Estimating Water Productivity using WaPOR database

Marloes Mul, Wim Bastiaanssen, Livia Peiser, Jippe Hoogeveen

BACKGROUND

The coming 10-40 years will see major challenges in meeting food demand in a sustainable manner. Increase in agricultural production required to meet demand in 2050 is 50% (48.6%), compared to 2013 baseline (FAO, 2017). This occurs at a time of increasing pressure on water quantity and quality. Agriculture is by far the world's largest water user and competition between water use sectors is increasing rapidly, not only in semi-arid and arid zones. Against this background, the international debate pleas for improved crop water productivity. Production in agriculture should not only be considered per unit of land (kg/ha), but also expressed in the production per unit of water consumed, or in short Water Productivity (WP) (eq 1). An optimal use of land and water provides the best allocation of resources (see Figure 1).

$$\text{Water Productivity} = \frac{\text{Yield}}{\text{Water consumed (ET)}}$$

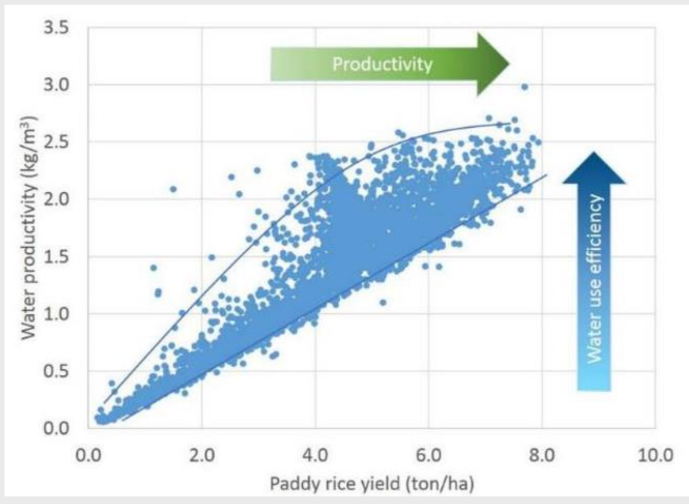
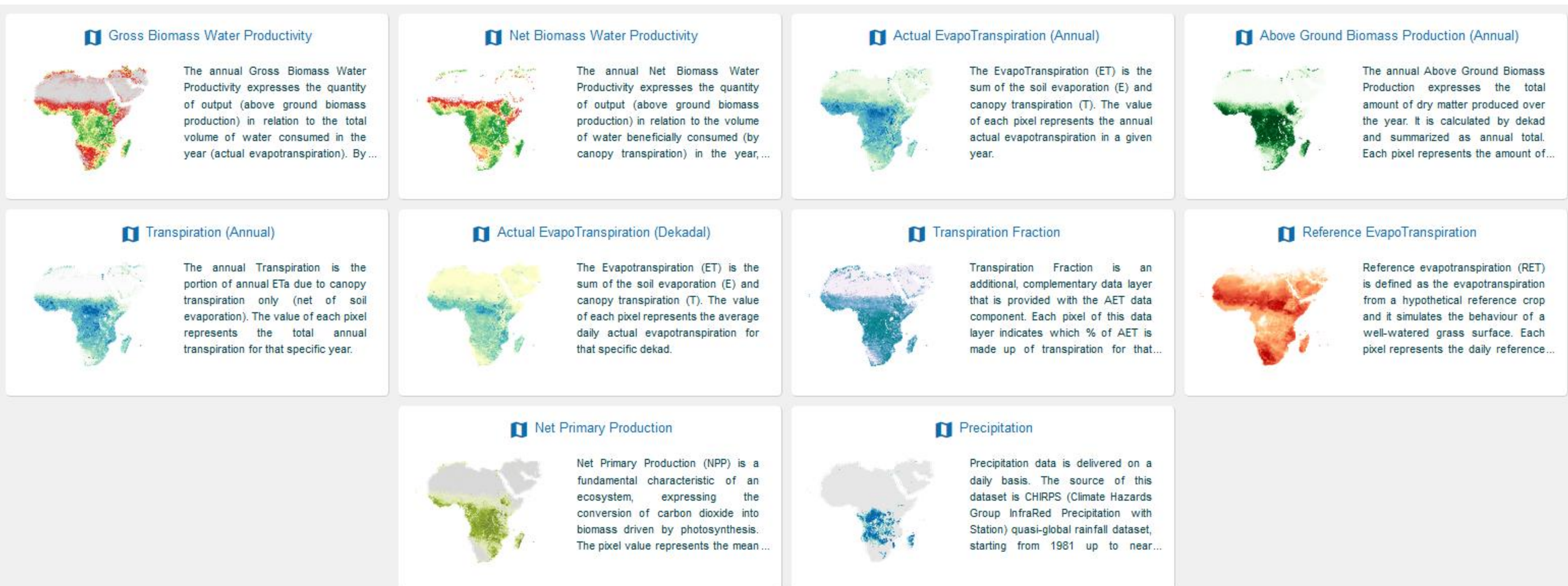


Figure 1 optimizing land and water productivity

A key policy priority of the Dutch Development Cooperation is to enhance WP in the agricultural sector by 25%. As such it intends to contribute directly to Sustainable Development Goal 6.4 on improved water use efficiency. Therefore, DGIS supported the development of the FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data (WaPOR) (see below for example of WaPOR data layers). The WaPOR data is available from 2009 – present for the entire continent of Africa and the Middle East.



RESEARCH OBJECTIVES

The objective of this study is to verify the WaPOR database on land and water productivity using a case study from Ethiopia.

SOLUTIONS/CONTRIBUTION TO WATER SCARCITY DEBATE

A concerted effort to improve agricultural water management and increase WP leads to more benefits:

- Higher food security by more crop production and better import and export strategies. Cultivation of export crops enhances rural developments and boosts job opportunities, although certain minimum amounts of staple foods should be produced locally
- More water can be allocated for drinking, industries and the conservation or restoration of wetlands
- Less risk of droughts in rain-fed arid areas due to proper crop choice and adapted farming practices that require lower volumes of water. Water harvesting and supplementary irrigation makes certain agro-ecosystem less vulnerable to climate change
- Increased attractiveness and higher return of farming for women and young people and transform farming into agri-business. This makes agriculture more attractive for young people and helps to reverse the trend of outmigration of the most dynamic and educated part of the rural population

RESULTS

The Wonji irrigation system is located in the Awash basin, the area selected for comparison is an area cultivated by sugar cane. The cropping season of sugar cane in this area is 12-24 months on a rotational basis. We chose to calculate the annual AGBP and compare to the yield observations, taking into account that the cropping season extends beyond one year. We used our own predefined cropping season. We decided to estimate annual values for AGBP for Jan 2015 to June 2016 (18 months crop rotation).

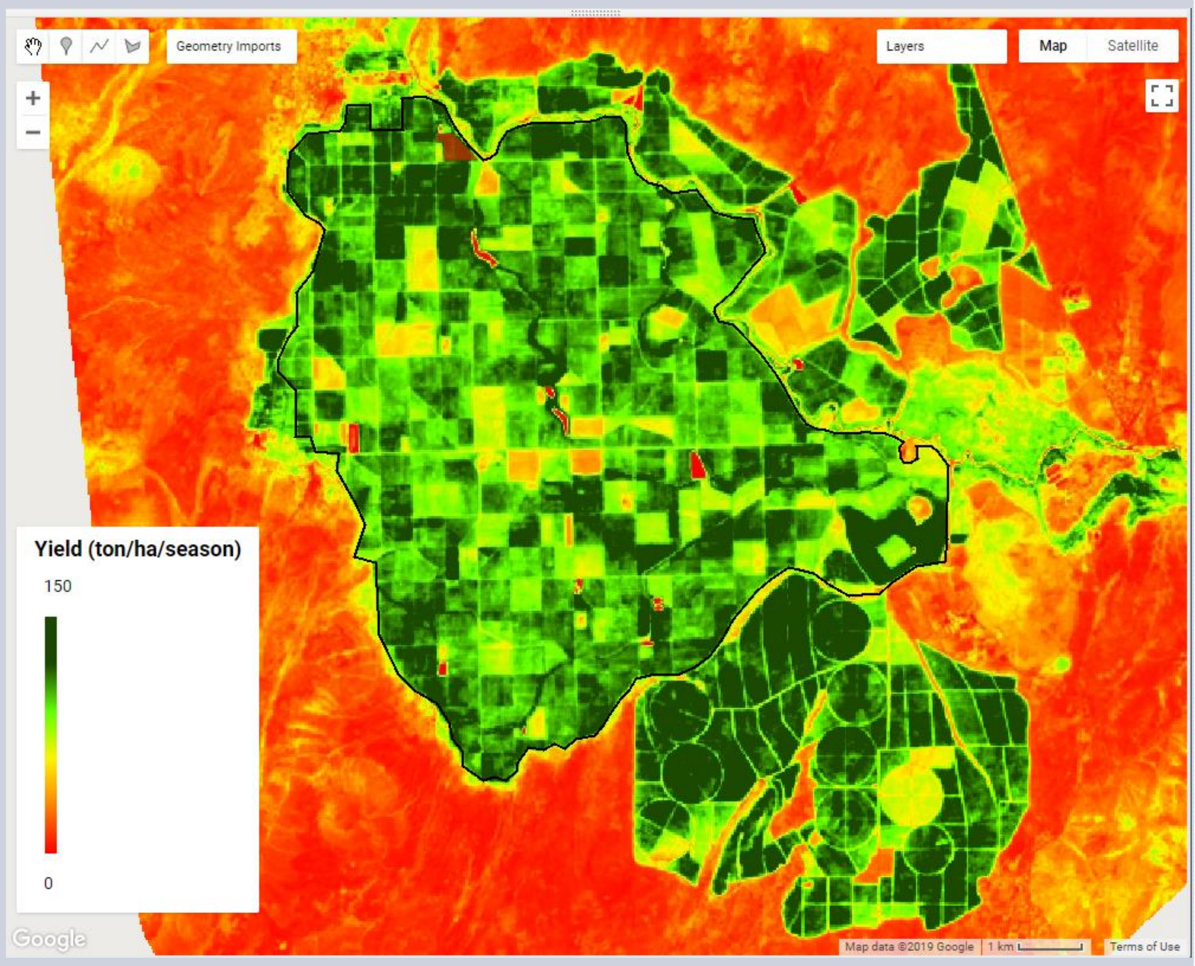


Figure 3 WaPOR derived yield for 2015 for the Wonji irrigation scheme using AGBP and specific conversion factors for sugarcane

Figure 3 and 4 show the yield distribution within the Wonji irrigation system. The average yield for 2015 a calculated is 100 ton/ha. This value is similar to Yilma (2017) observed of 100 ton/ha. Steduto et al (2012) gives an average cane yield of 70 ton/ha and FAO gives ranges between 50-150 ton/ha being in perfect agreement with our check.

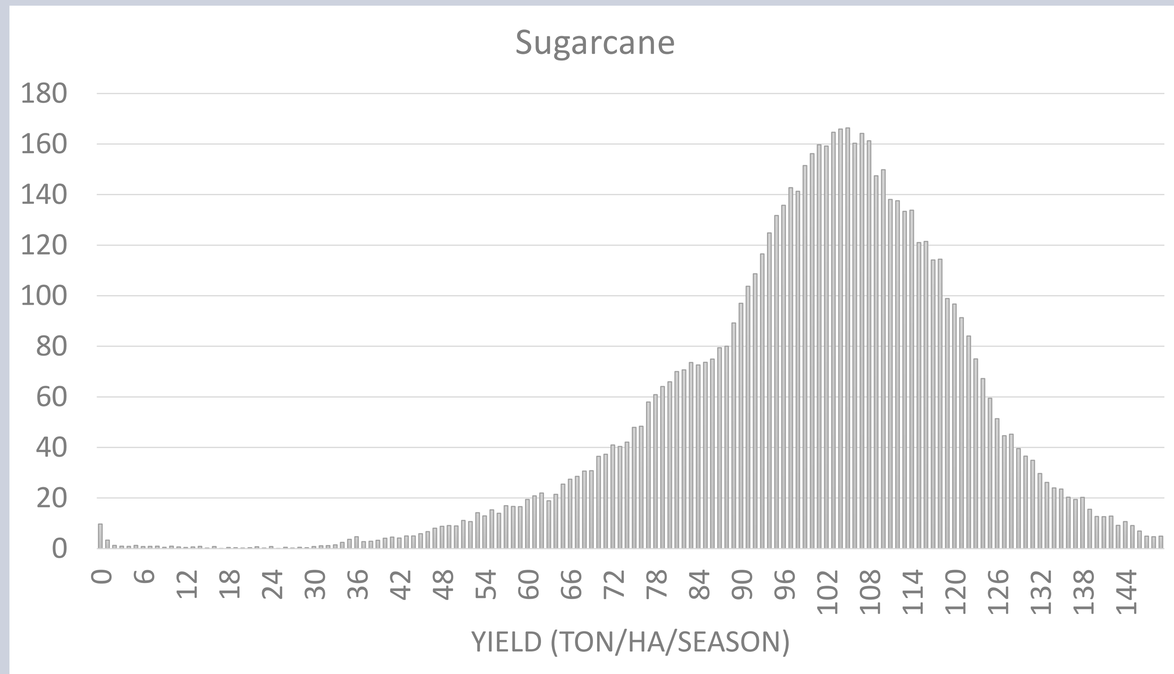


Figure 4 Sugar cane yield distribution Wonji irrigation

The estimated water productivity for the sugar cane is provided in Table 1. Similar to the land productivity, the values are in line with what is found by Yilma (6.22 kg/m³).

Table 1 Key indicators for Water Productivity in Wonji irrigation system

	Yield (ton/ha/season)	AETI (mm/season)	T (mm/season)	Gross WP (kg/m³)	Net WP (kg/m³)
Sugarcane	99.85	1,926	1,638	5.22	6.13

CONCLUSIONS

The WaPOR database provides reliable information to estimate yield and water productivity for the sugar cane estate in Ethiopia. With decadal data being available at 250m resolution for the African continent and the Middle East for the past 10 years, WaPOR provides powerful opportunities for monitoring improvements in water productivity and identifying areas for improvement. However, currently the portal does not provide sufficient information to compile yields and user defined inputs (such as exact location of irrigation scheme, occurrence and duration of cropping season, specific crop type, harvest index and moisture content) are required for accurate yield and WP estimations.

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Contact / Project Website

https://wapor.apps.fao.org/home/1

Dr Marloes Mul – m.mul@un-ihe.org