely, simulations considering a sea level rise of 0.84 meters while keeping the dike in place predicted much smaller impacts, with tidal effects remaining closer to current conditions.

"The projections show the dike's ability to retain incoming water during an increase of sea level and the risk of full submersion if removed, both during spring tides", says Inês Couto. "These findings provide critical insights for decision-makers to evaluate restoration efforts and climate change impacts".

'Spatially explicit hydrodynamic models are essential to design measures that adapt to and mitigate the effects of climate change on the hydrological functioning of Doñana's natural marshes,' explains Ricardo Díaz-Delgado.

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Inês Couto, Ana Picado, Marisela Des, Alejandro López-Ruiz, Manuel Díez Minguito, Ricardo Díaz-Delgado, rita Bastos, João Miguel Dias. **Climate Change and Tidal Hydrodynamics of Guadalquivir Estuary and Doñana Marshes: A Comprehensive Review.** *Journal of Marine Science and Engineering.*  
<https://doi.org/10.3390/jmse12081443>