

# Mapping Changes in Irrigated Rice Area in Senegal Using the PhenoRice Algorithm and MODIS Imagery

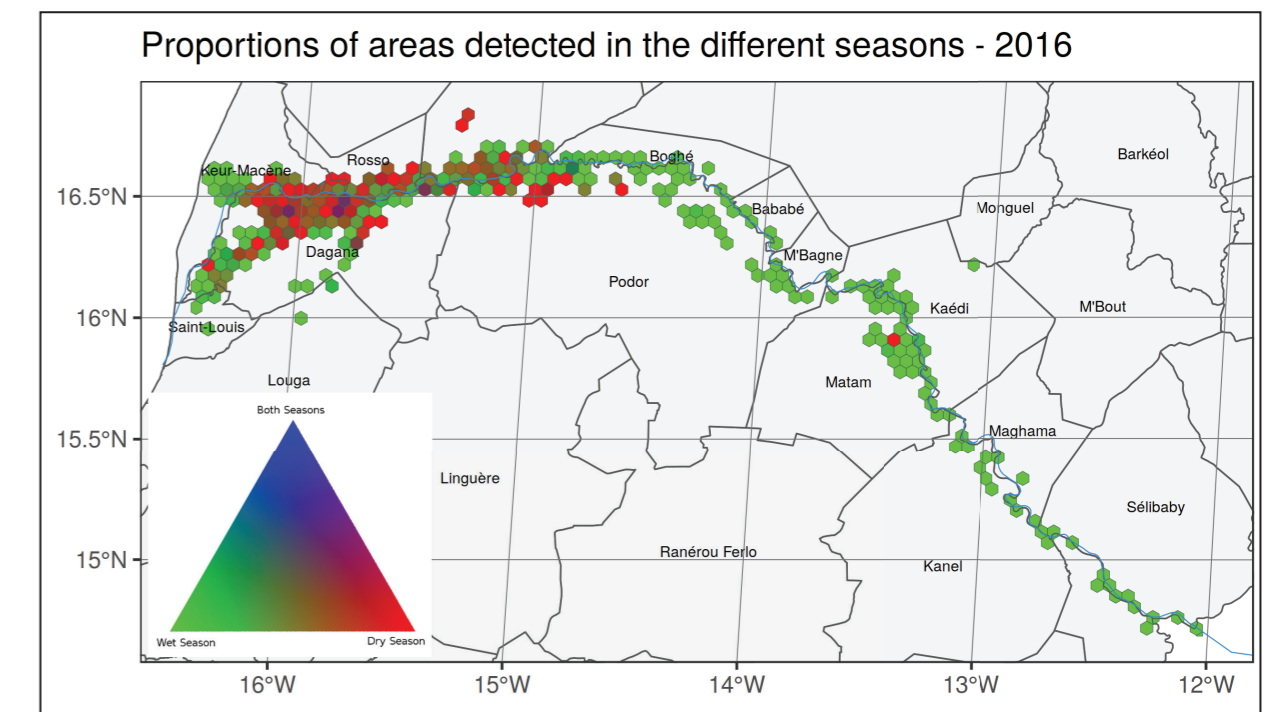
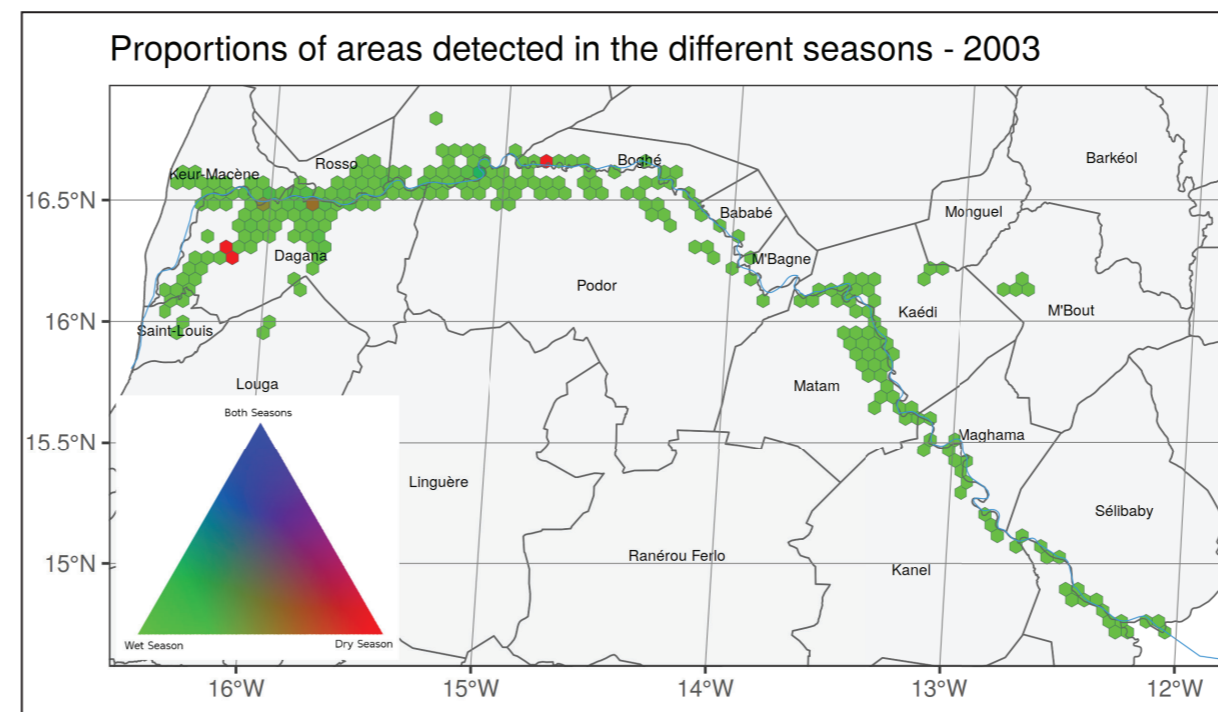
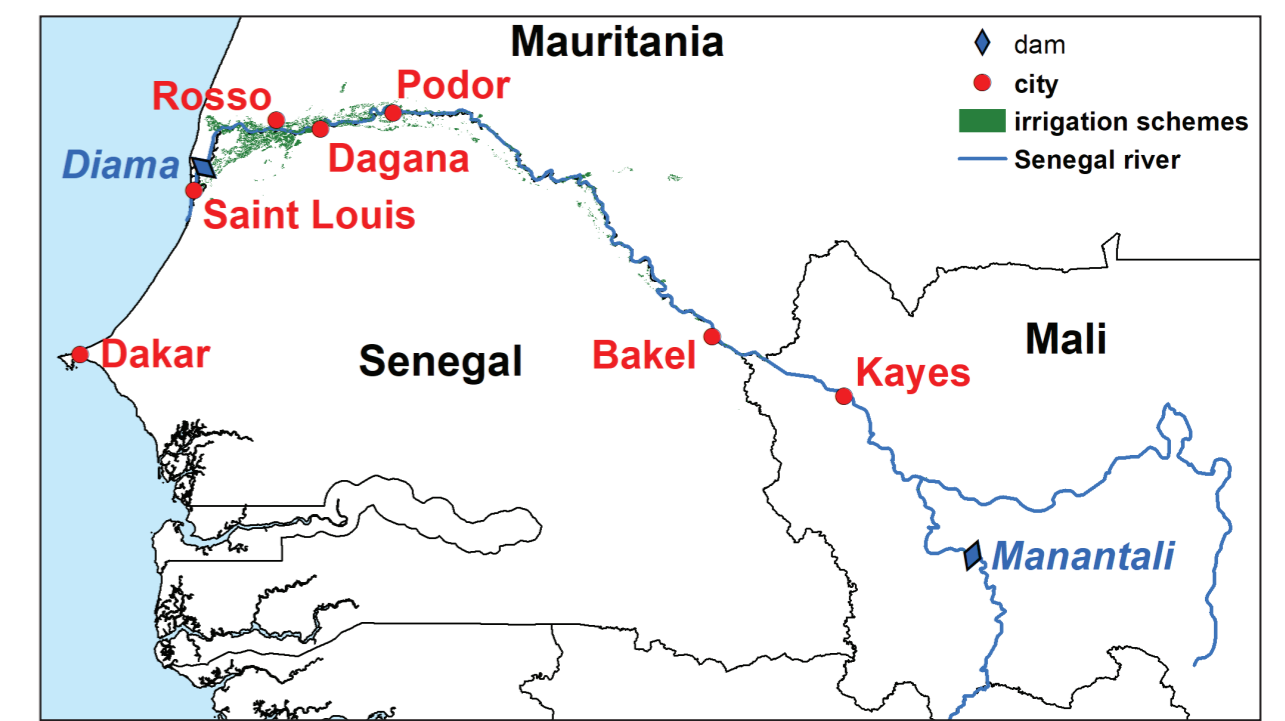
## Introduction and objectives

- Irrigated agriculture in the Senegal River Basin is highly **dynamic in space and time**: the area is increasing and rice farmers adapt their management strategies
- Competition** for water resources is increasing
- No **monitoring system** is in place to support sustainable planning of land and water resources
- The **goal** is to assess the capacities of remote sensing to **capture the dynamics** in **rice area** and **growing seasons**



## Study Area

- Achieving rice self-sufficiency** is a major policy of the government of Senegal
- Mauritania and Senegal are **expanding** irrigated rice area at fast pace on the banks of the Senegal River and its delta
- Conversion to **dry season** rice cultivation and **double cropping** have been widely reported in the last 10 years
- The major rice areas are characterised by low rainfall in a **short rainy season** and **high temperatures**



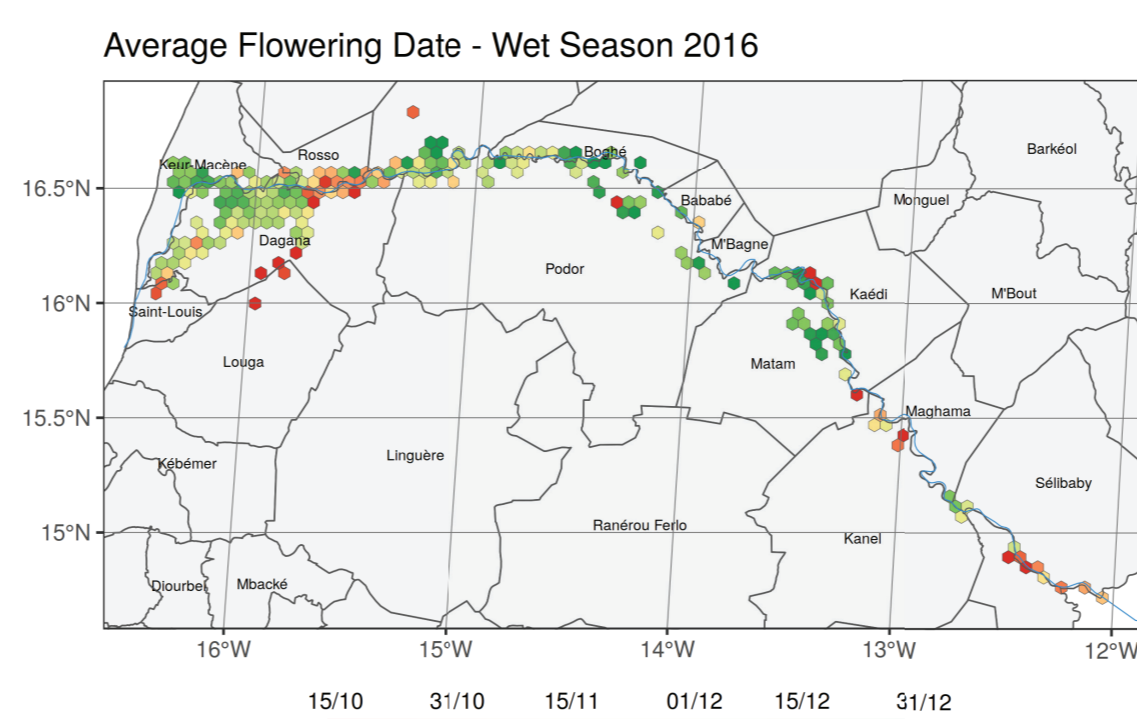
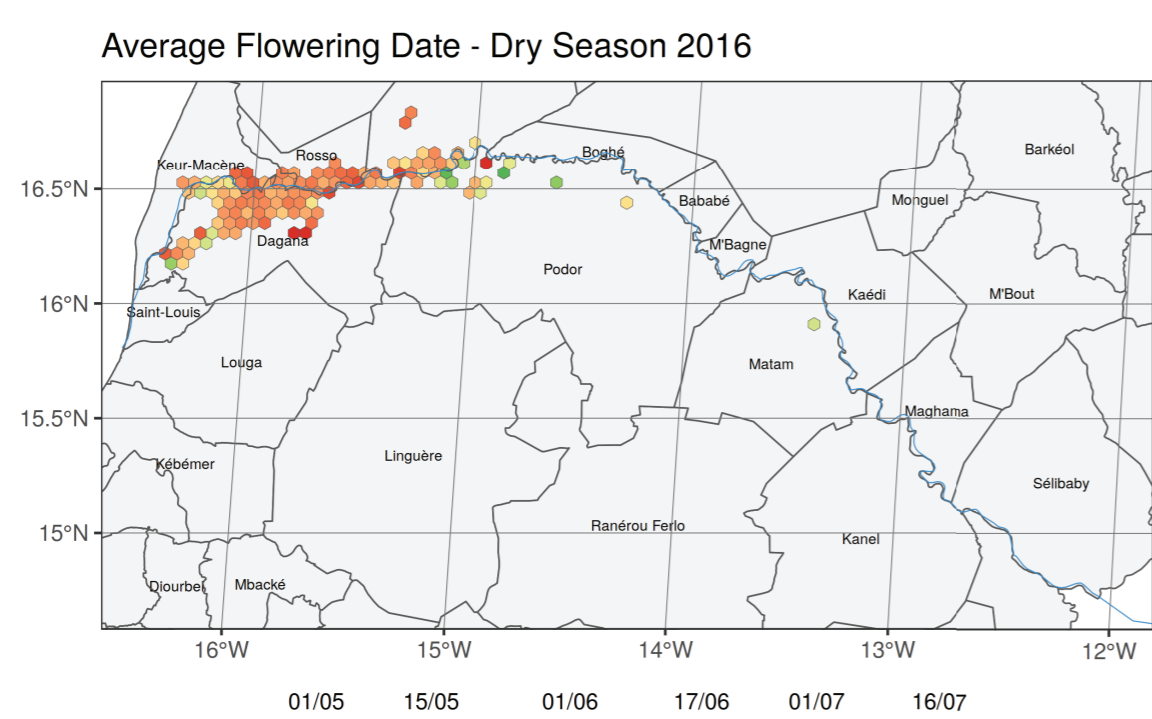
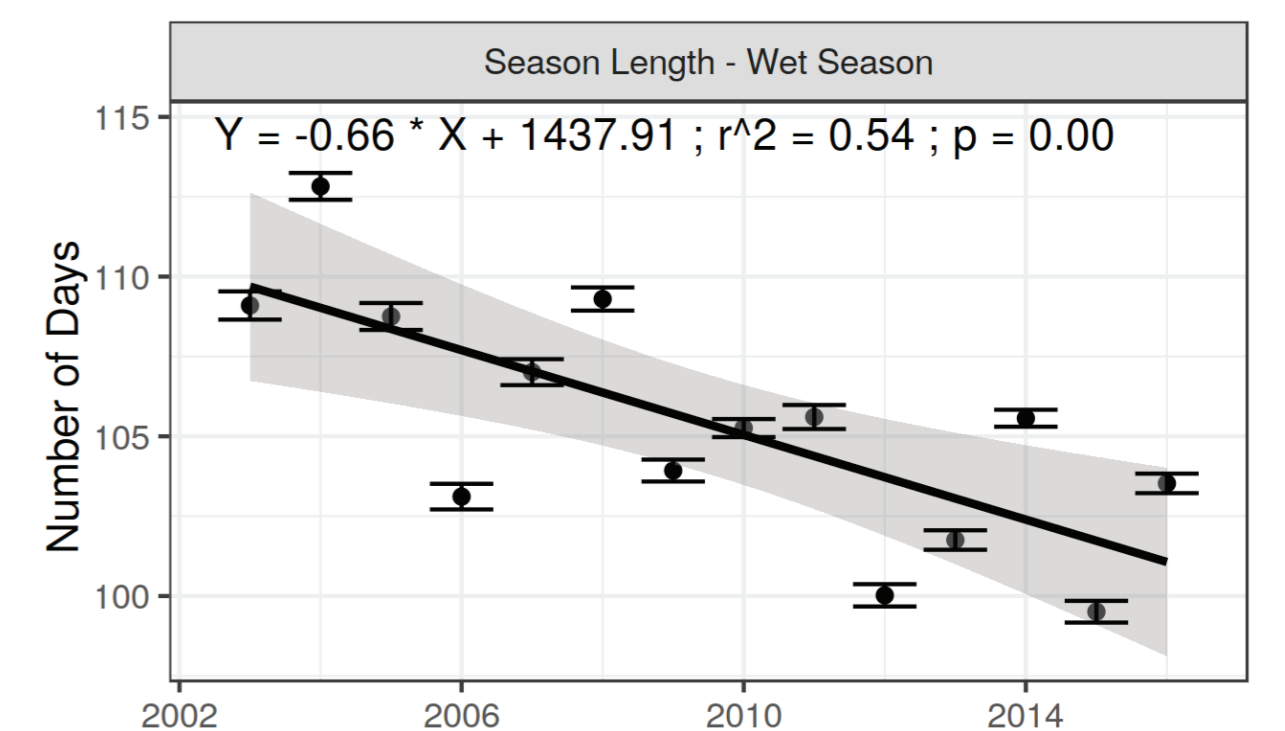
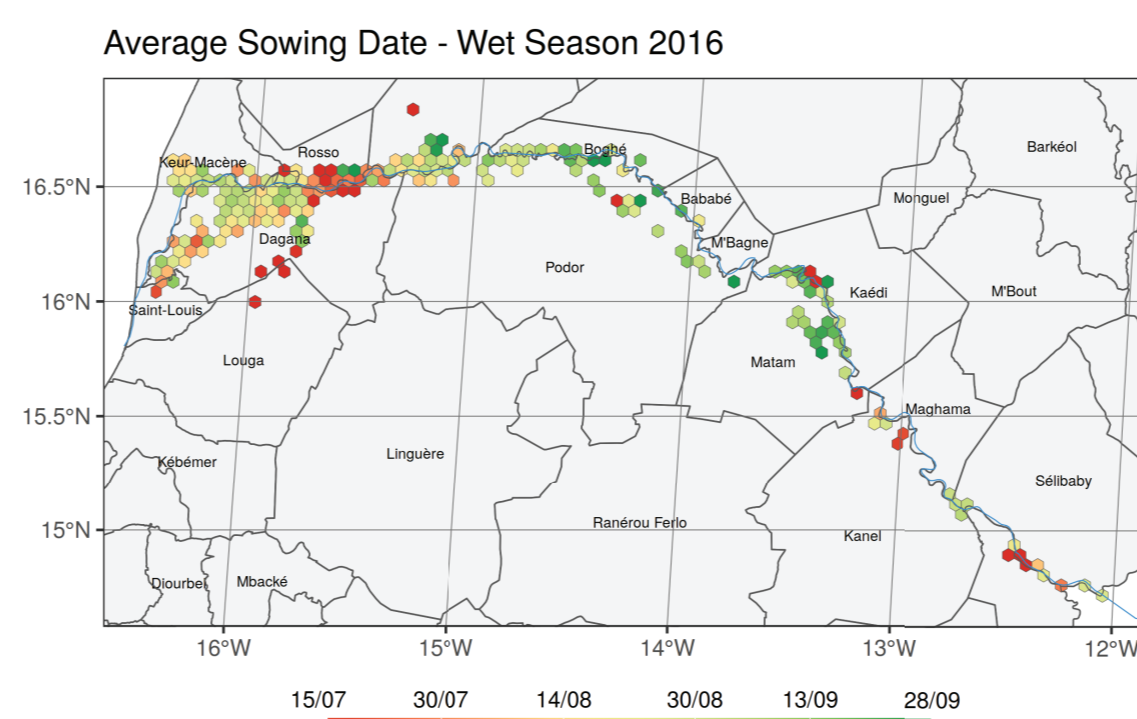
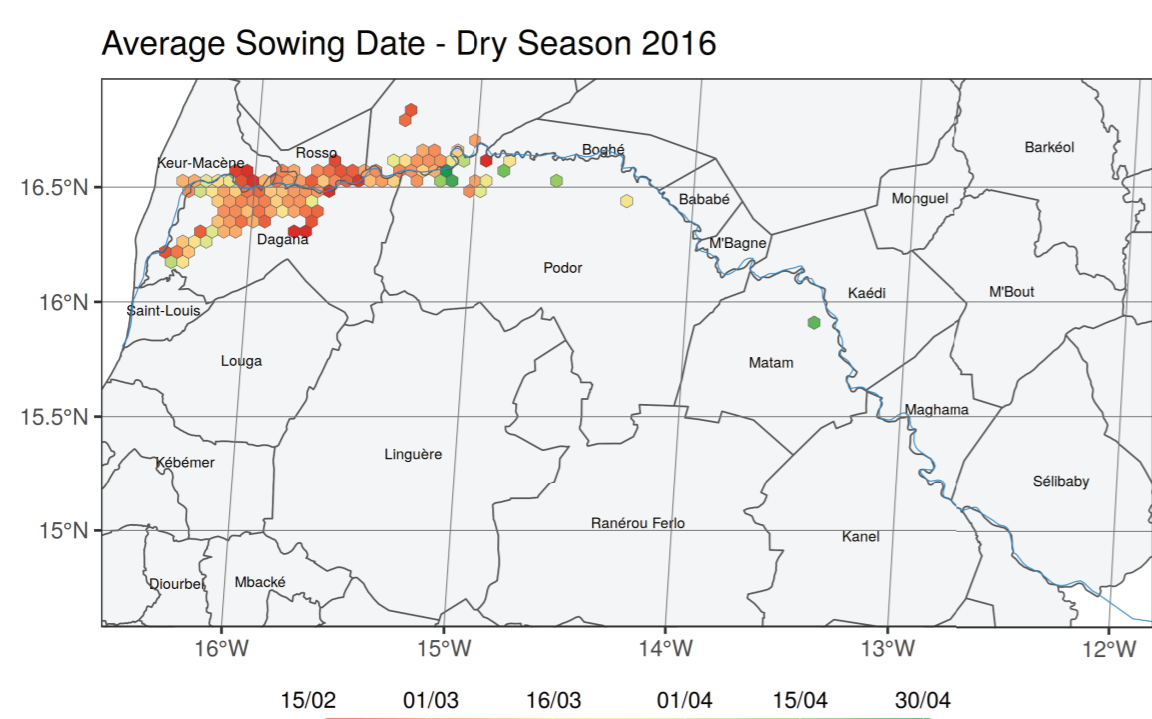
## Methodology

- A time-series combining **MODIS Aqua and Terra** 250 m resolution composites was used as input
- The **PhenoRice algorithm** (Boschetti et al., 2014) was deployed to map the **main rice areas**, and estimate **sowing and harvesting dates**, based on analysis of the EVI **vegetation index** and the NDFI **flooding index**
- Two rice growing seasons** (wet season and dry-hot season) were analysed for **14 consecutive years** from 2003 to 2016

## Major findings

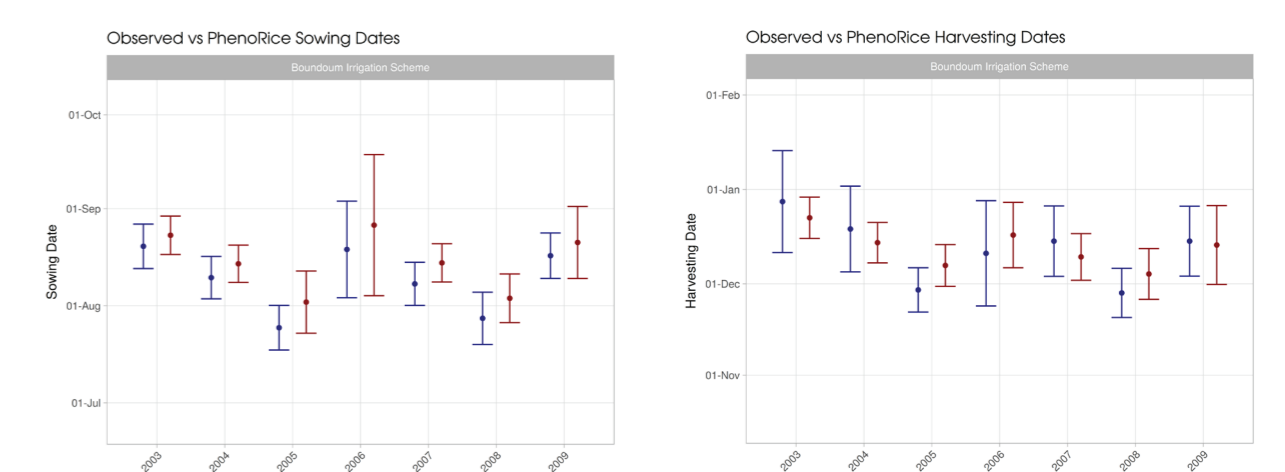
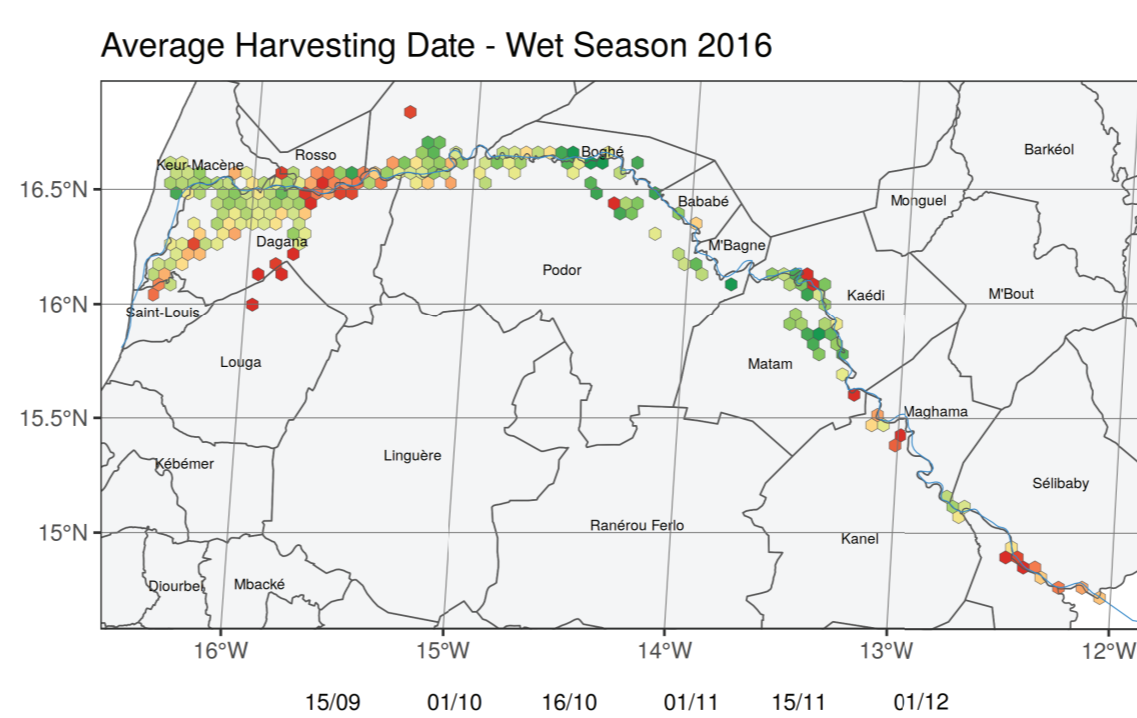
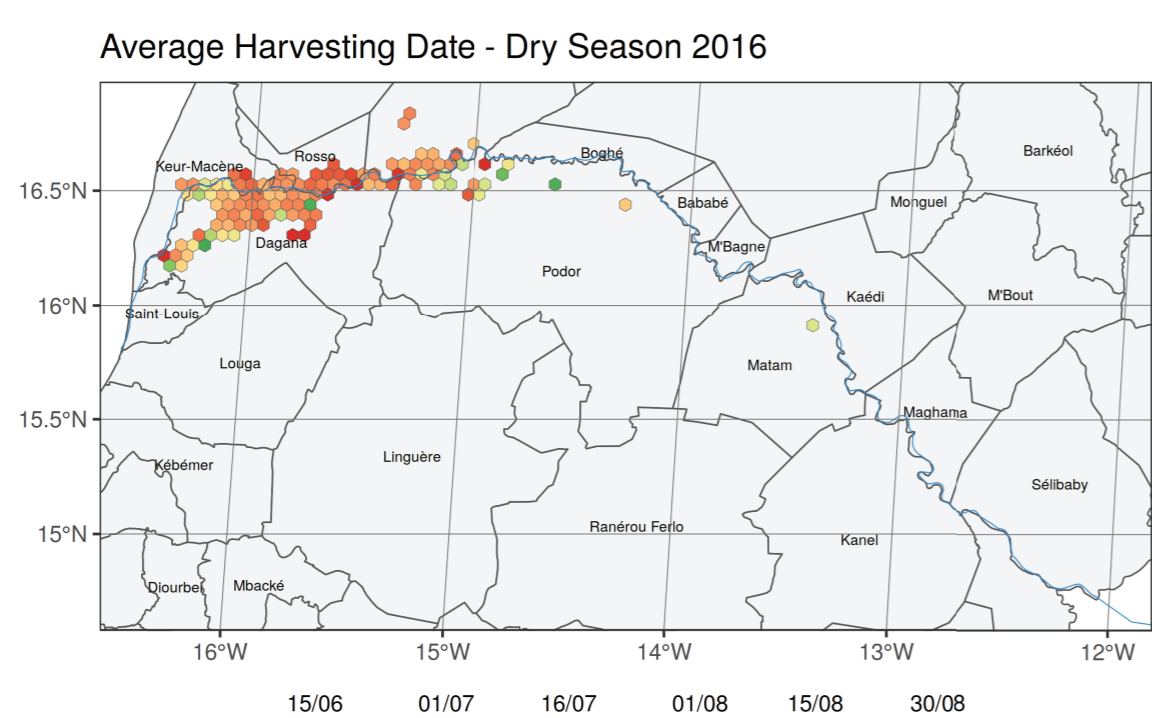
- Farmers shift massively **rice cultivation from the wet-season** to the dry-hot season when favourable climate condition lead to higher yields
- Rice double cropping**, uncommon before 2009, **increased** significantly, mostly in the delta area
- Bound by climatic conditions and risks in the wet season, farmers **changed from medium to short duration varieties** to cater for double cropping

- PhenoRice** is a **suitable tool** to detect changes in area, length and timing of the growing season, and rice intensification in the Senegal River Valley



## Validation

- Official statistics of reported rice area in Senegal in the wet and dry-hot seasons were compared with PhenoRice detected rice areas *The algorithm detects more than 50% of the reported area in both seasons, and correctly depicts its inter-annual variations.*
- A field survey of among 100 farmers located in two zones and interviewed annually between 2001 and 2010 was deployed to validate detected sowing and harvesting dates for the wet season *PhenoRice accurately detects the sowing and harvesting dates in the Delta area with RMSE of 6.1 and 5.6 respectively and R^2 equals 0.97 and 0.78. In the Middle Valley the RMSE is 9.1 and 16.2 and R^2 equals 0.82 and 0.76 for sowing and harvesting dates respectively.*



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## For more information

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