Water Productivity: from monitoring to improvement

## FutureWater solutions and experiences

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2 March 2017

MetaMeta, Wageningen

FutureWater

Research and consultancy for a
sustainable future of our water resources

FutureWater

- **"Research and consulting on water resource management"**
- Topics: water, food, irrigation, climate change, droughts, simulation models, remote sensing
- Outputs: technical reports, policy reports, scientific publications, training, datasets, models, operational services
- Partners/Clients: World Bank, Asian Development Bank, Governments, River Basin Organizations, Research Entities
- Geographical focus: Europe, Asia, Africa
- Offices: Wageningen (NL), Cartagena (ES): 13 staff
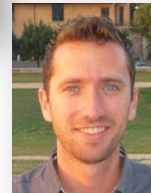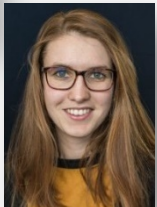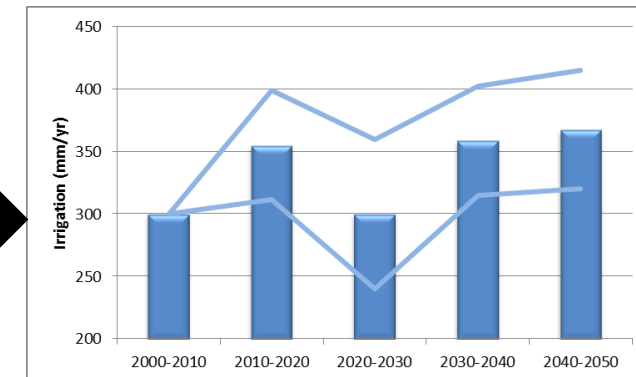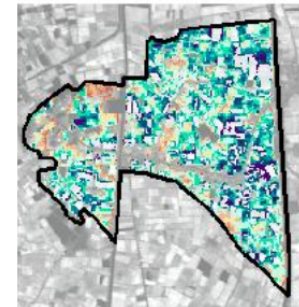
Water productivity in FutureWater activities

> **Field-scale monitoring and advice**

e.g. ThirdEye: Flying Sensor Support to Farmers' Decision Making, Mozambique
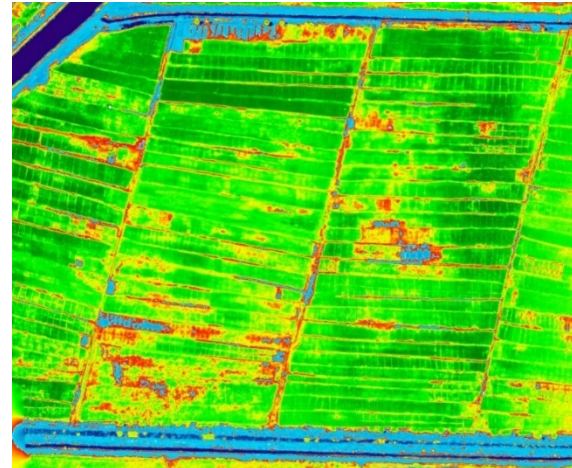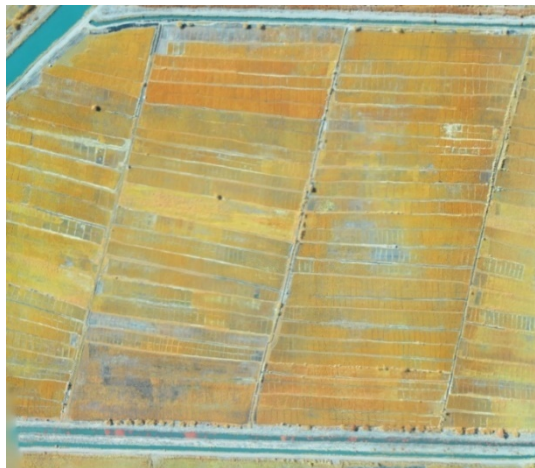
> **Prediction and improvement**

Using simulation models to go from monitoring to interventions for WP improvement

ThirdEye

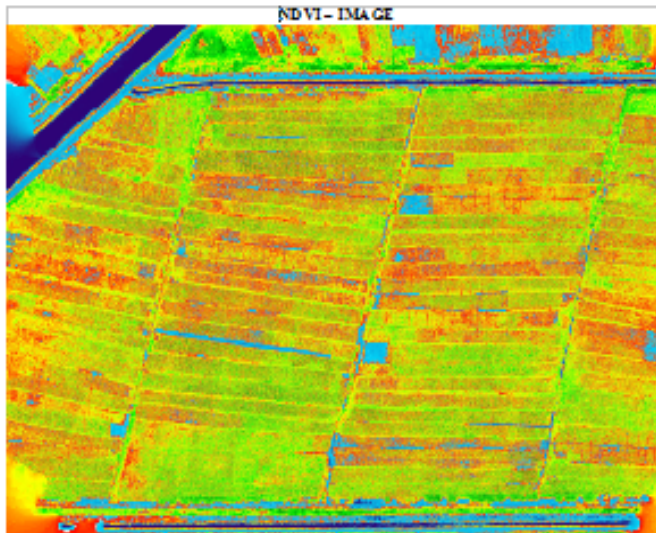> Year 3 of the Securing Water For Food program
> Training of flying sensor operators for decision support to Mozambican farmers
> Currently over 20,000 beneficiaries, 14 trained operators, ~10,000 USD product sales to large-scale farms
> 2017: focus on enhanced outreach, business development, establishment of a central support unit

STATUS OF VEGETATION

No vegetation — Poor — Medium — Good — Excellent

ThirdEye

① Crop status 10 days earlier than the human eye, timely warnings for the right cultivation practices.

② Accurate and pinpoint identification of field weed/pests/weed infestation areas.

③ Increased agriculture output, decreased input use.

ThirdEye: observed results

> Impact on crop yields and irrigation applications (farmer questionnaires and RBL statistics)

Location	Main crop	ThirdEye area		Control area	
		Yield (2015/2016 vs 2014/2015)	Irrigation (2015/2016 vs 2014/2015)	Yield (2015/2016 vs 2014/2015)	Irrigation (2015/2016 vs 2014/2015)
Xai-Xai	Rice	+69%	+19%	+20%	+36%
Chókwè	Corn	+17%	-41%	-18%	-37%

Remote Sensing NDVI data
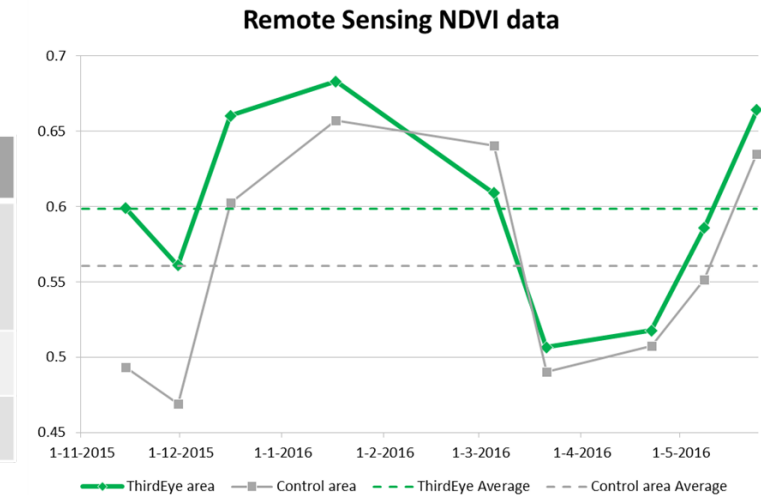
> Crop status maps supported decision to enhance water distribution by improving tertiary channels (Xai-Xai)
> Tool to support decision on altering water tables by controlling the gates in secondary channels
> Discussion: water productivity vs. SWFF target of "water saving"

From monitoring WP to improving WP

Strategic decision support
Operational decision support
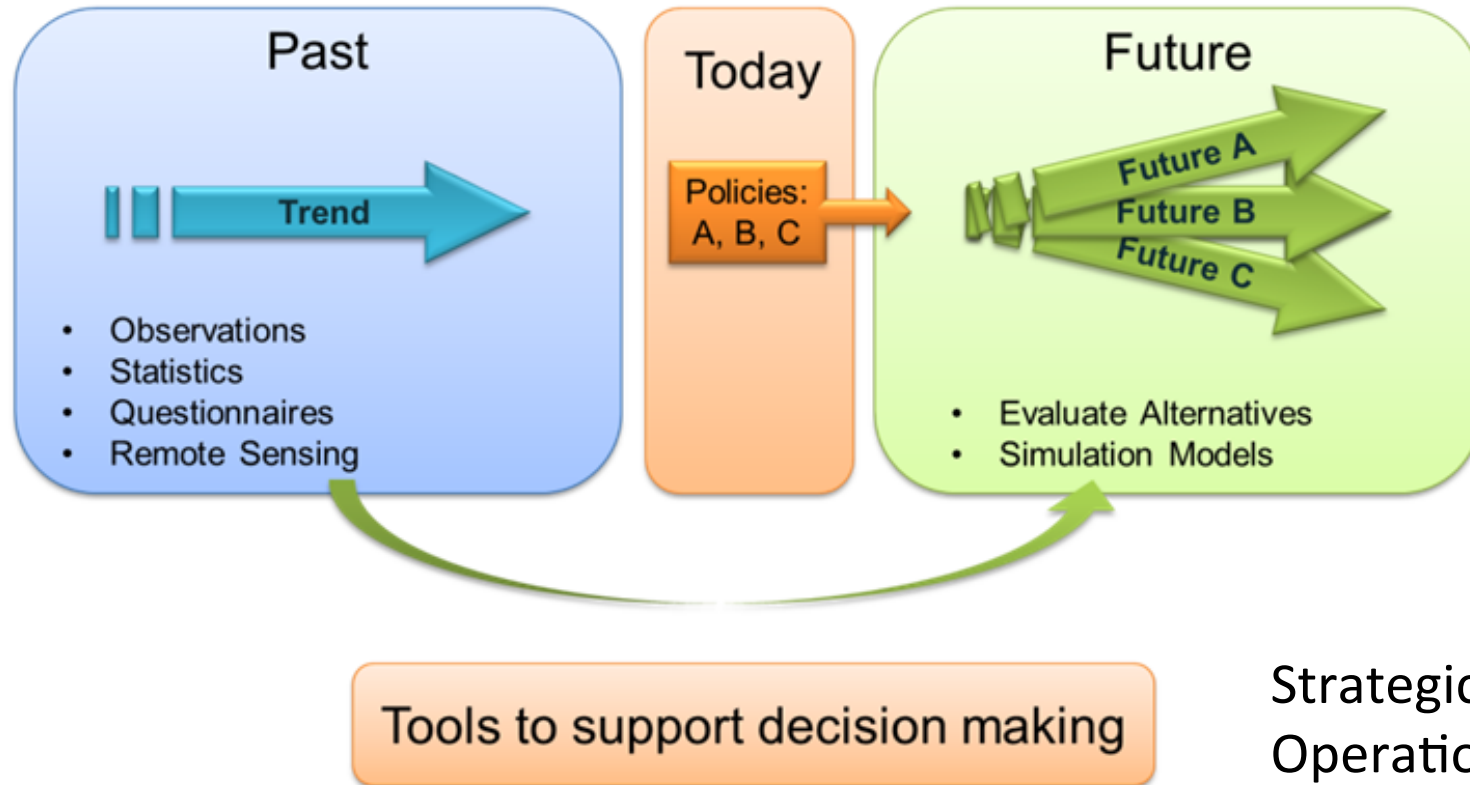
*SDG 6.4: **by 2030**, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity*

From monitoring WP to improving WP

Crop water productivity = Yield / Evapotranspiration

Agro-hydrological models
- SWAP
- AquaCrop
- Etc.

Spatial hydrological models
- SWAT
- SPHY
- Etc.
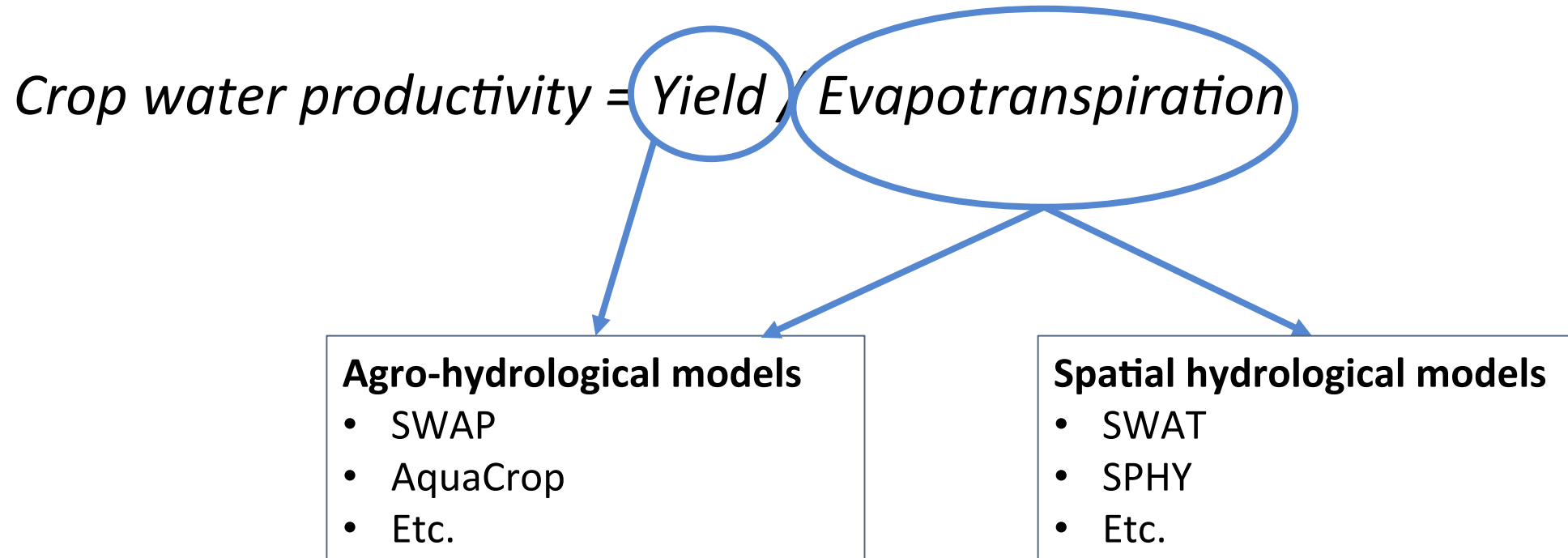
Scenario runs:
- Climate change
  - Changes in rainfall
  - Changes in temperature
  - Changes in reference ET
  - CO_2 fertilization effect

- Human interventions, e.g.
  - Enhanced seed varieties
  - Changing cropping patterns
  - Adjusted irrigation scheduling
  - Increasing fertilizer application
  - Mulching

Example AquaCrop application: Albania

Future irrigation water requirements towards 2040 (%/10yr), **assuming current yields**

Scenario	Crop	Interme-diate	Coastal Lowlands	Northern Mountains	Southern Highlands
MEDIAN	Alfalfa irrigated	-3%	-2%	-6%	-6%
	Maize	11%	7%	6%	9%
	Tomatoes	25%	14%	4%	24%
	Watermelons		9%		

Future crop yield changes towards 2040 (%/10yr) **assuming current irrigation applications**

Crop	Interme-diate	Coastal Lowlands	Northern Mountains	Southern Highlands
Alfalfa irrigated	2%	2%	4%	8%
Alfalfa non irrigated	-1%	-1%	4%	0%
Grapes	-8%	-10%	-6%	-10%
Grassland	-2%	1%	3%	1%
Maize	-1%	-2%	-4%	7%
Olives	-1%	-8%	-5%	-5%
Tomatoes	0%	-2%	-3%	-1%
Watermelons		-1%		
Wheat	4%	3%	11%	8%

Example Albania: adaptation assessment

> Impact on olive crop yields (ton/ha) for various management interventions

Scenario		Intermediate		Coastal Lowlands		Northern Mountains		Southern Highlands	
Current		**1.3**		**1.1**		**1.0**		**1.2**	
2040's	Impact	1.2	(-3%)	0.9	(-21%)	0.8	(-19%)	1.1	(-9%)
	Increased Fertilizer Use	1.6	(+28%)	1.1	(+5%)	1.1	(+9%)	1.3	(+12%)
	Enhanced Varieties	1.4	(+13%)	1.1	(-1%)	1.0	(+0%)	1.3	(+10%)

Concluding remarks

> Satellite-derived WP database is a huge information resource on past and current situation

> For implementing interventions to improve WP, simulation models are needed to examine impact of different futures (farm management, water supply, climate change ....)

> Models can be effective on different spatial (country to field) and temporal (daily forecast to climate change) scales

> Many additional uses related to WP: operational decision support, quantifying potential yield and yield gaps, partitioning agricultural water balance (return flows, gw recharge, soil evaporation)

> Model applications will be discussed in detail during FutureWater's contribution to the WP Masterclasses

Thank you for your attention!

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