eGROUNWATER
Working paper 12

Use of remote sensing to help identify illegal water use for irrigation in Doñana, Spain

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Original study actors include WWF, supermarkets and farmers

In brief – The Doñana natural area is subject to ongoing drought and overexploitation of water resources endangering its rich biodiversity. A persistent issue is illegal water use for irrigation by the agricultural sector. The innovation arises from the collaboration of actors comprising a conservation NGO, large supermarkets and legal farmers, in order to design a sustainability assessment process to help identify whether the berries purchased by food retailers were grown in compliance with the land and water regulations. To this day, the method is still used by many supermarkets to better inform their decision and contribute to reducing the pressure from illegal water use in the area.

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Context

- ## Illegal irrigation in the surroundings of the Doñana natural area: antecedents

The case study area is located in the surroundings of Doñana marshlands within the province of Huelva, in the region of Andalusia (Spain).

The Doñana National Park (537 km^2) is a mosaic of ecosystems (marshlands, beach, dunes, scrubland areas...) with a unique biodiversity, this is the reason for which it is considered one of the most important protected natural areas in Europe. Moreover, Doñana is a key transit point for migratory bird routes and stands out for being a refuge for several species that are in danger of extinction, among them, the Iberian lynx and the Imperial eagle[1].

This natural environment has been seriously affected in the last 50 years due to drought[2] and overexploitation of water resources in the area, resulting in August 2022 in the disappearance of the last remaining permanent lagoon[3].

Due to these problems, in 2014 the “Special Plan for the management of irrigated areas located in the north of the Doñana forest crown”, also known as the "Strawberry Plan", was approved with the aim of transitioning to a sustainable development of the territory[4]. To accomplish this, it was decided not to grant new water concessions and define irrigable agricultural land based on a number of clearly defined criteria.

However, illegal water use remains a big issue in the area. WWF has published several reports which estimate illegal irrigation within the area between 1,500 and 2,000 hectares. These works are based on the use of remote sensing, which has also been adopted by the River Basin Authority as a tool to map illegal water use. This is proving to be a robust approach although not sufficient to turn around the ongoing problem. In the summer of 2019, after a six years judicial process, the High Court of Justice of Andalusia authorized the closing down of several illegal water uptakes in the area[5]. The Guadalquivir Water Authority started the closure of illegal boreholes but found a strong resistance from local farmers, with more than 200 persons creating barricades and confronting the Water Authority staff to prevent the wells being closed[6]. One month later, the Civil Guard had to intervene with a massive operation to allow the closure of at least 116 wells in the area. However, the problem has not been solved as new wells continue to be opened since it has been observed through remote sensing that the illegally irrigated area has been maintained at similar extension. For this reason, in the summer of 2022, a new campaign was carried out to close illegal wells by forced execution under the supervision of the Water Authority, i.e. ‘Confederación Hidrográfica del Guadalquivir’.

[1] MITECO. 2022. La fauna de Doñana. Red de parques naturales [online]. Link

[2] Ramirez, Laura. 2022. Doñana cumple 53 años con la sequía como amenaza principal. Diario de Sevilla [online] Link

[3] CSIC. 2022. La sequía y la sobreexplotación de los acuíferos secan la última laguna permanente de Doñana. Web Estación Biológica de Doñana [online] Link

[4] Junta de Andalucía. 2014. Plan Especial de ordenación de las zonas de regadío ubicadas al norte de la corona forestal de Doñana [online] Link

[5] El País. 2019. Doñana se despide del gran punto negro del robo de agua con el cierre de 77 pozos [online] Link

[6] El País. 2019. La Comisión Europea aplaude el cierre de los pozos ilegales en Doñana [online] Link

In the meantime, the European Court of Justice has condemned Spain for failing to protect Doñana National Park because of illegal water abstraction with serious consequences for the nature reserve[7]. Nonetheless, in spite of the regulations that require the conservation of the Doñana area and the efforts of the public administration, there are governance problems that make it difficult to control what the law dictates to be followed.

Despite these setbacks, many actors (i.e., supermarkets, legal farmers and environmental NGOs) are collaborating to ameliorate the existing challenges, which is described in this case study.

- Case study presentation

In the last four decades, berry crops have largely extended over the area producing a situation of overexploitation of groundwater resources, which is reducing the surface water contribution to the Doñana natural area and disconnecting some lagoons from the groundwater table. Tourism activity, i.e., summer tourism in Matalascañas, fully dependent on groundwater is also contributing to this issue.

[7] WWF. 2021. Histórica condena de la UE a España por destruir Doñana [online]. Link

Figure 1. View of Doñana National Park

Socio-economic development is limiting water availability in Doñana. There is an increasing difficulty in ensuring sufficient water provision to the Doñana natural area, which is directly related with existing issues in ensuring compliance with the law in relation to the consumption of water from illegal catchments and putting an end to this practice. These are high-value economic activities and the main economic pillar for the region, being the main berry production area across Europe and the largest berry exporter. As a consequence, there is a wicked conflict between the use of water for agriculture versus the use of water for ensuring ecosystem conservation and the good status of water bodies. The Special Plan was conceived as a consensus approach to this problem but the difficulties in limiting the action of free-riders is jeopardizing the effectiveness of this plan.

European consumers are increasingly getting concerned about the impact of berry production in Doñana, which is a wintering site for many European birds. Supermarkets are also concerned about the sustainability of their supply chains. And more in general, many actors are concerned about the full sustainability of the Doñana landscape. As an answer, large berry

retailers and supermarkets and WWF are partnering to help identify legal producers and ensure that European consumers are purchasing berries that have been grown and been irrigated in full compliance with the land and water regulations in place.

Innovation

- Sustainability assessment of berry producers in Doñana region

As aforementioned, illegal water use is reducing water contributions to the Doñana marshlands. The degradation of the wetlands is increasing the vulnerability of endangered species. This situation is being aggravated due to the ongoing drought, a direct consequence of climate change conditions. Moreover, there are political and governance conflicts[8] limiting the effectiveness of control strategies since local and regional decision-makers are often not well aligned with the position of national and EU bodies.

In this context, several actors comprising WWF-Spain (a leading conservation NGO in the area), large supermarkets (initially grouped within the SAI initiative) and legal farmers have started to collaborate to mitigate the problem.

The proposed solution was to design a sustainability assessment process to help food retailers to get reliable information on whether the berries they are purchasing are compliant with the land and water regulations. A GIS-based methodology has been put into place to identify the farming areas in compliance with the existing legislation, fed with annual remote sensing data mapping irrigated areas under greenhouses and plastic-cover infrastructures.

Figure 2. GIS map helping with the identification of farming areas

The approach encompasses several steps. Firstly, information on the farming areas of the berry providers is compiled. As a minimum, the berry growers need to identify the cadastral

[8] El País. 2022. Gobierno y Junta chocan por Doñana mientras se agrava el deterioro ecológico [online] Link

plots for their farming areas, although it is often required that they provide some standard certificates and figures depicting the production areas.

This information is then compared to remote-sensing derived maps, which allows mapping the precise cultivation area for each producer. The irrigated areas maps are produced through a non-supervised classification of several Sentinel images captured in winter and early spring. This classification is later refined using digital orthophoto and using as reference cartography the maps produced in previous years.

As a next step, the berry production areas are overlapped with the official cartography of irrigable lands, with the official cartography of water rights, and with the cartography of green corridors. The analysis concludes with the classification of the farming areas into three categories: fully compliant; with potential issues in the compliance and non-compliant.

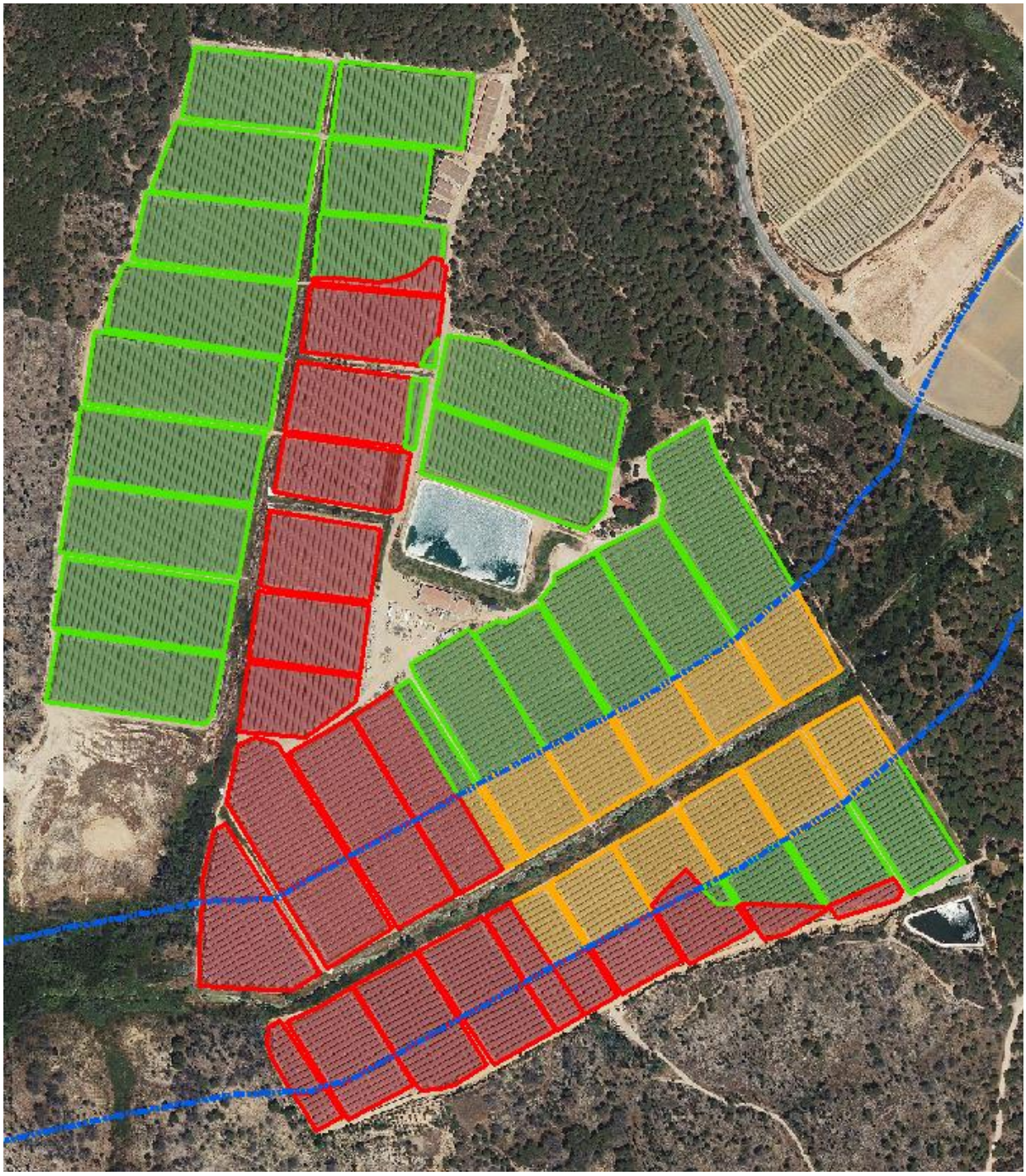

Figure 3. Analyzed farming areas. Green: fully compliant; orange: with potential issues in the compliance; red: non-compliant.

This information allows the food retailers and distributors to make well informed decisions on what producers they are incorporating into their value chains, as well as to lobby on some of their clients to improve their practices and not cultivating some specific areas which are not fully legal.

The results have been compared with field audits in some cases, showing that the methodology is highly accurate, since greenhouses can be detected through remote sensing with high reliability and the use of other ancillary data sources is also contributing to improved results.

After several years the approach is still operational, with many supermarkets conducting this type of analysis to ensure they are making the right decisions and contributing to reducing the pressure that illegal irrigation is producing on Doñana sustainability.

The approach is not particularly innovative from a technical standpoint (considering current development and state of the art in remote sensing applications), although this kind of analysis started several years ago when these applications were still not so largely adopted. This is, however, a ground-braking approach from a governance point of view. This is a good example of how the use of technology can contribute to sustainability approaches that are mainly pushed forward by the private sector and the civil society, and that have a large buy-in by the legal farmers, e.g., the main irrigators community is concerned that Doñana may turn into a negative brand.

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