Groundwater Irrigation for Smallholders in Sub-Saharan Africa – A Review

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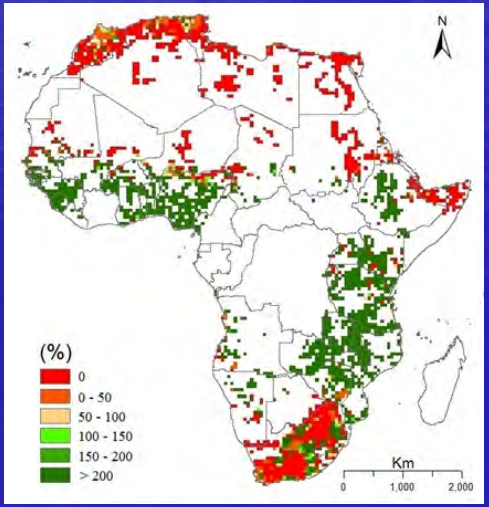

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ICID2015
26th ERC & 66th IEC

ICID 2015: **Innovate to Improve Irrigation Performance,** *Montpellier, France, 11-16 Oct. 2014*

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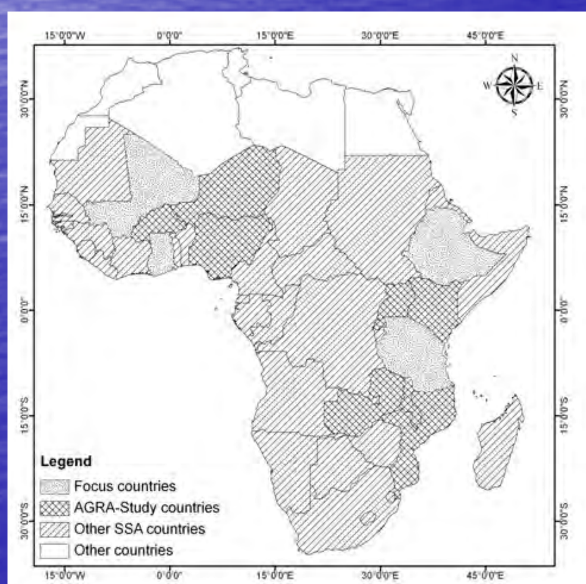
- 'Agricultural Water Management Solutions', 2009-2012 funded by Bill and Melinda Gates Foundation (*http://awm-solutions.iwmi.org*)
- 'Water, land and Ecosystems', CGIAR Research Program, (*http://wle.cgiar.org/*)



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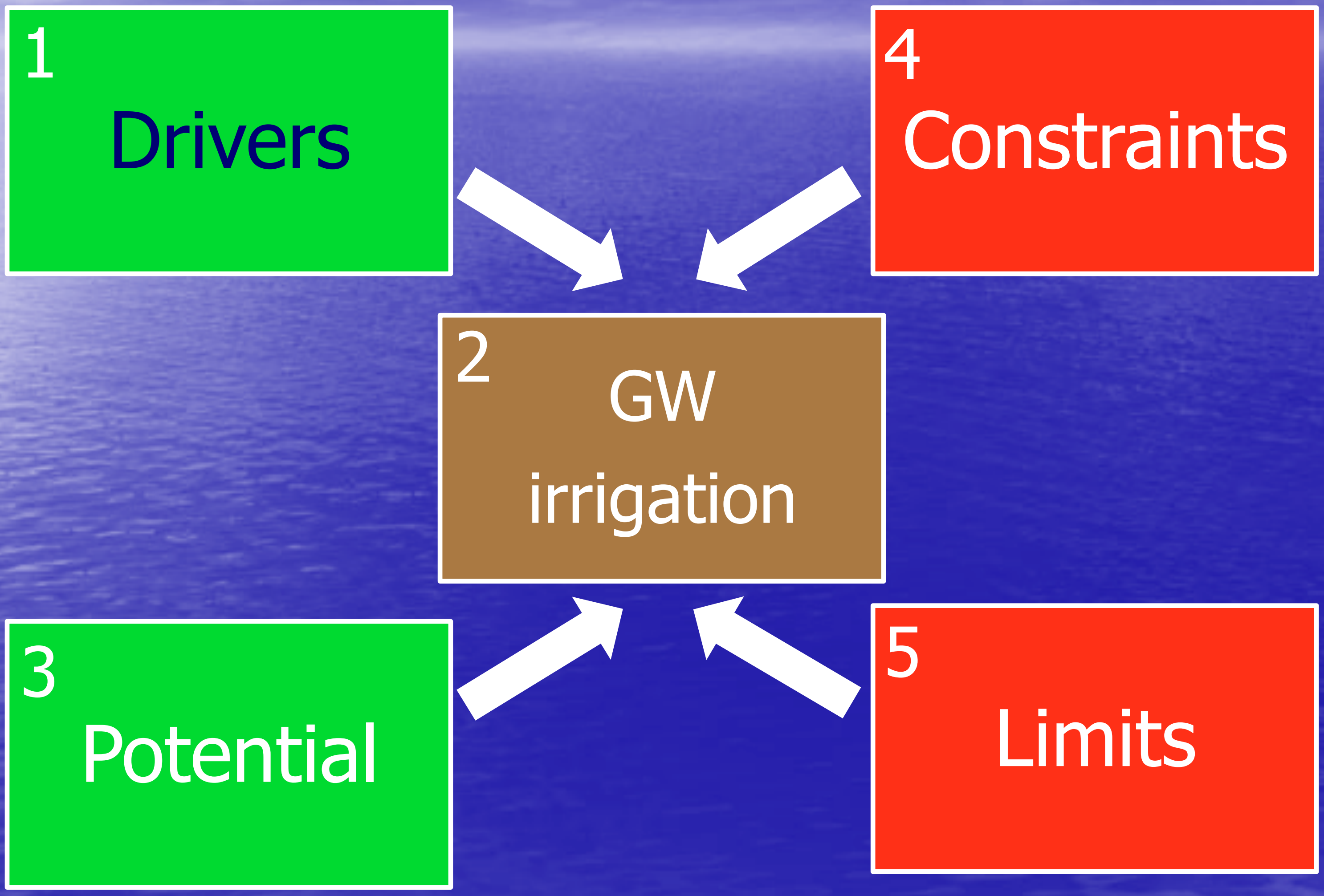
Context of GWI development in Africa



Drivers

- Groundwater provides a reliable and suitable irrigation source for smallholders:
  - Distributed resource, lack of SWI
  - In-built distribution and storage
  - Better water control
  - All-year irrigation (and income)
  - Drought resilience, multiple uses
  - Individual access and management
- Increasing market demand for horticulture crops
- Better (and better access to) low-cost pumps and wells
- Increasing attention from governments and donors

Positive socio-economic aspects and impacts of GWI

- GW is the preferred water source for many farmers, incl. women
- Farmers in Ghana using GW with manual means obtained larger net revenues per area irrigated than any of the other irrigation types, by minimum 20%
- Value added per area for GWI (by pumping or manual lifting) were at least twice that of other irrigation systems in Malawi, and even added value per labour was largest
- Treadle pump users in Malawi were better off than non-adopters
- Distress migration was reduced in Ghana through dry-season cropping with GW

Negative socio-economic aspects and impacts of GWI

- Women and the poorest farmers are often disadvantaged in GWI, due to lack of land tenure, financial sources, labour, illiteracy, cultural norms, and technical skills

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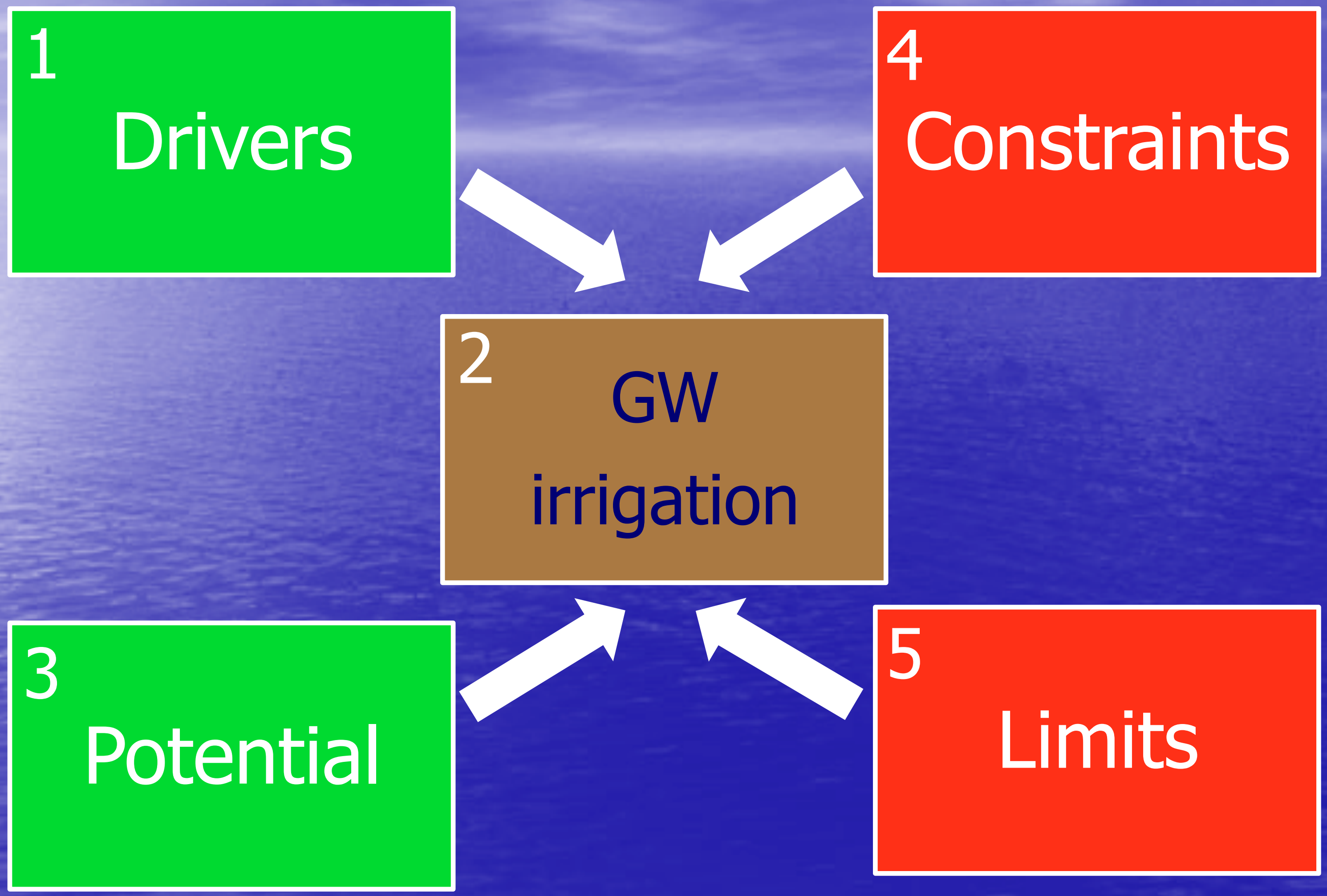
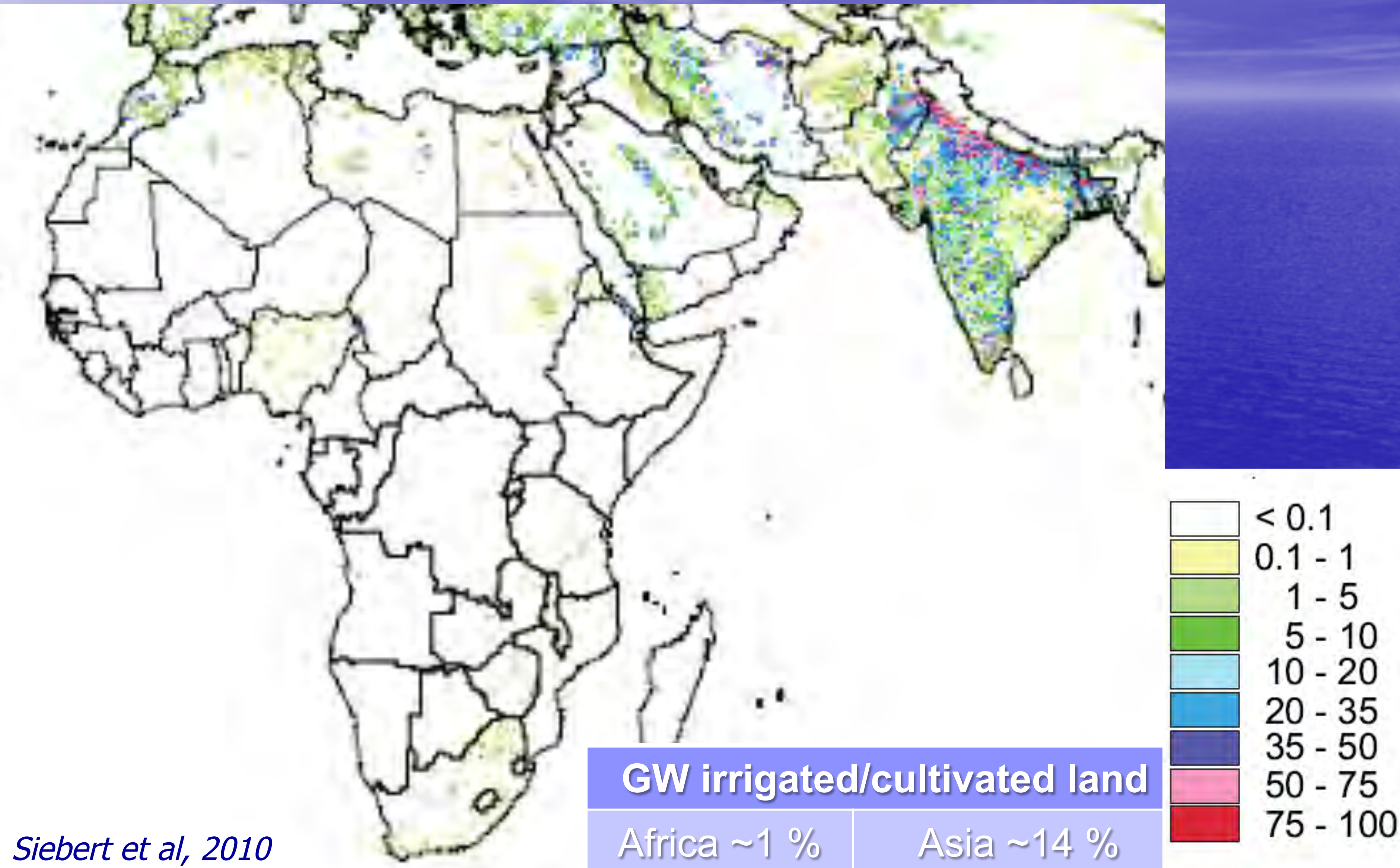

1
Drivers
4
Constraints
2
GW
irrigation
3
Potential
5
Limits

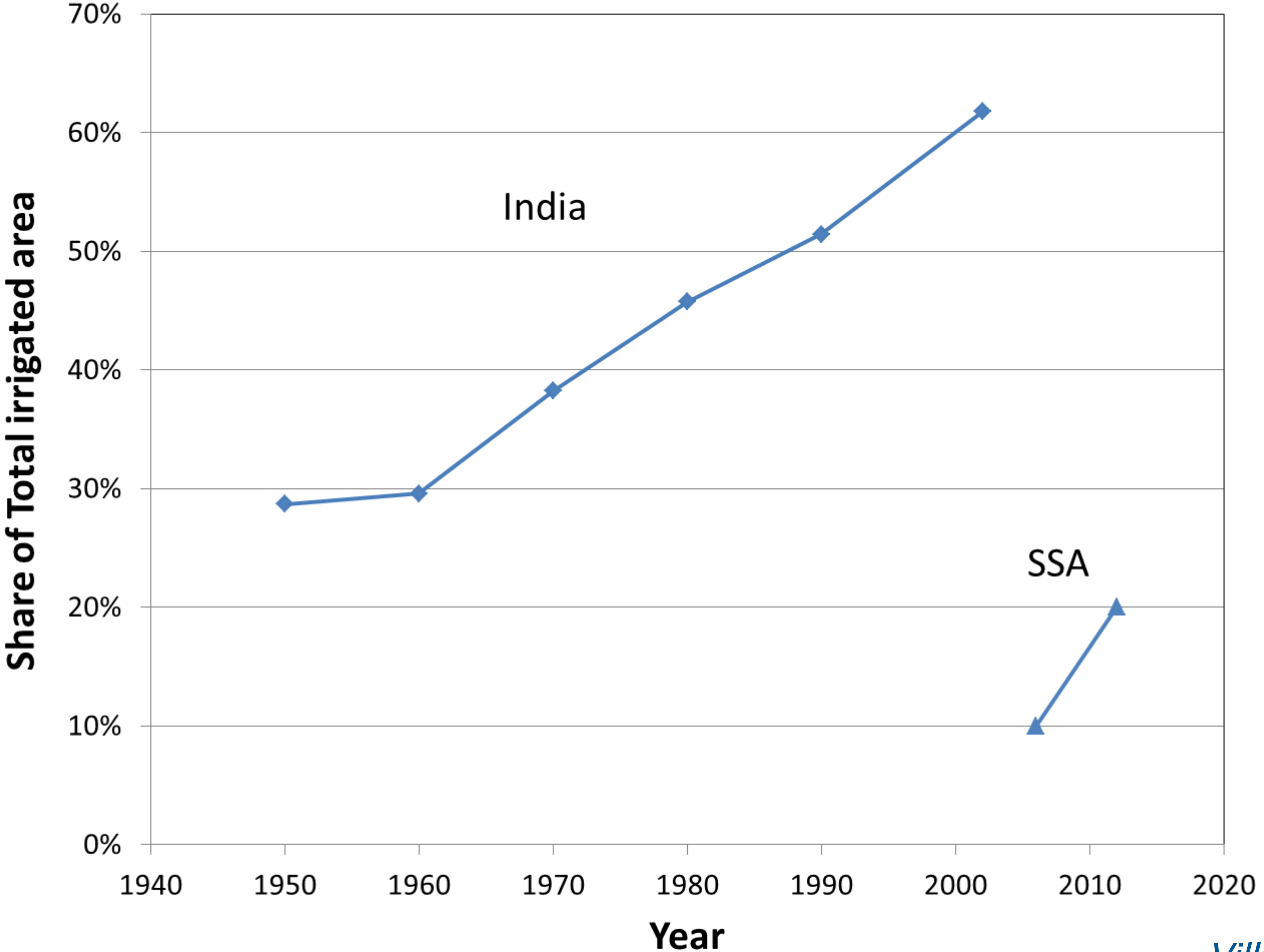
GW irrigation intensity



GW irrigated/cultivated land	
Africa ~1 %	Asia ~14 %

Siebert et al, 2010

GW irrigation is increasing in SSA



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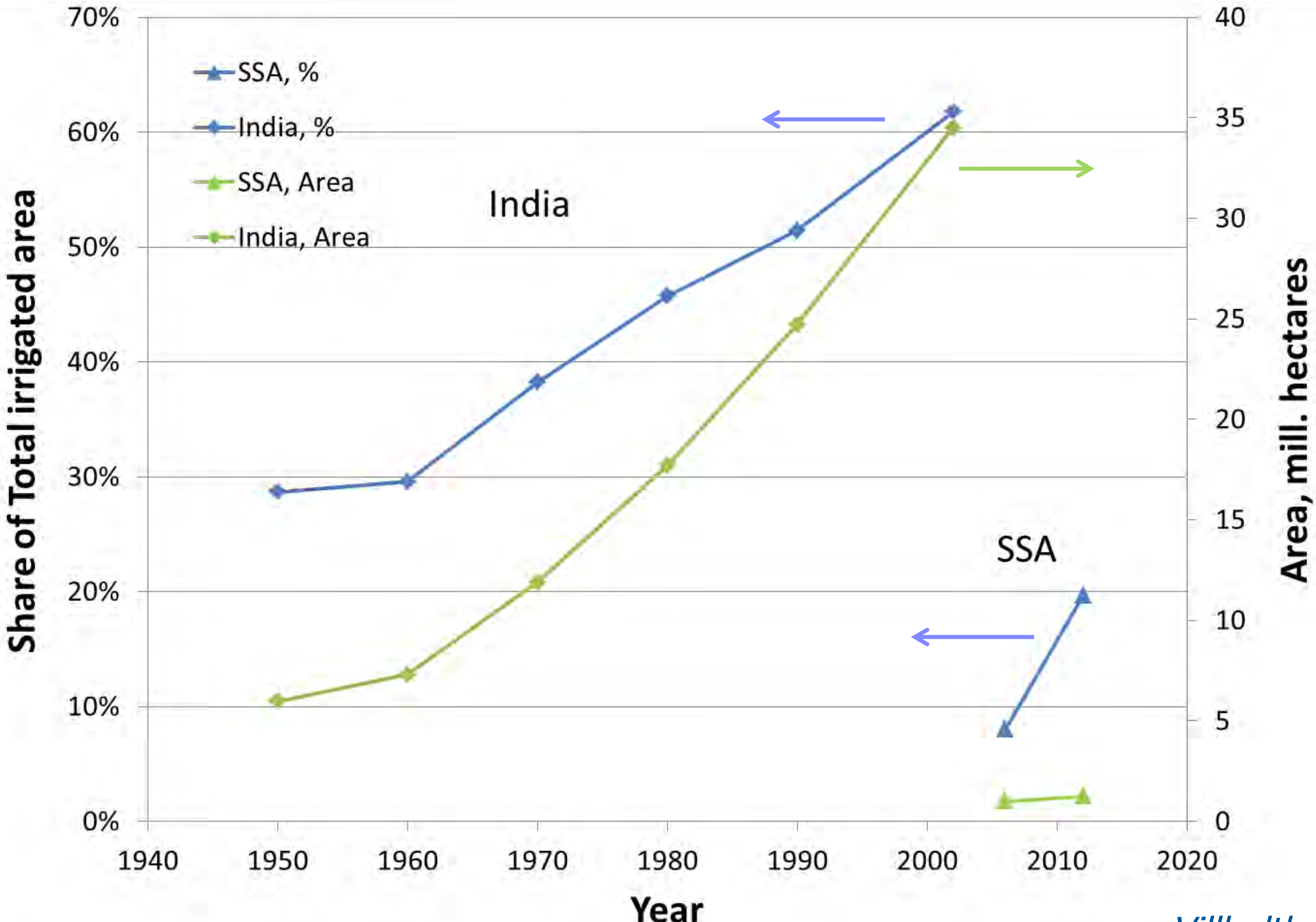
…. but absolute levels are still low



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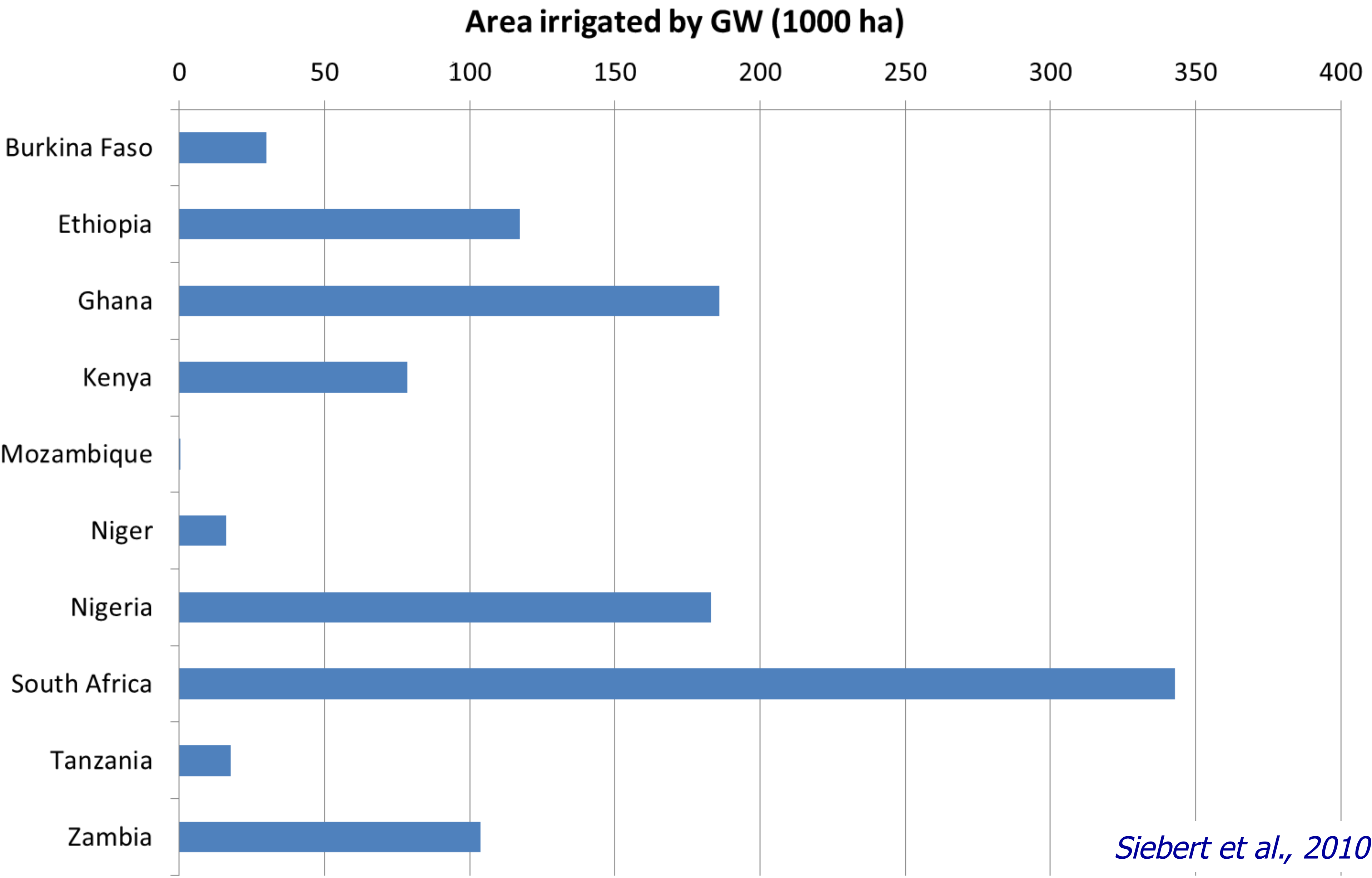
Importance varies across countries



Siebert et al., 2010

GW irrigation typology

		Depth of wells	
		Deep	Shallow
Funding source	Private	**1. Commercial, larger-scale, mechanized, export-oriented**	**2. Informal, small-scale, farmer-driven**
	Public	**3. Deep systems, subsidized**	**4. Shallow systems, subsidized**

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Type 1

Type 2

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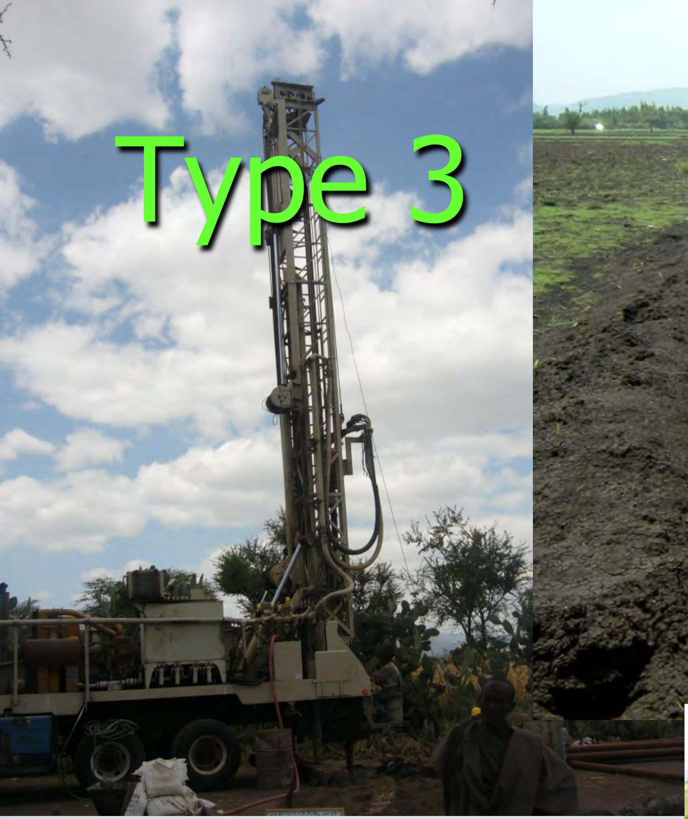
Type 3



Type 4

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Capital cost of GWI development

- Ethiopia (Raya Kobo Valley) (type 3): 4,900 US$/ha

(incl. electric power and power house, installation of drip and sprinkler systems)

- Zimbabwe (Maunganidze) (type 3): 10,940 US$/ha

(incl. power transmission lines and concrete distribution canals)

- Nigeria (various parts) (type 4): 1,650 US$/ha

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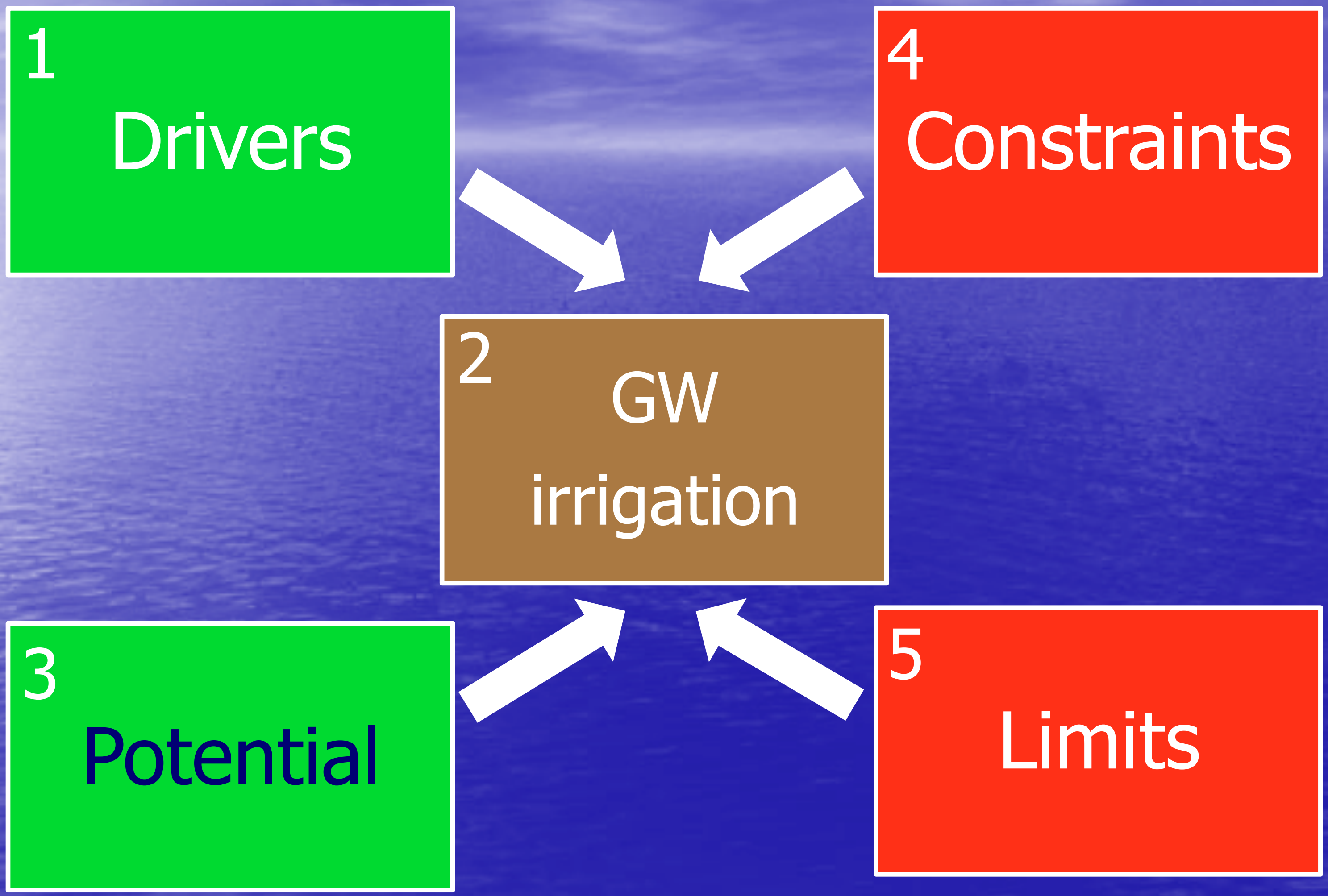
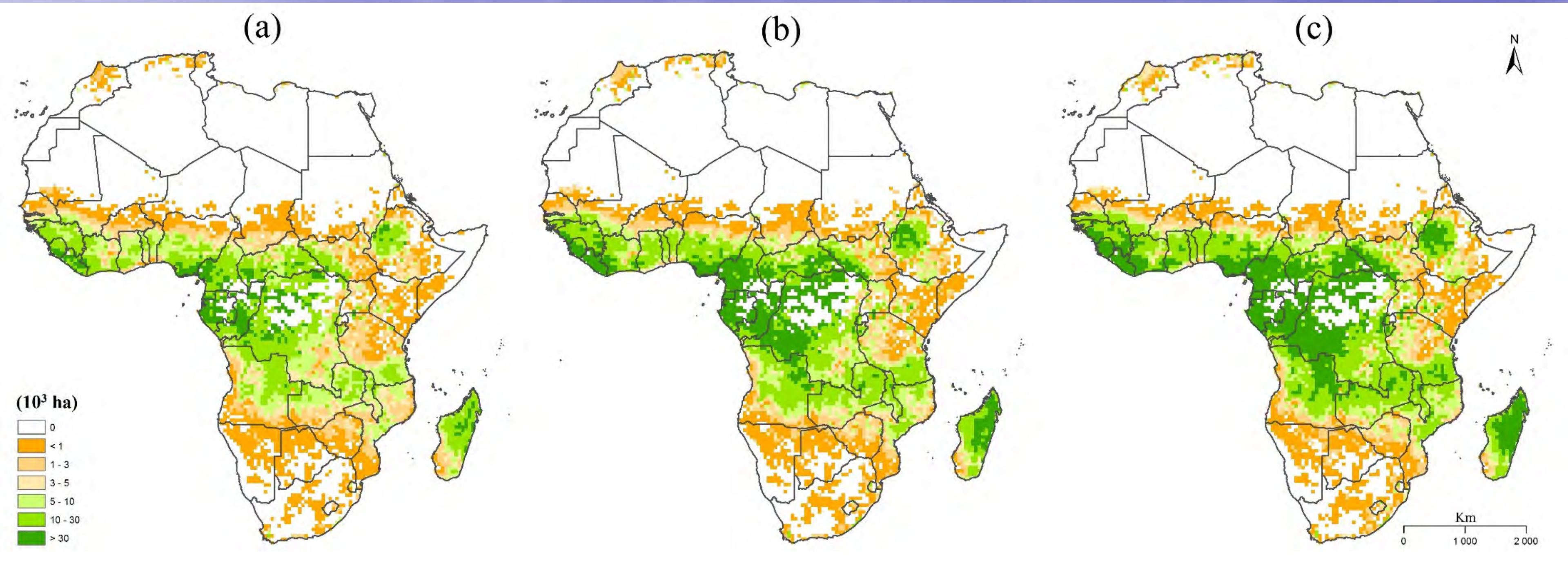

1 Drivers
4 Constraints
2 GW irrigation
3 Potential
5 Limits

Unexploited potential for GWI

- GW use in SSA is less than 20% of renewable supplies (*World Bank, 2010*)
- 0.3 to 16 M ha for small-scale irrigation in SSA (*You et al., 2010*)
- 0.1-3.9 M ha per country, in total: 13.5 +/-6.0 M ha), supporting 26 M smallholder households in 13 SSA countries (*Pavelic et al., 2013*)
- Additional 45 M ha (27-64 M ha) over Africa (*Altchenko & Villholth, 2015*)

Gridded GWI potential



← Increasing environmental requirement

Altchenko and Villholth, 2015

Groups of prospective countries

1. Low or localised potential:

   Kenya, Mali, Niger, South Africa, Tanzania

2. Still appreciable potential:

   Burkina Faso, Ethiopia, Ghana, Malawi, Mozambique, Nigeria, and Zambia

3. Great potential, but demand limited at present:

   Rwanda, Uganda

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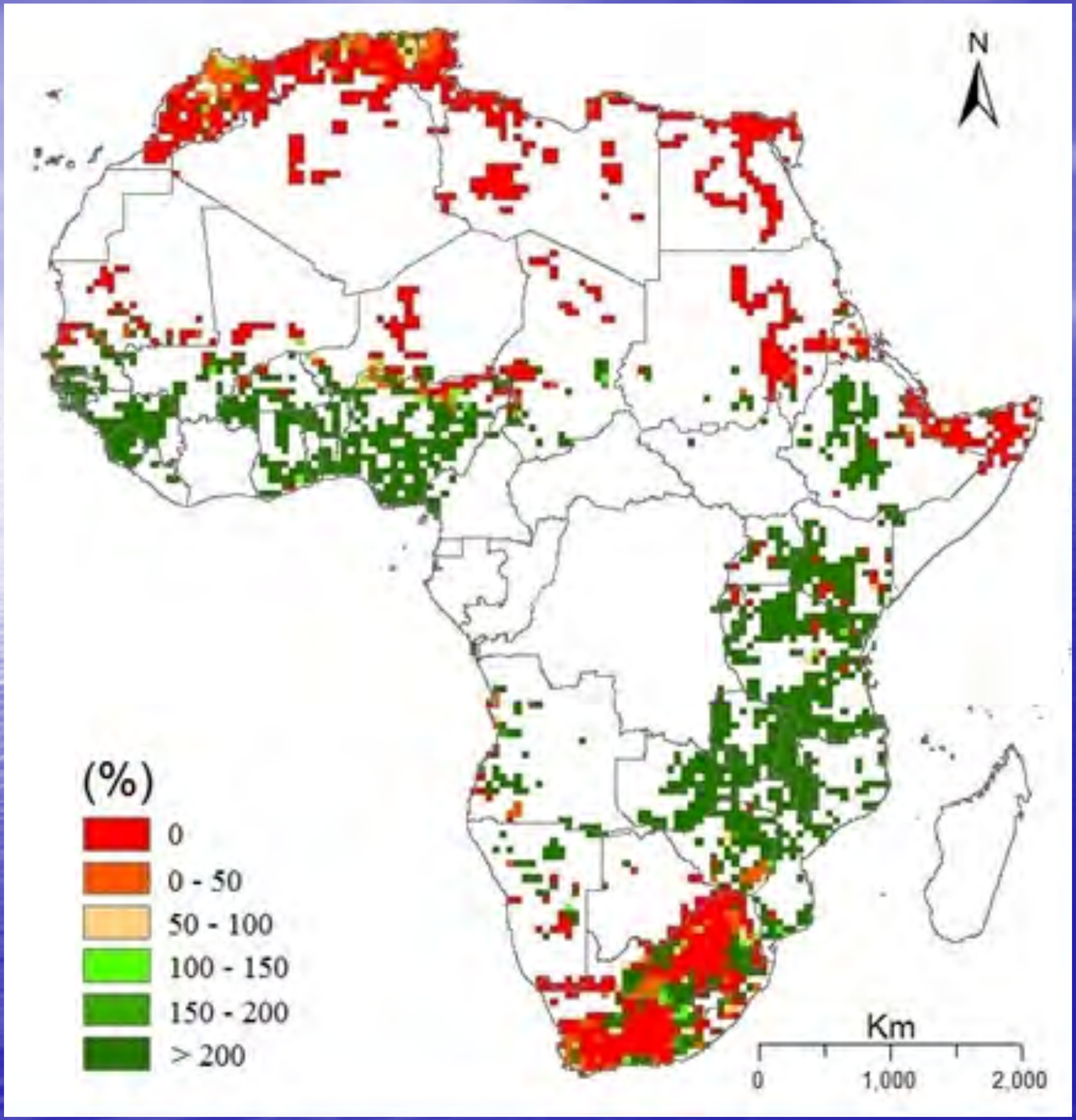
Uncommitted GWI potential



Percentage of present GWI area

Altchenko and Villholth, 2015

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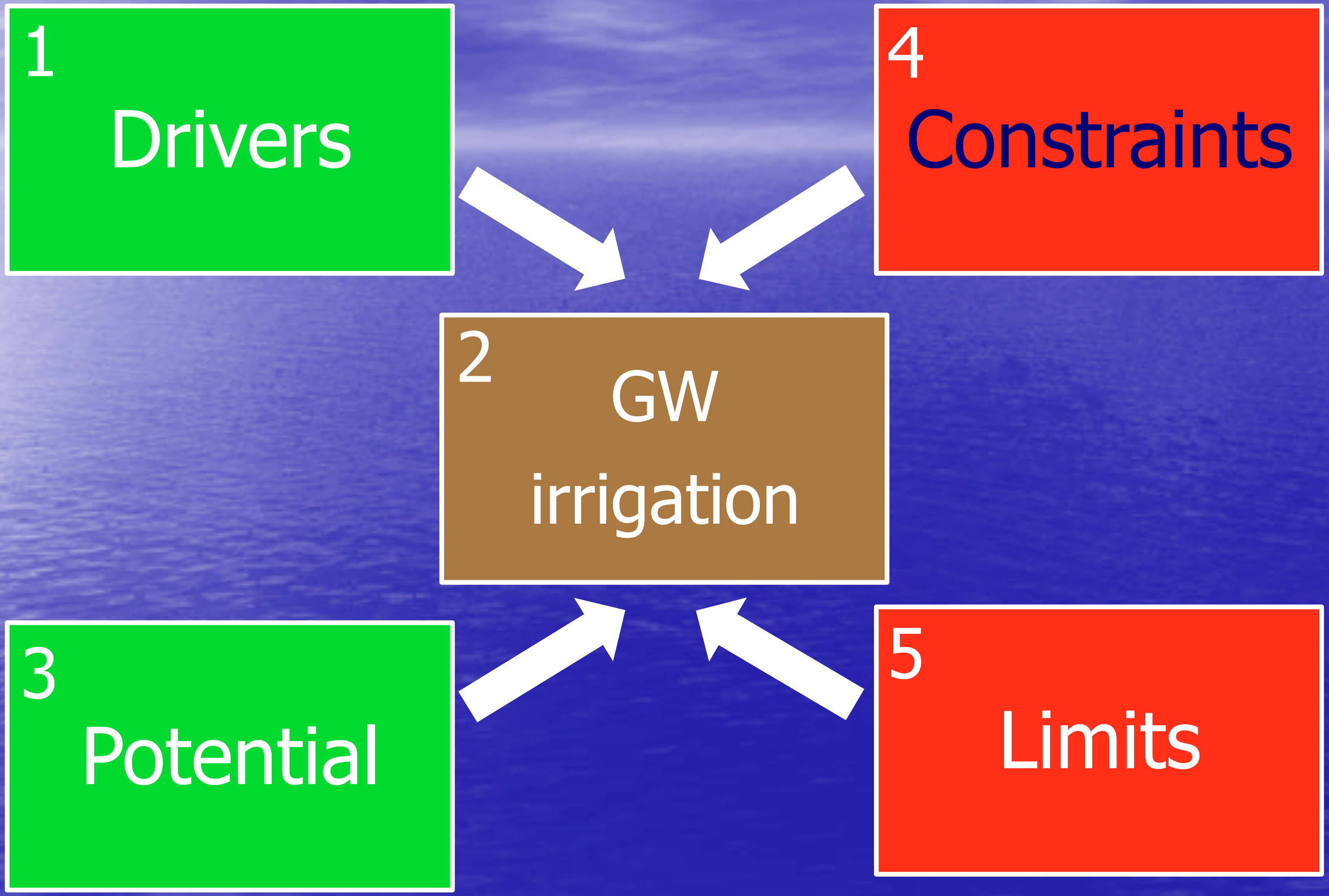
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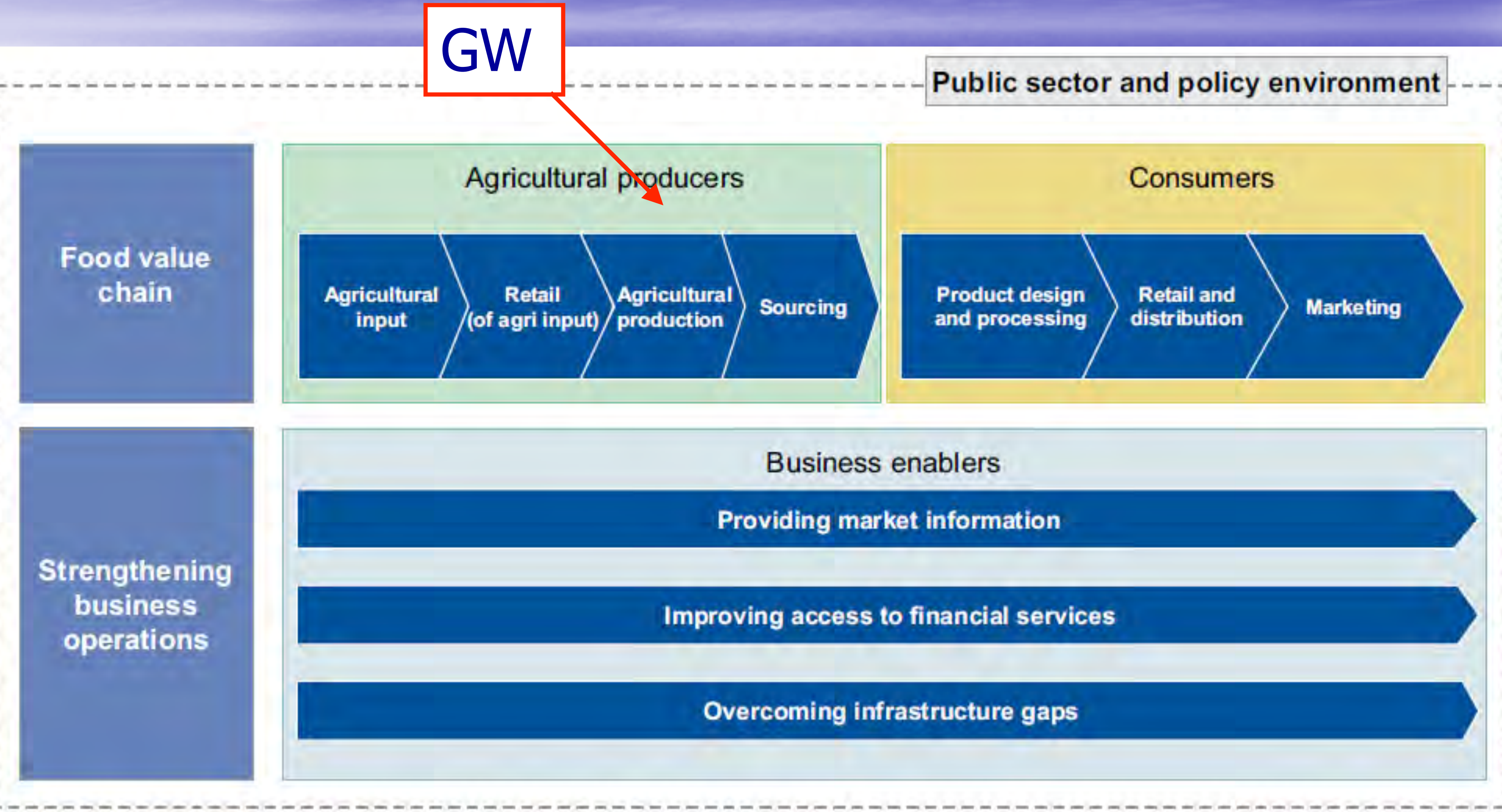
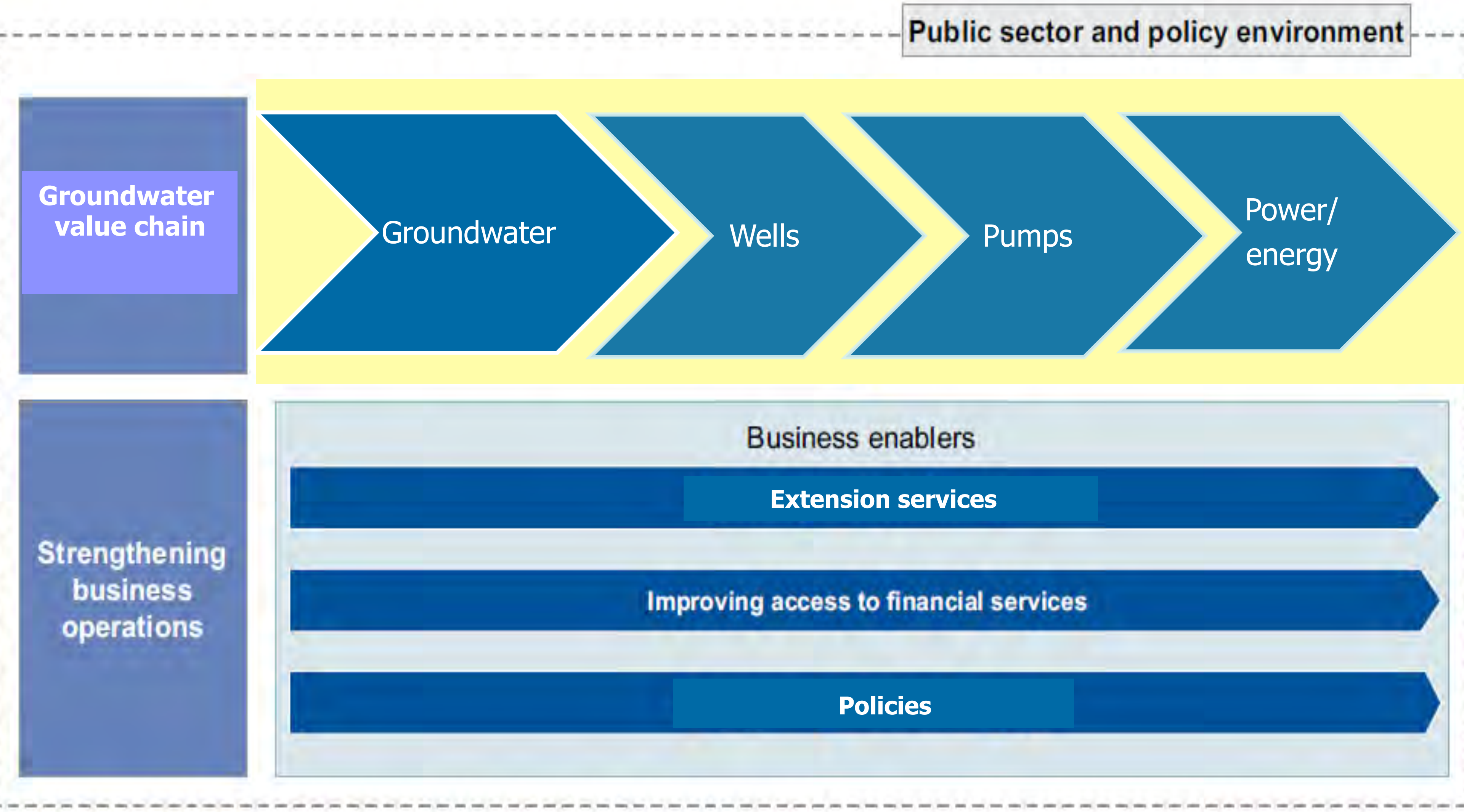
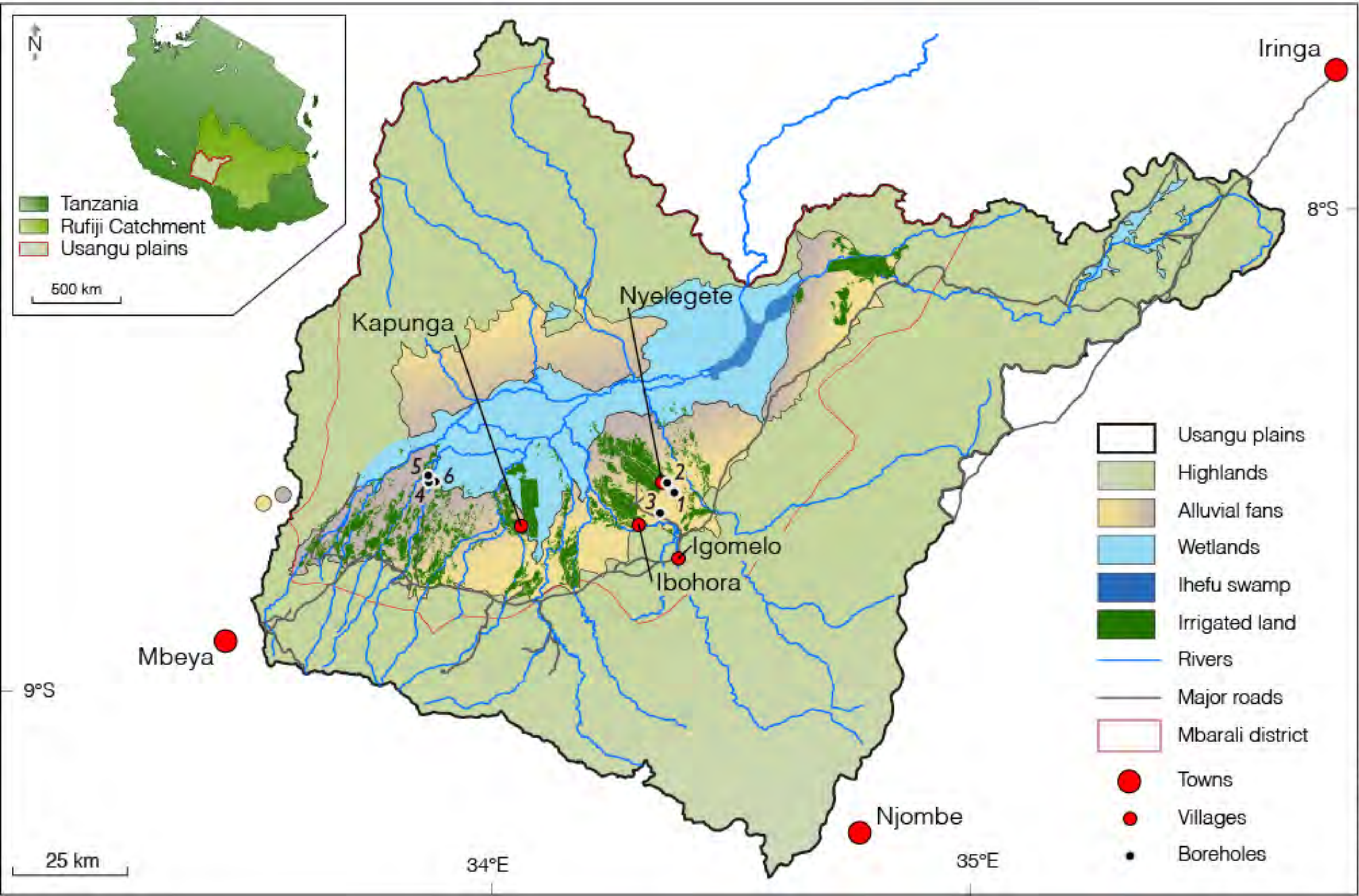
Food value chain



Groundwater value chain





Villholth et al., 2013

Constraints/needs

GW related:

Pumps
Drilling/wells
Energy
Policies

Non-GW related:

Credit
Training
Markets/infrastructure
Land tenure
Labour

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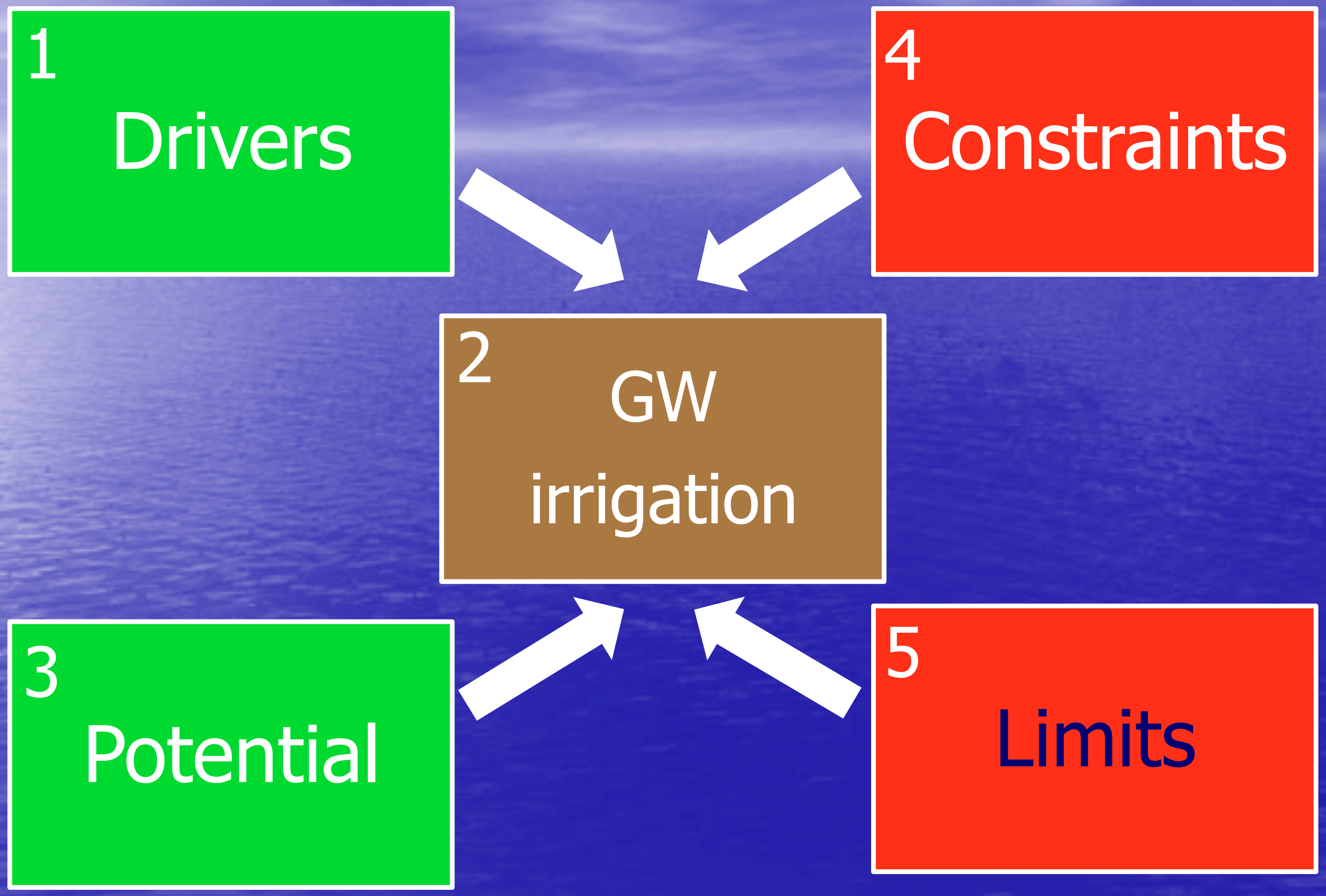
New trends, Sunflower pump

Manual drilling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Limits to GW Irrigation

Water requirements for a smallholder family:

8,200 L/d for **irrigation**
(0.3 ha crop, 500 mm/yr)

408 L/d for **livestock**
(10 cattle and 10 poultry)

250 L/d for
domestic uses

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Limits to GWI

- GWI is not easily controlled or managed
- Competitive expansion may threaten resource base, environment, and domestic uses
- Considerations/recommendations:
  - Sensible subsidies, gender-sensitive
  - Ex-ante, ex-post monitoring
  - Organisation/training of farmers is essential
  - Opportunistic uses, livelihood diversity
  - Elements of resource protection/enhanced renewal/ diversity in sources

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Conclusions

- GWI by smallholders is on the rise in SSA
- GWI enhances livelihoods and possibly secures food
- However, GWI is labour-intensive and/or capital intensive => it requires dedicated efforts to further support women and poorest farmers
- Farmers as resource custodians requires organisation
- To scale up, investment/support models need to be analysed and adapted to context
- GWI institutional capacity needed at all levels
- GWI for smallholders needs to be taken seriously, change mind-set from technology provider to enabler
- GWI to be conceptualised broader, in conjunctive use, salinity control, multiple use, flood protection, ecosystem services, climate change adaptation

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Thank you!

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