WaterPIP
Water Productivity Improvement in Practice

Intensification vs land expansion in sugarcane production

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IHE Delft Institute for Water Education

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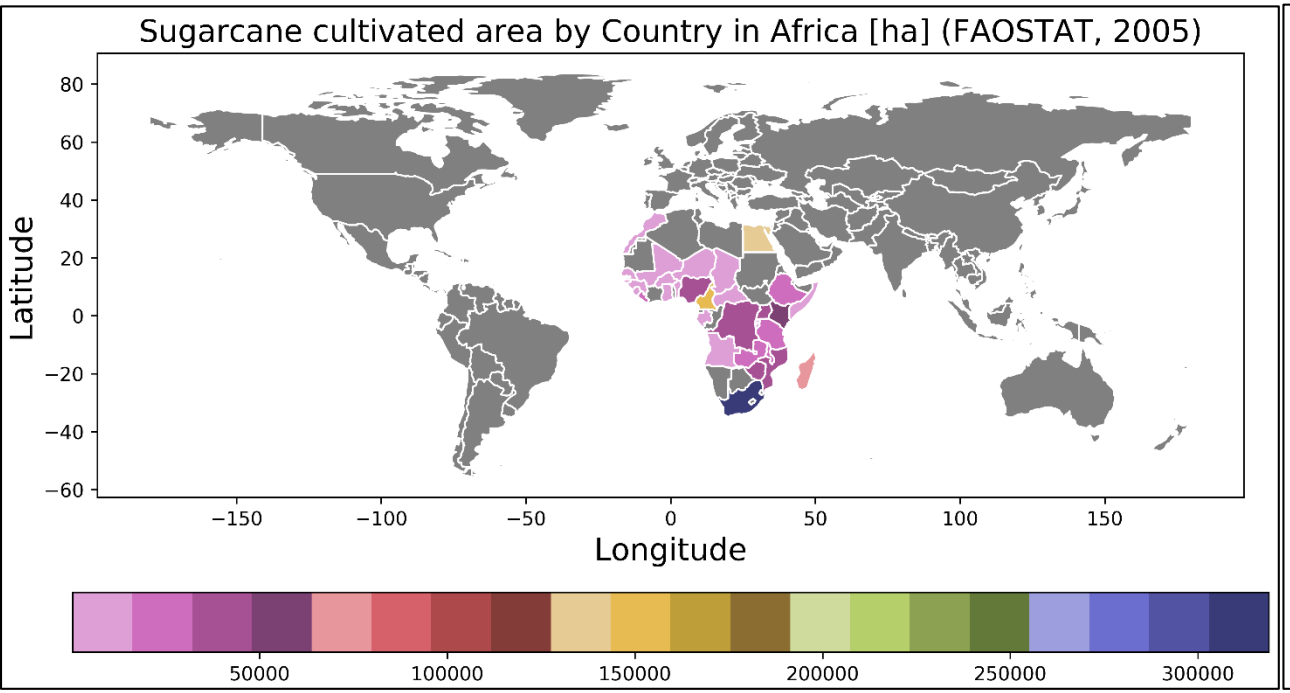
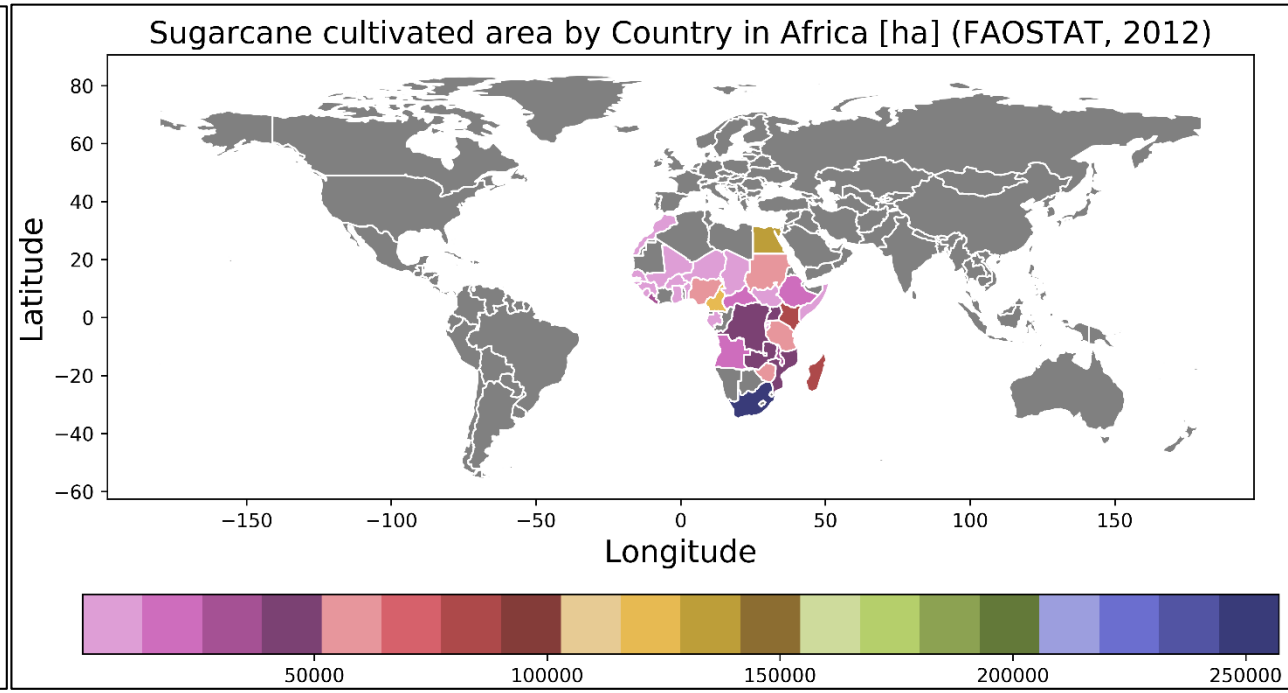
WAGENINGEN UNIVERSITY & RESEARCH
META

Outline

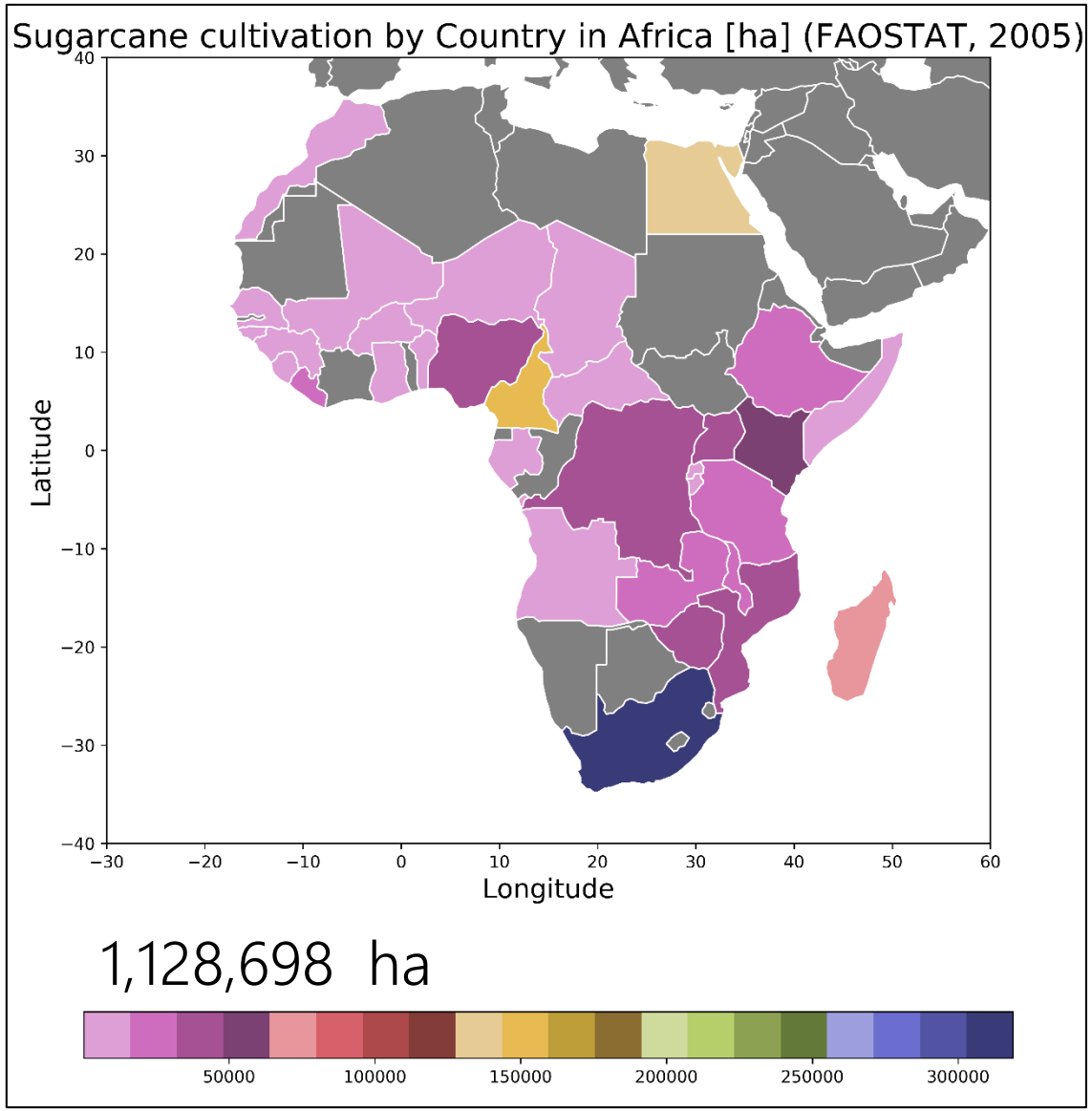
- the increase in sugarcane production in Africa, **is it from land expansion and/or improving productivity**?
- What is the potential for intensification on existing land?
- What is the implication of intensification on land use and water consumption?

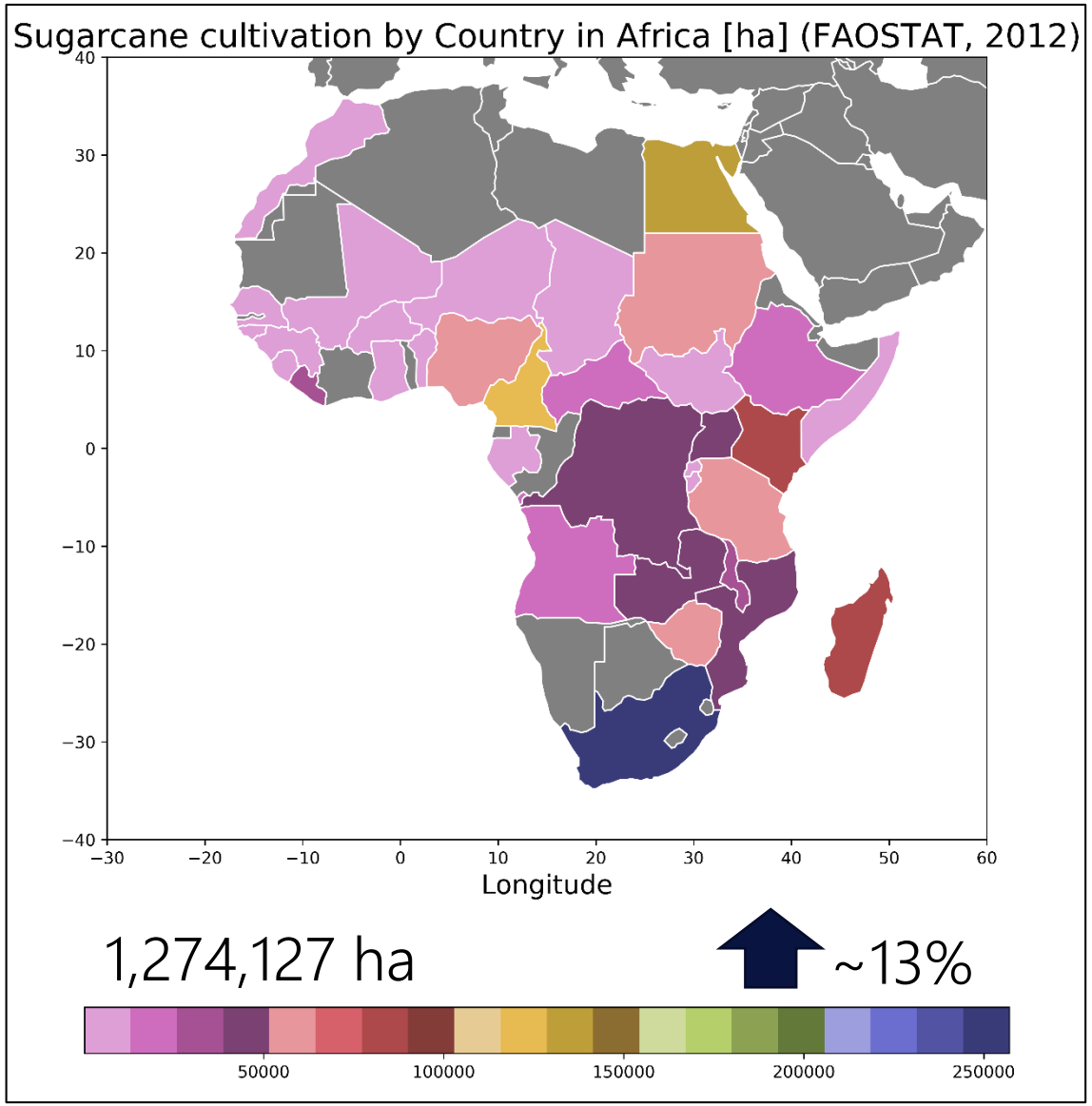
Sugarcane production in Africa



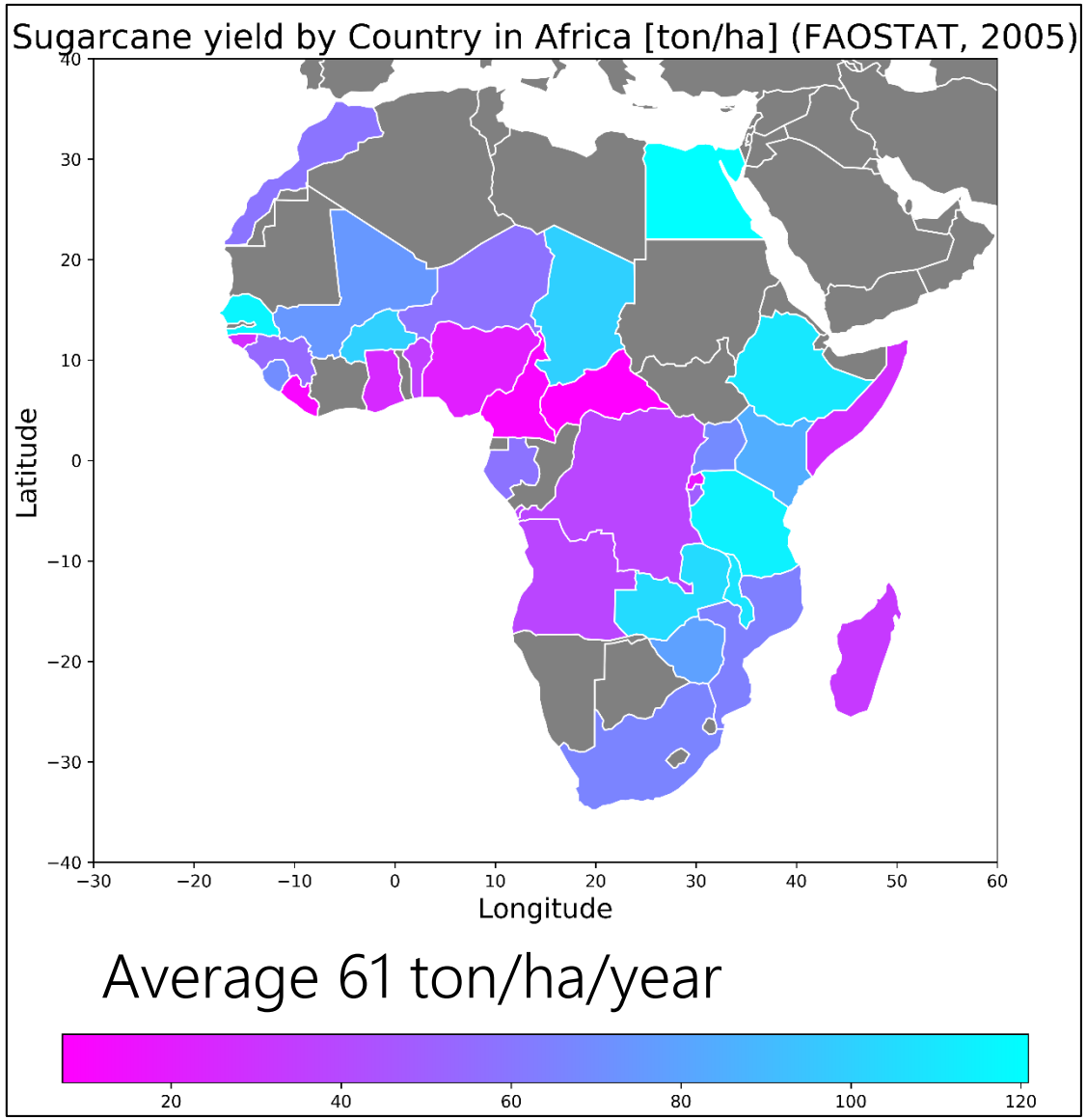


Sugarcane production in Africa

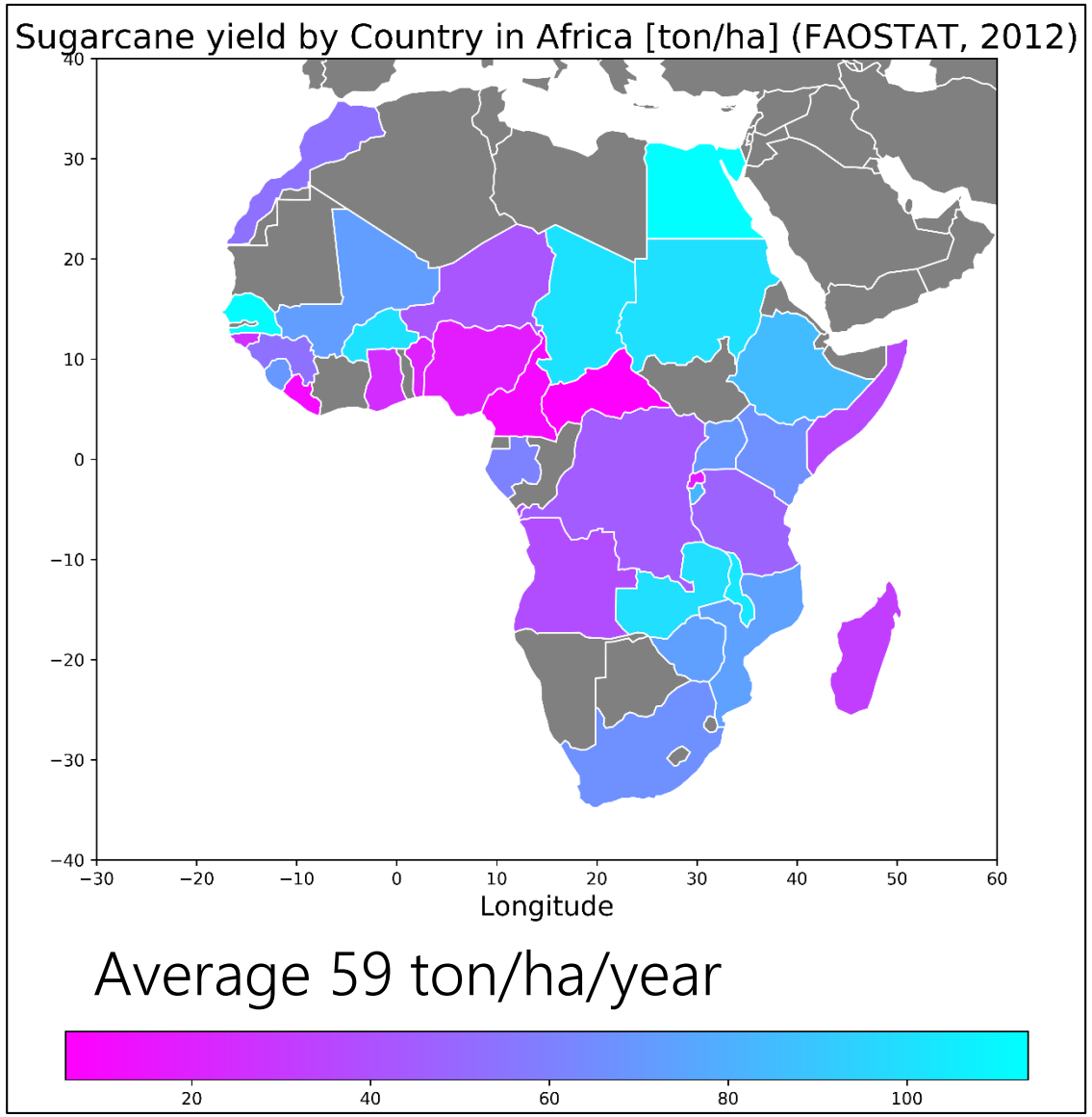




Sugarcane production in Africa



Average 61 ton/ha/year

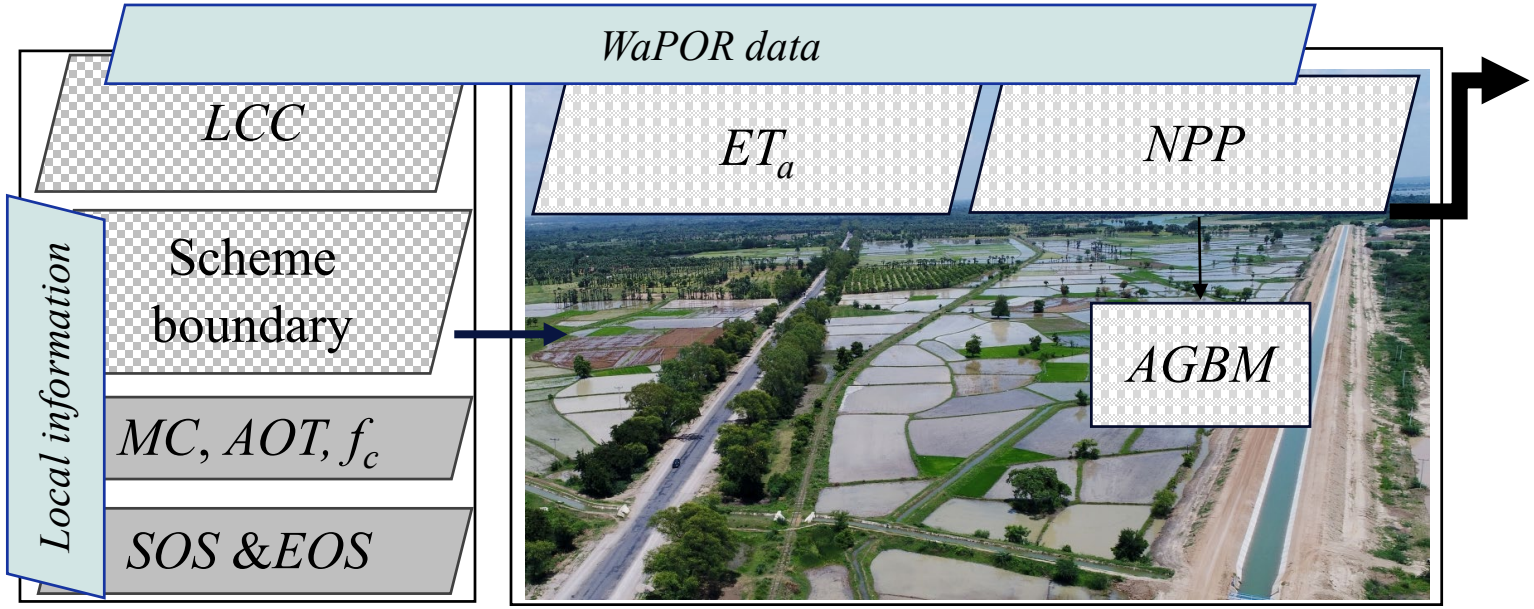


Average 59 ton/ha/year

? Is there a scope for intensification

- The case from Xinavane, Mozambique
- The total area considered for this analyses is 10,012 ha (363 ha irrigated using furrow, 935 ha irrigated using centre pivot and 8,714 ha irrigated using mixed irrigation system).

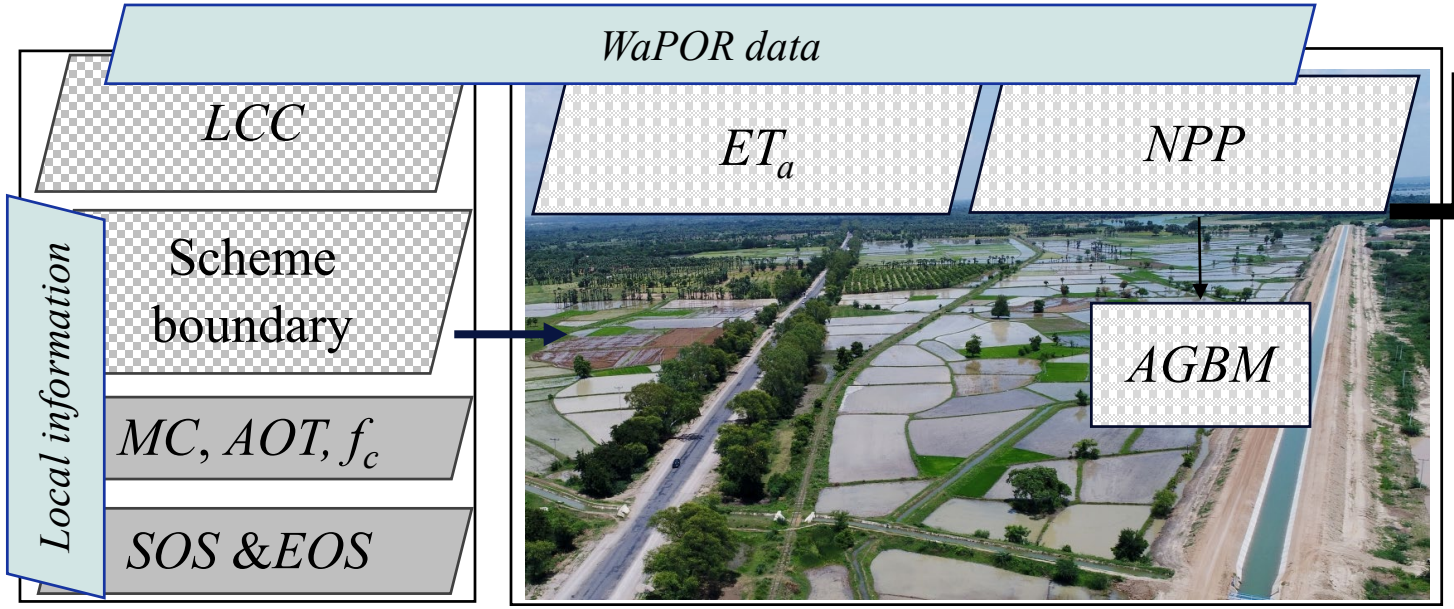
Methods and data

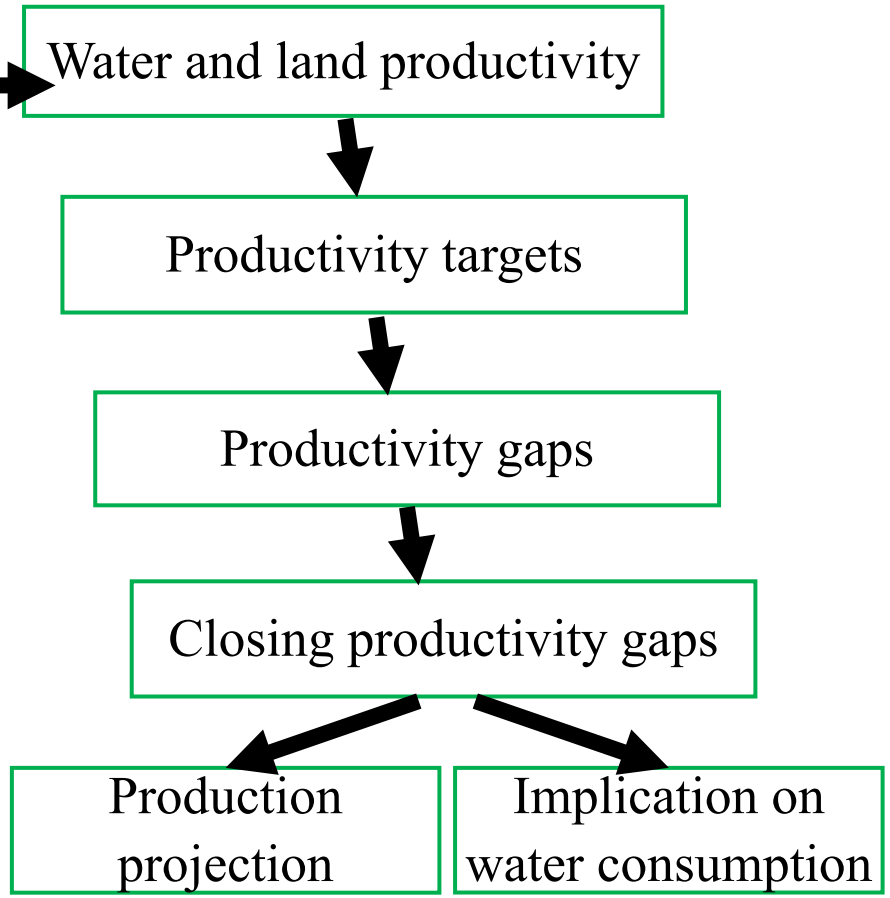


$$Seasonal \text{ water consumption/prroduction} = \sum_{SOS}^{EOS} X_i$$

WaPOR: FAO portal to monitor Water Productivity through Open access of remotely sensed derived data. https://wapor.apps.fao.org/home/WAPOR_2/1

Methods and data





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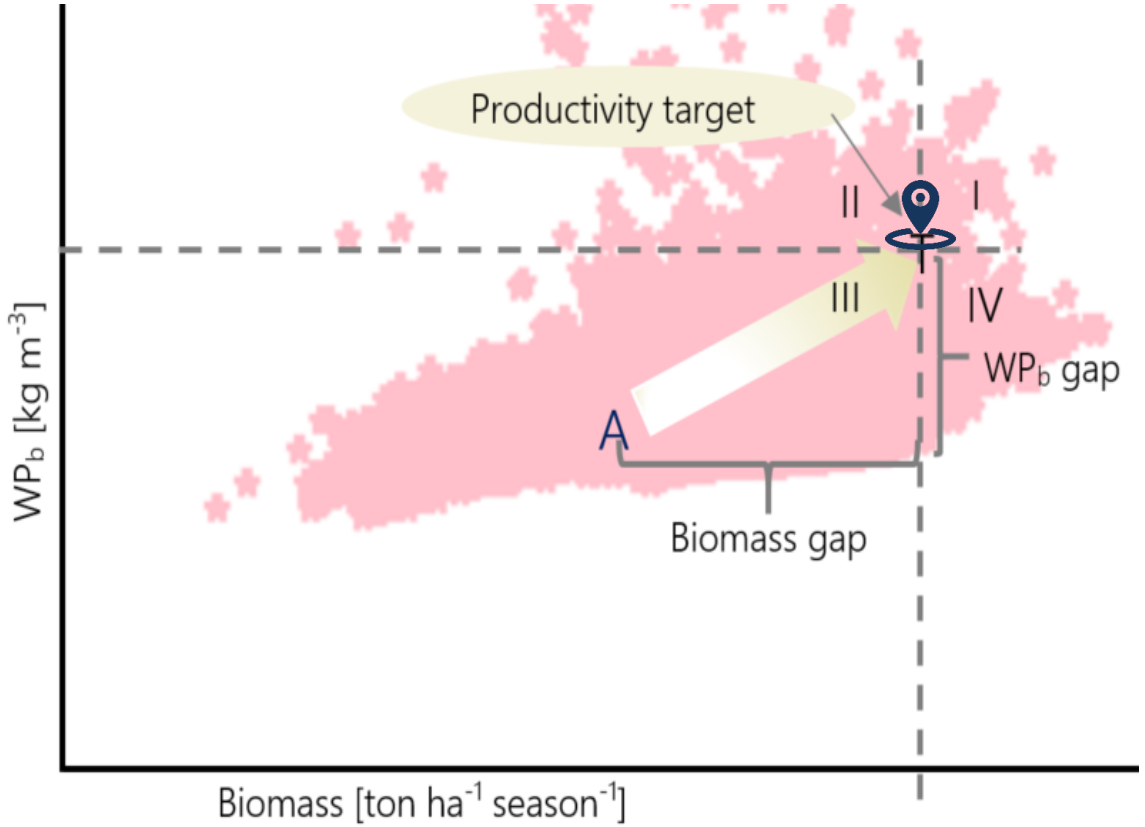
Methods and data

$$WP_b = \frac{B}{ET_a}$$



$$Biomass = AOT * f_c * \frac{NPP * 22.222}{(1 - MC)}$$

Water and land productivity

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Productivity targets

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Productivity gaps

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Closing productivity gaps

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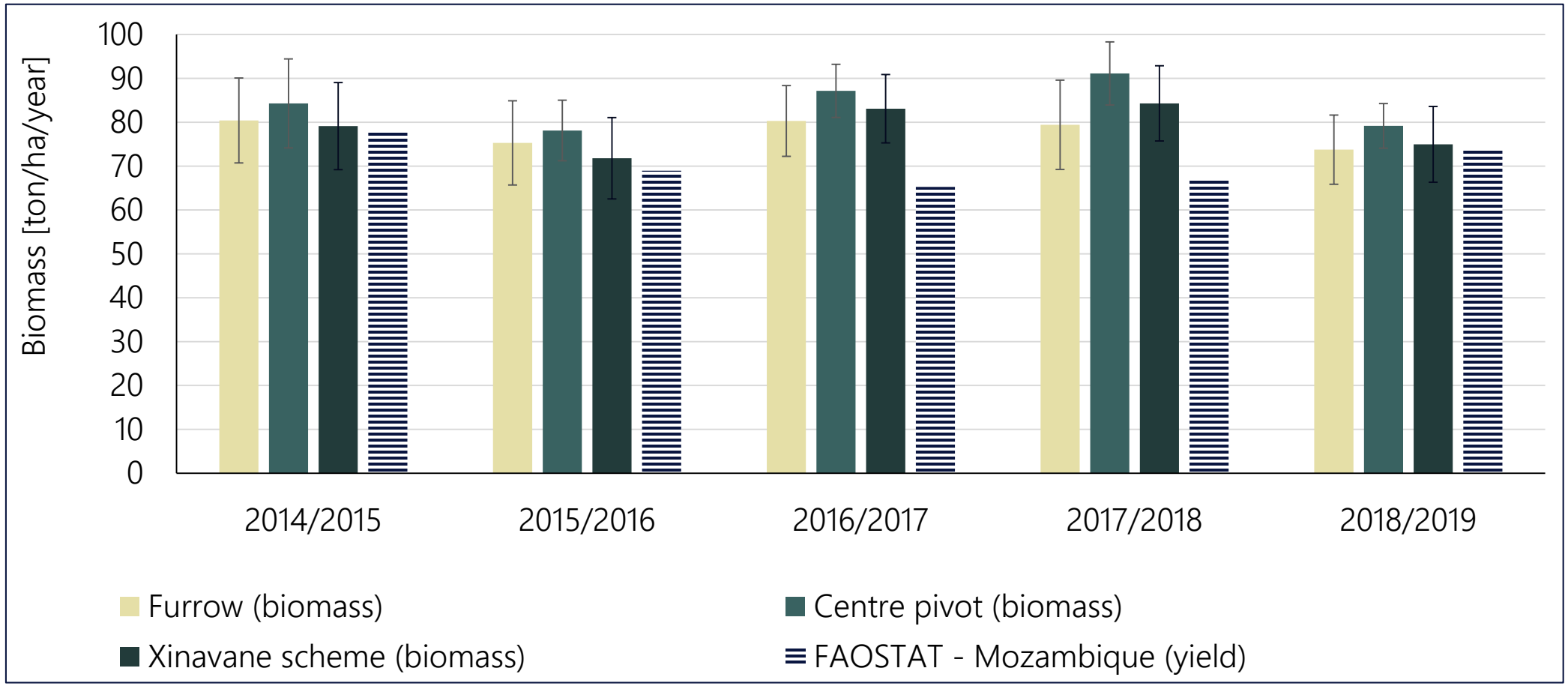
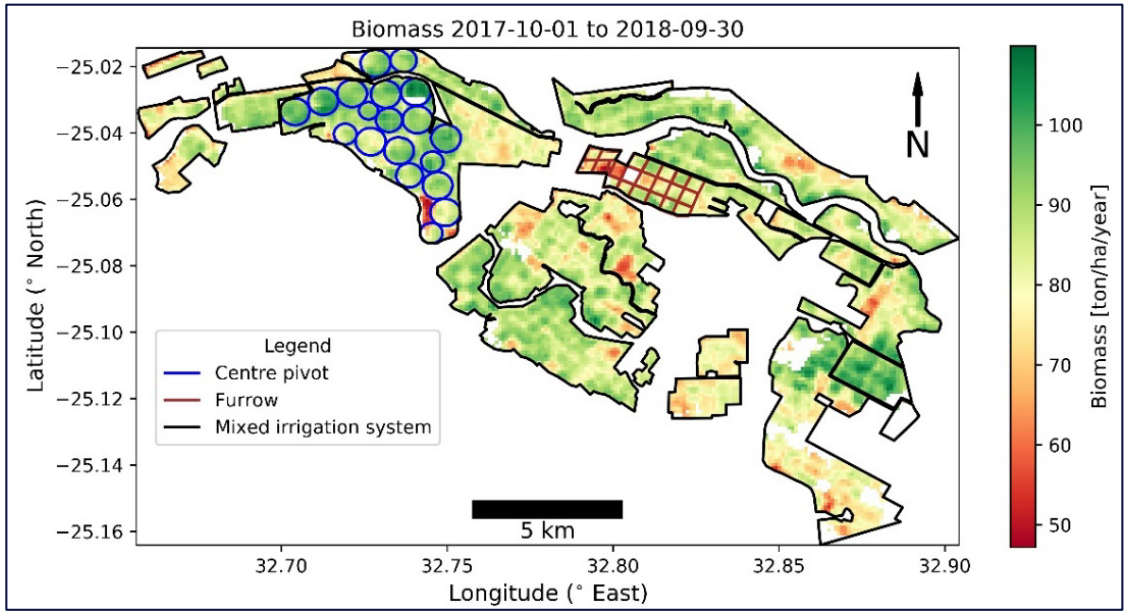
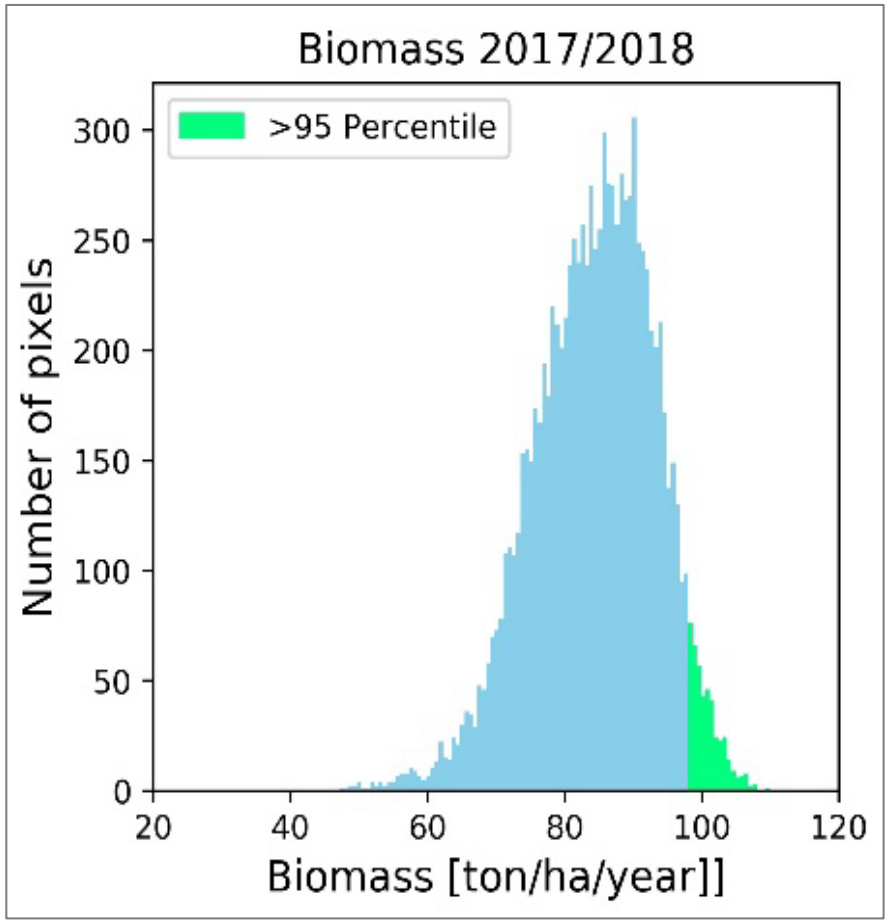
Production projection | Implication on water consumption

Land productivity: biomass

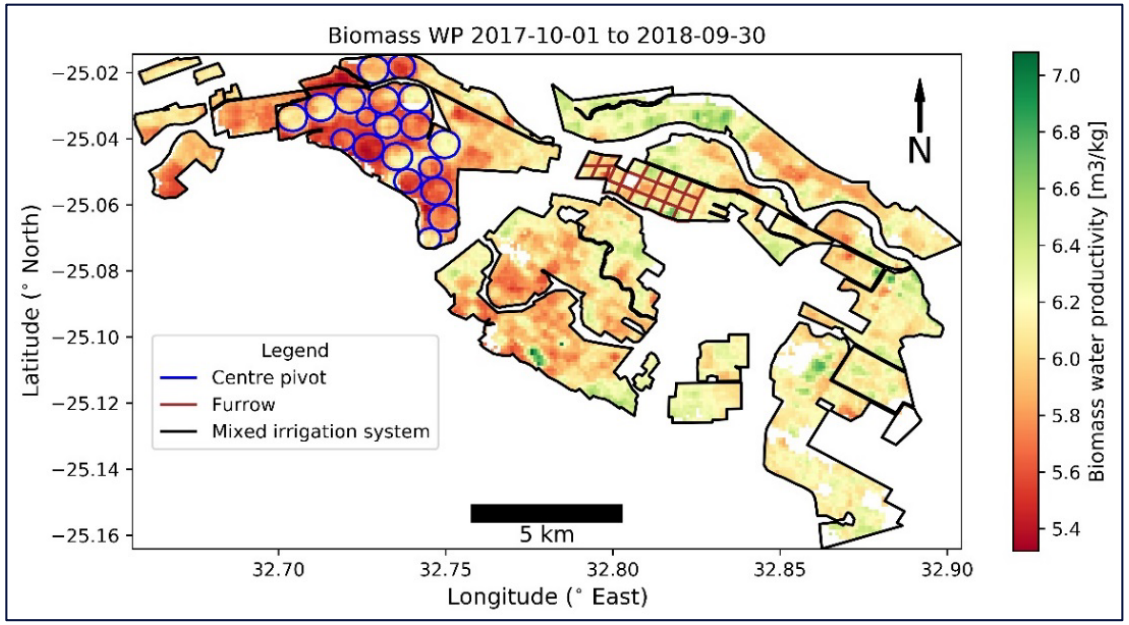


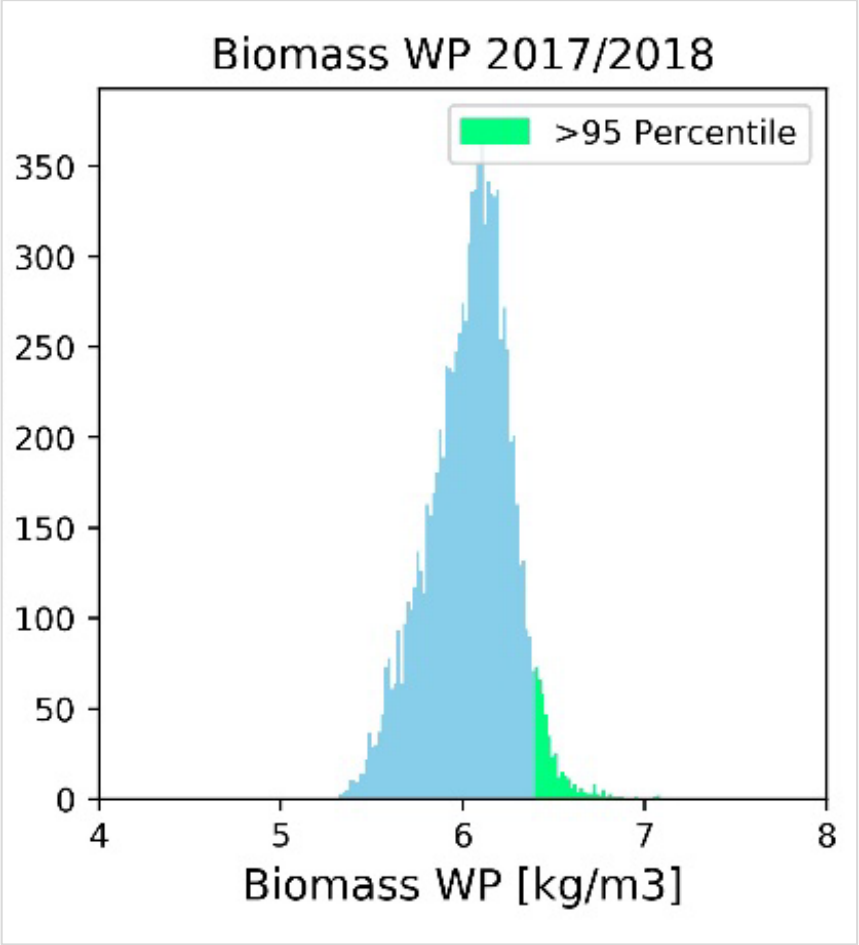
Land productivity: biomass



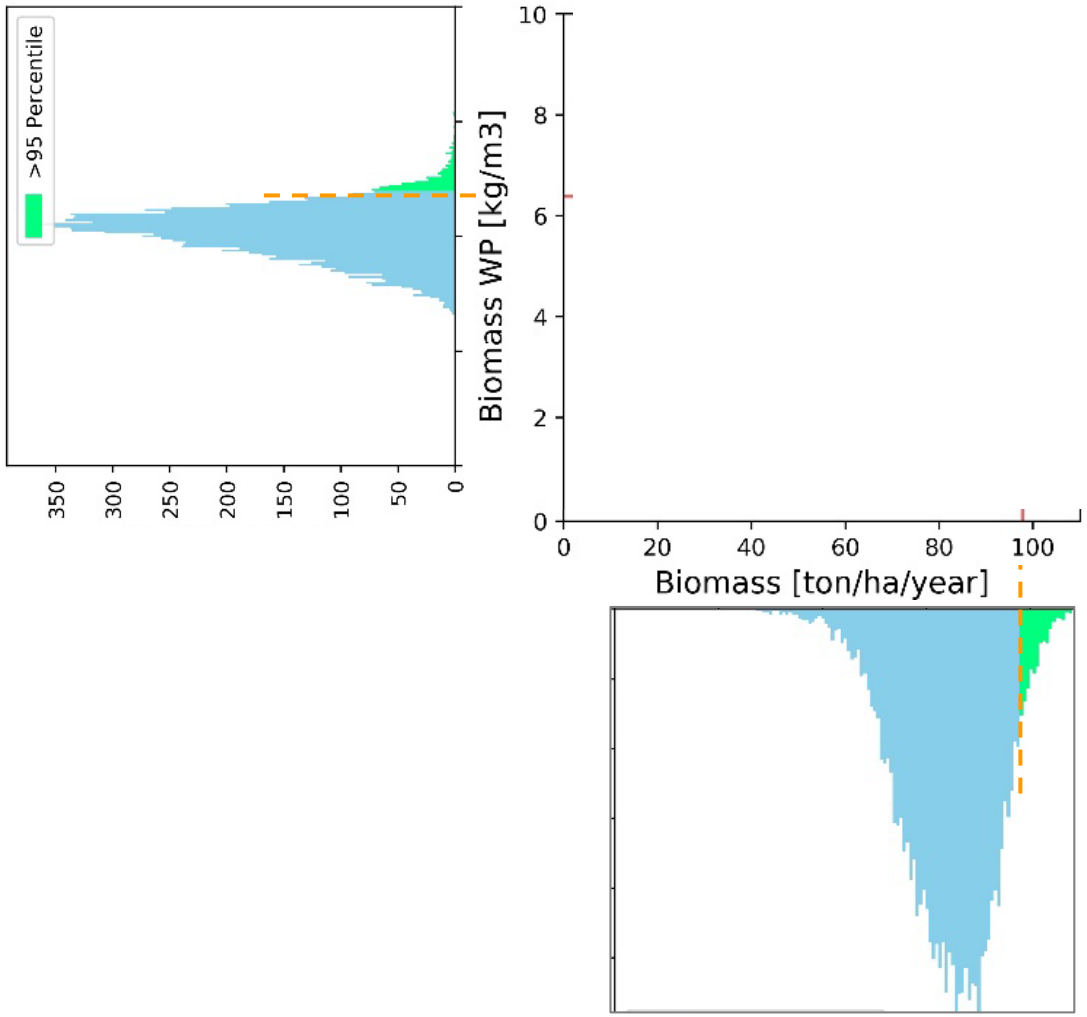


Water productivity: biomass WP





Productivity targets



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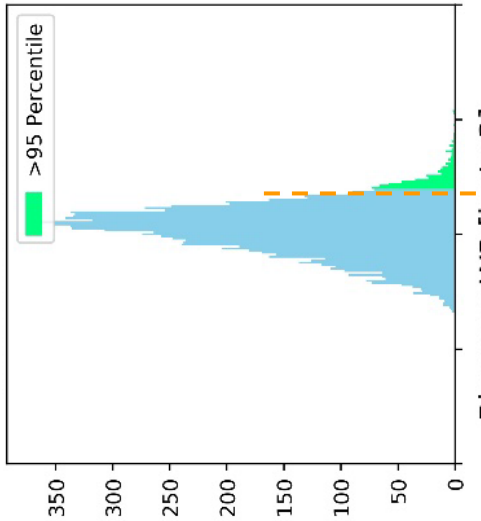

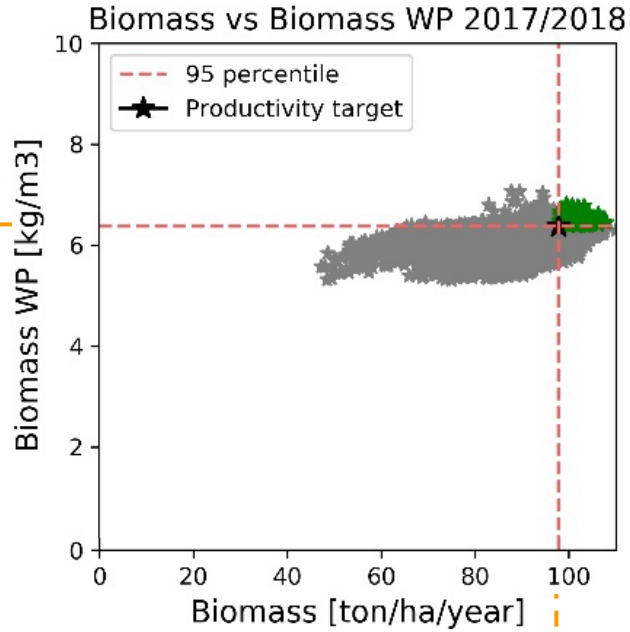

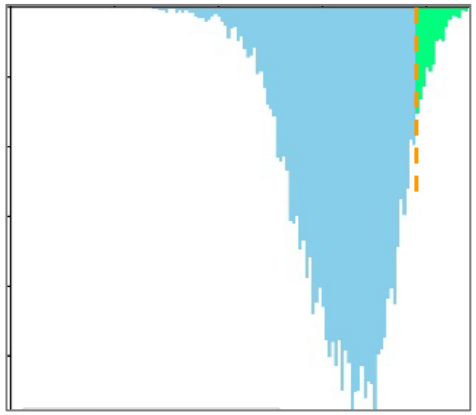

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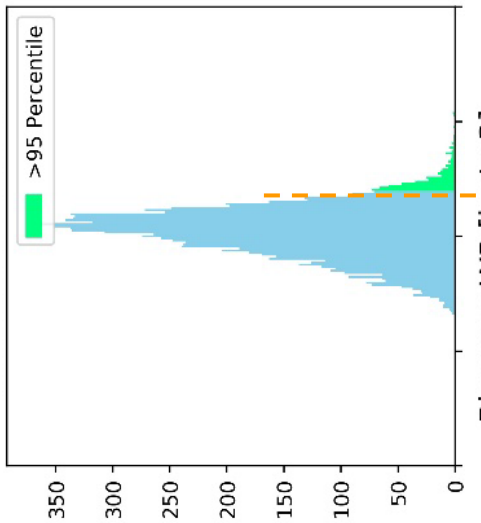
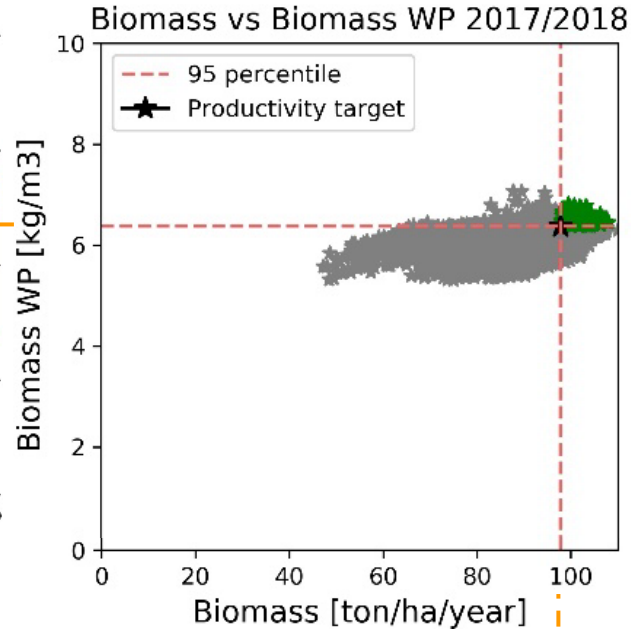
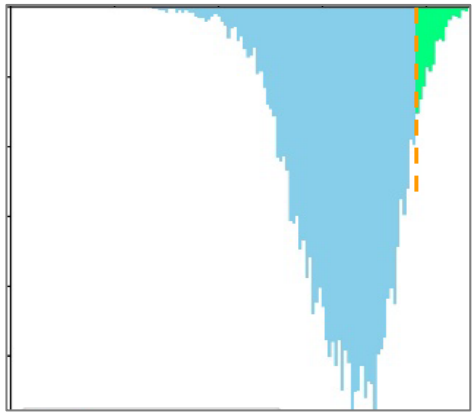
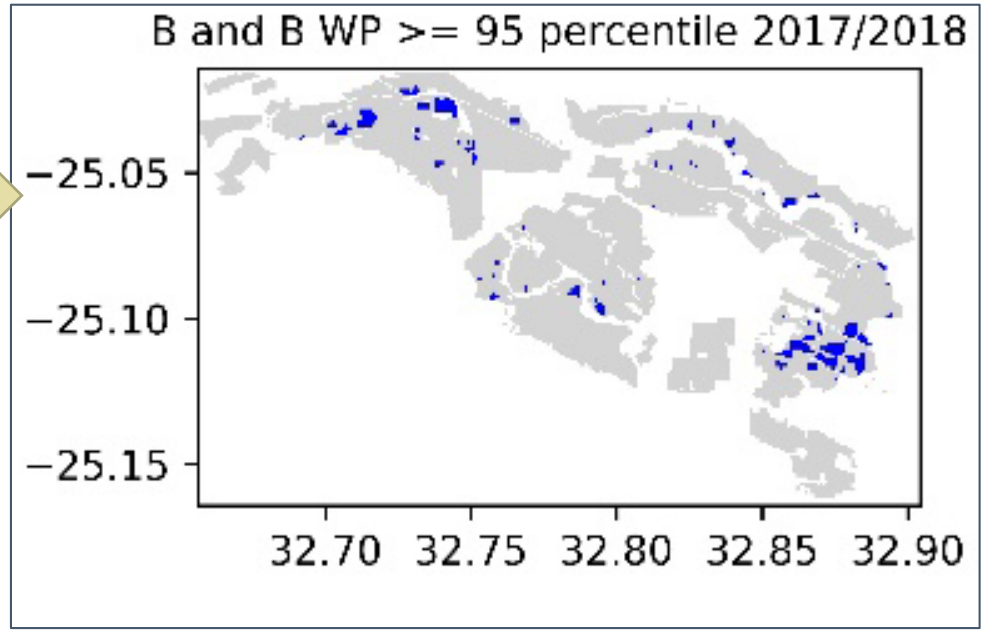
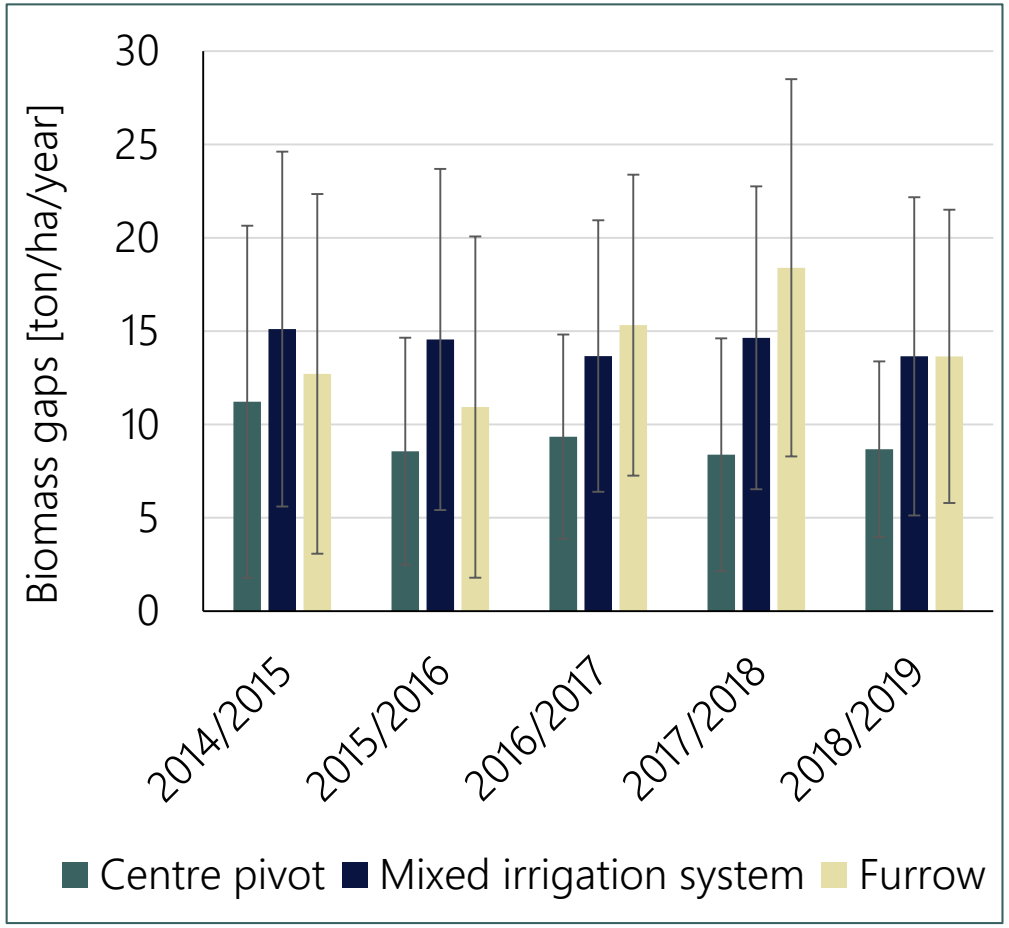


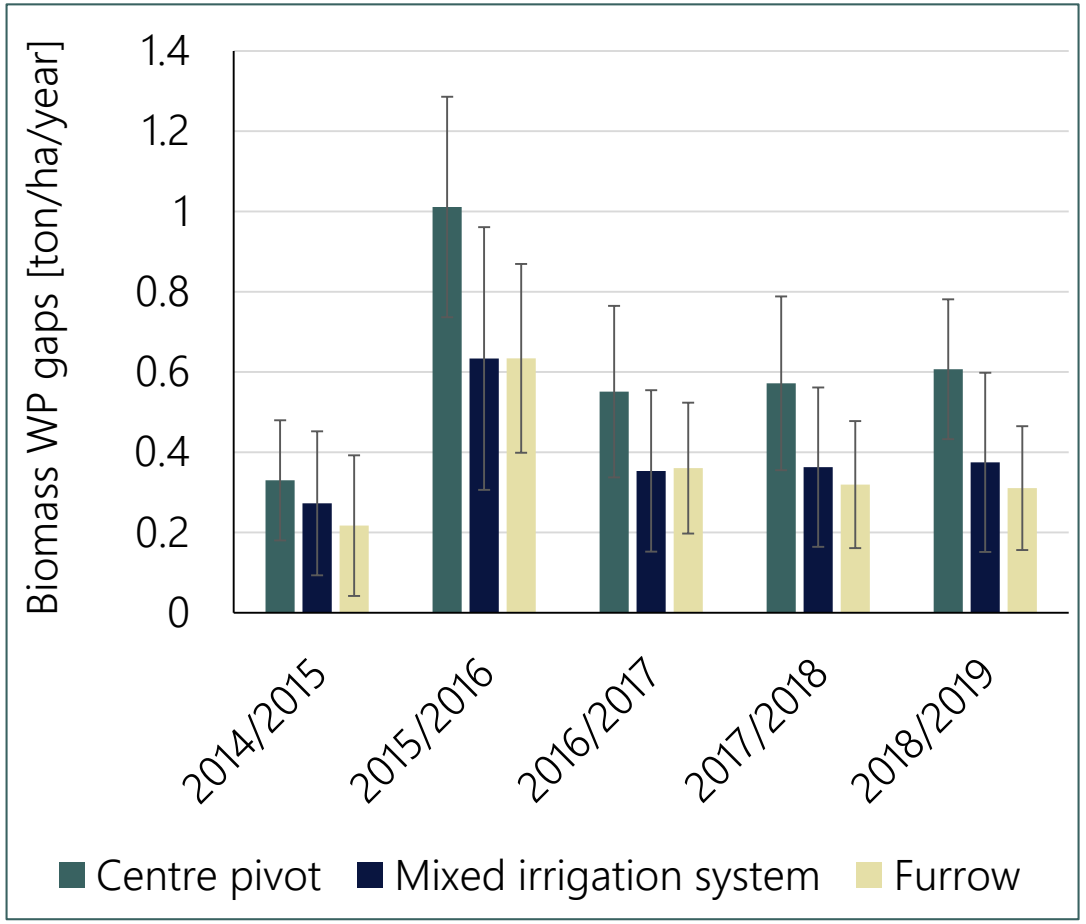




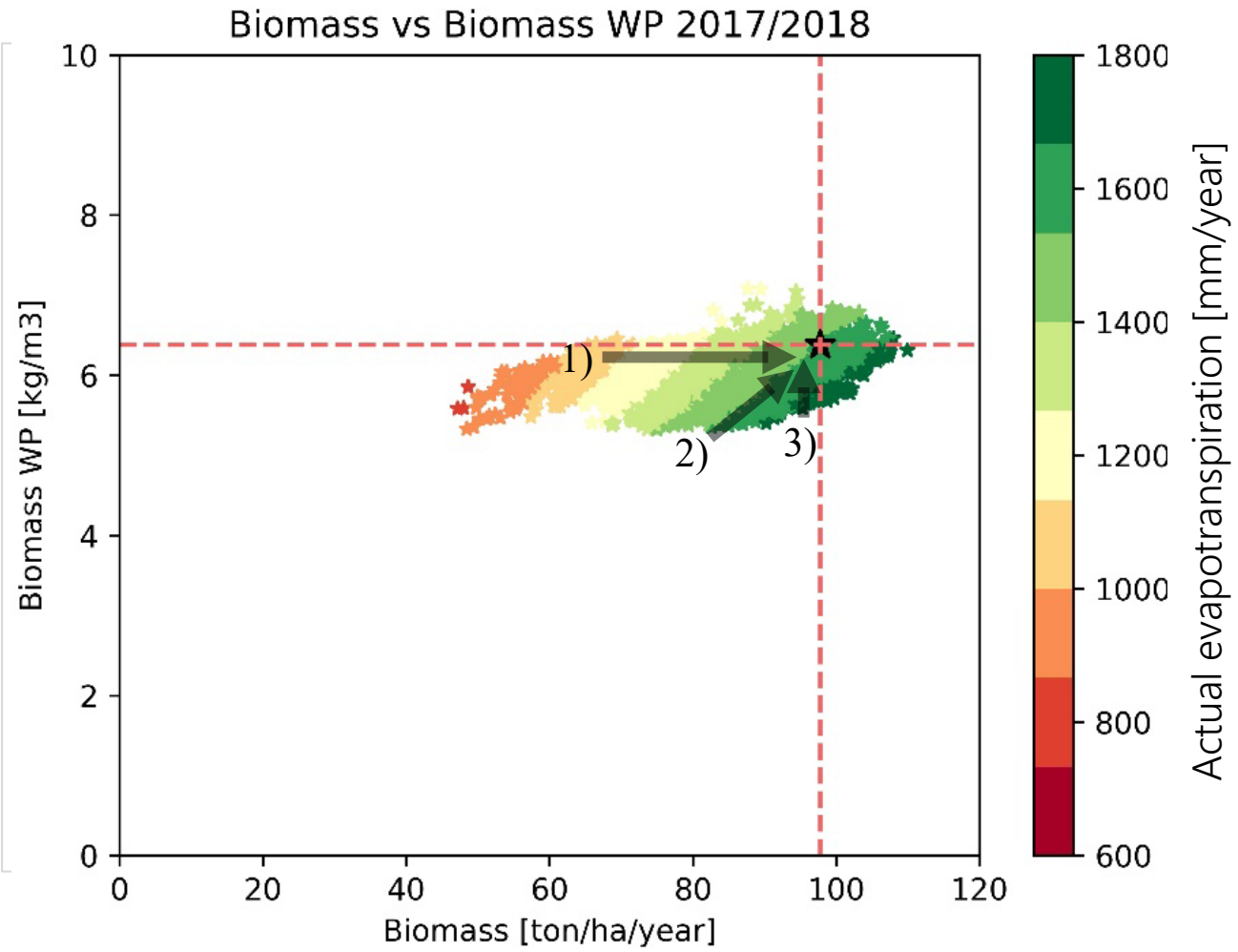


Productivity gaps





Closing productivity gaps



1) Close biomass gaps & WP gaps by increasing ET_a
2) Close biomass gaps & WP_b gaps at the same ET_a
3) Close biomass gaps & WP gaps by reducing ET_a

Production projection

Year	Biomass gap [ton/ha/year]		Biomass WP gap [kg/m^3]		Production gap [ton/year]
	Mean	SD	Mean	SD	
2014/2015	14.7	9.6	0.3	0.2	139,782
2015/2016	13.9	9.1	0.7	0.3	131,938
2016/2017	13.3	7.3	0.4	0.2	126,693
2017/2018	14.3	8.3	0.4	0.2	135,488
2018/2019	13.2	8.3	0.4	0.2	125,231
Average	13.9		0.42		**131,826**

Implication on water consumption

	ET_a Increase				ET_a Reduction			
Year	Area ha]	Mean [mm]	SD [mm]	[m^3/year]	Area [ha]	Mean [mm]	SD [mm]	[m^3/year]
2014/2015	8,442	202	147	17,042,258	1,058	39	301	409,030
2015/2016	5,710	195	156	11,155,927	3,755	95	70	3,568,423
2016/2017	8,276	149	105	12,335,516	1,218	38	31	461,342
2017/2018	7,880	184	122	14,498,279	1,614	54	39	878,183
2018/2019	7,082	166	126	11,756,116	2,412	68	54	1,642,862
Average	7,478	179		13.4 M m^3		59		1.4 M m^3

Conclusions

- Intensification at Xinavane by closing biomass gaps can increase water productivity as well as production up to 131,826±5,414 ton/year, which is equivalent to harvesting from additional irrigation land of more than ~ 1,437 ha (~14% of the existing crop land).

- The increase in production from existing land comes with additional water consumption (13.4 million m^3), which would have been higher if the production gain is from land expansion.

- Subsequent studies, could additionally consider sucrose content of sugarcane as it is the most important indicator of the marketable output (sugar) than biomass.
- WaPOR play an important role in bridging the data gaps, particularly the spatial detail, which are unavailable from the traditional means of data collection (point data). However, validation and accurate interpretation of the results, diagnoses of the productivity gaps and formulation of practical solutions can be made if WaPOR analyses and results are complemented with observed data and local information.

WaterPIP

Water Productivity Improvement in Practice

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Project activities are led by:

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