

Linking Irrigated Land and Water Scarcity: A Global View

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Outline

1. Introduction: Rationale, Aim and Approach

2. Trends in Agricultural and Total Water Use at the Global Level
3. Country-Level Agricultural Water Use
4. Irrigated Agriculture and Water Scarcity
5. Concluding Remarks

References

1. Introduction: Rationale, Aim and Approach

Rationale

- Water scarcity is increasingly seen as a major risk in many parts of the world.
- Irrigated agriculture is by far the largest user of water worldwide.
- Agricultural water management is moving to the center of water management concerns

Aim

- To explore the link between irrigated agriculture—and the related water use—and global water scarcity

Approach

- Analysis is based on an innovative use of data reported from FAOSTAT and AQUASTAT, in particular country-level data on:
 - area equipped for irrigation
 - agricultural water withdrawals and total water withdrawals
 - total renewable water resources

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2. Trends in Agricultural and Total Water Use at the Global Level

Preliminaries

Special Characteristics of Water

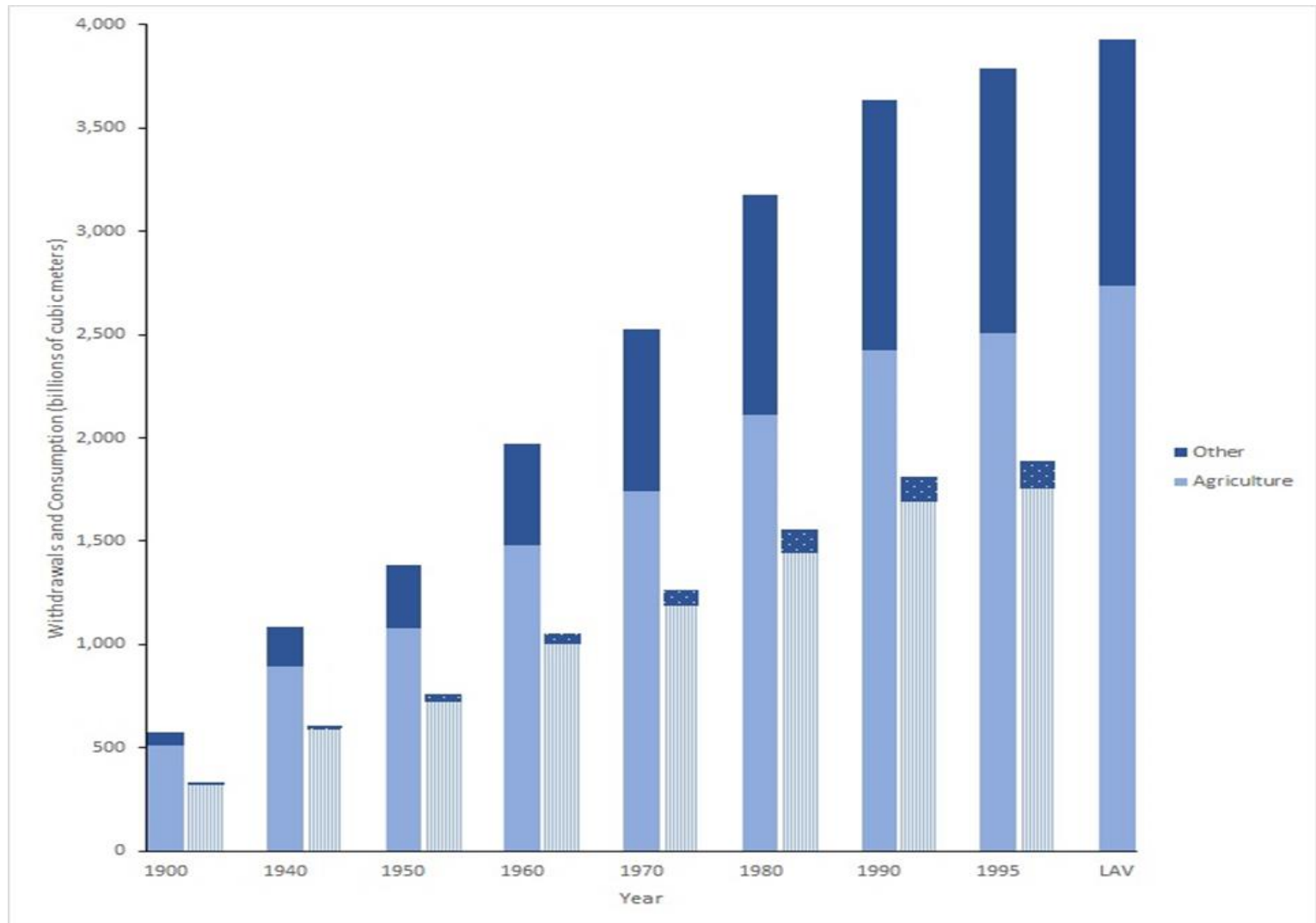
- Water is mobile, moving through the hydrological cycle
- Water supplies are relatively variable and unpredictable
- Water-related problems are typically localized
- Water is rarely completely “consumed” in human production and consumption activities
- Return flows create unique interdependencies among water users
- Due to these externalities, there is a need for public policy

Key Measures of Water

- *Water withdrawals*: the amount of water removed from surface and groundwater sources
- *Water consumption/consumptive use* (or evapotranspiration in the case of crop production): the amount of water that is actually consumed by the use

The difference between these two measures are the *return flows*.

Global Trends in Agricultural and Total Water Withdrawals and Consumption



Source: Authors, based on Shiklomanov and Rodda 2003.

Note: Solid colors, show withdrawals, and patterned colors consumption. LAV=latest available value.

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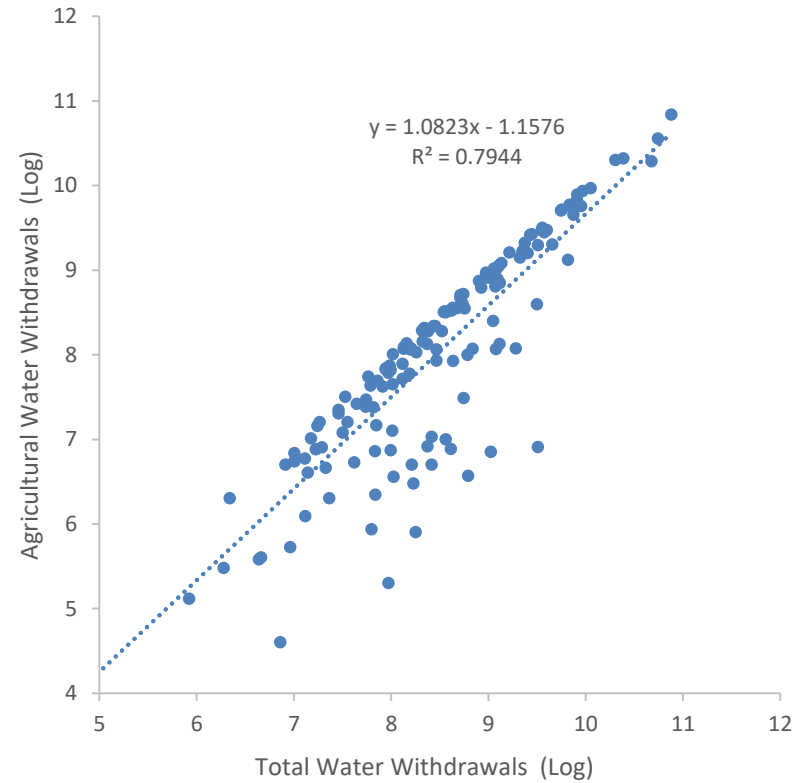
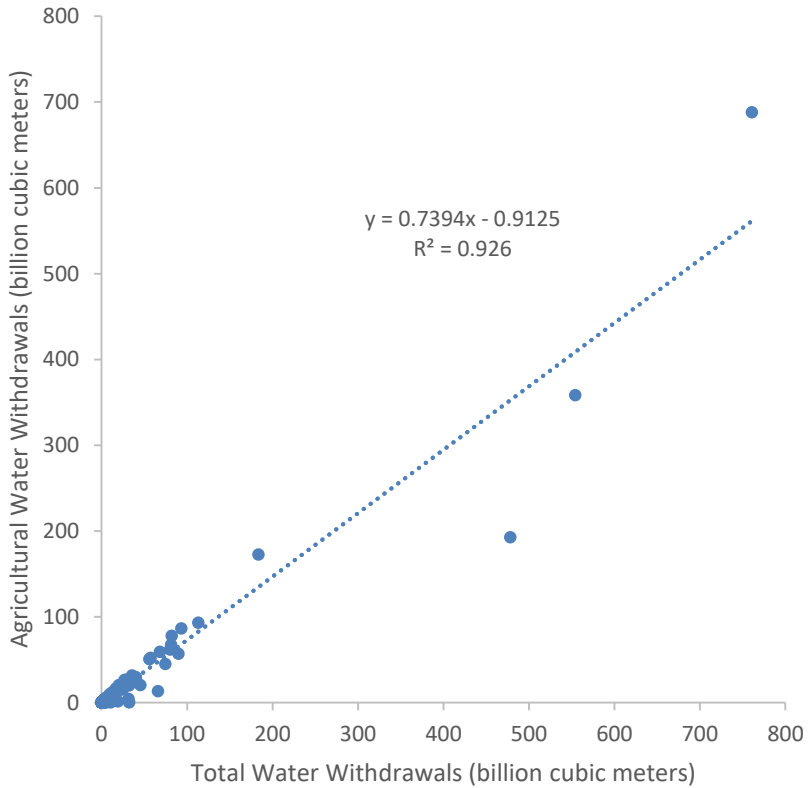
References

Countries with the Largest Agricultural Water Withdrawals

Country	Agricultural Water Withdrawals (billion cubic meters)	Total Water Withdrawals (billion cubic meters)	Agricultural Water Withdrawals as Percent of Total Water Withdrawals	Area Equipped for Irrigation (million hectares)	Area Equipped for Irrigation as Percent of Agricultural Area	Agricultural Water Withdrawals per Area Equipped for Irrigation (m)
India	688	761	90%	67	37%	1.0
China	358	554	65%	69	13%	0.5
United States	175	486	40%	26	6%	0.7
Pakistan	172	184	94%	20	75%	0.9
Indonesia	93	113	82%	7	12%	1.3
Iran	86	93	92%	10	19%	0.9
Vietnam	78	82	95%	5	42%	1.6
Philippines	67	82	82%	2	13%	3.4
Egypt	67	78	86%	4	100%	1.5
Mexico	62	80	77%	7	6%	0.9

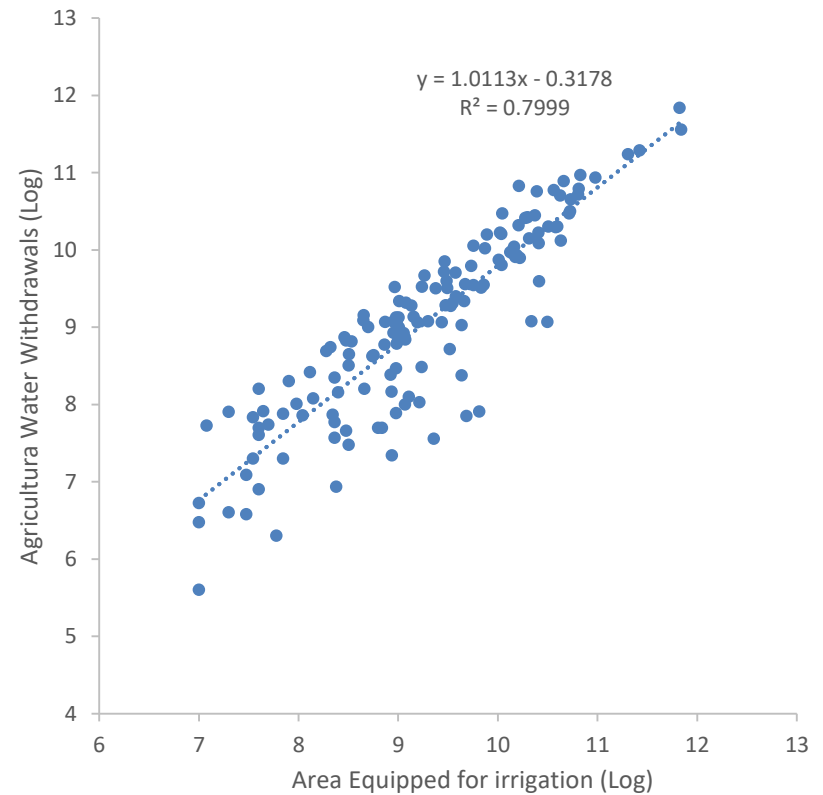
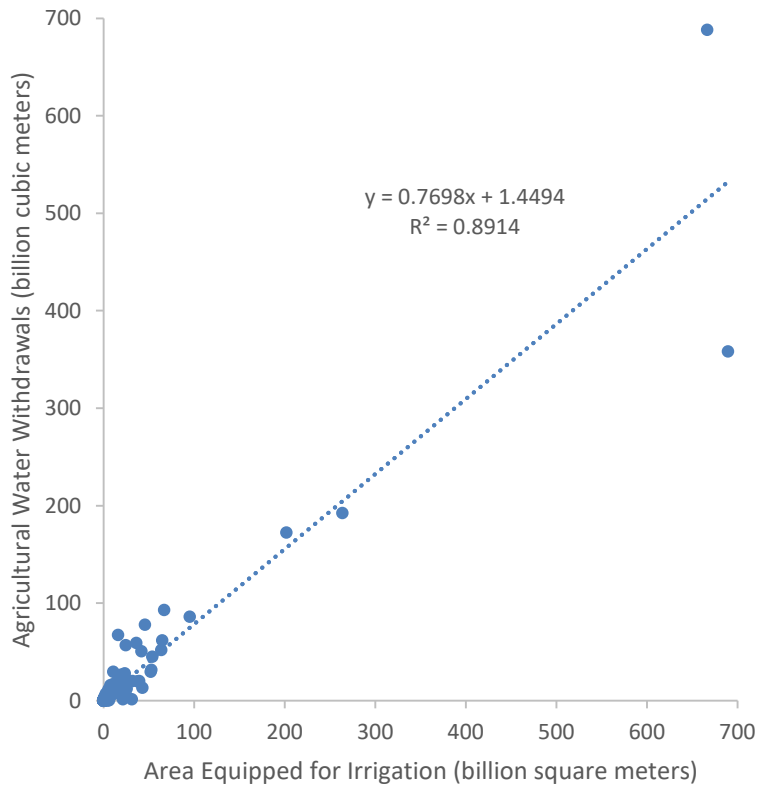
Source: Authors, based on FAO 2016a, 2016b.

Agricultural Water Withdrawals and Total Water Withdrawals, by Country



Source: Authors, based on FAO 2016a.

Agricultural Water Withdrawals and Area Equipped for Irrigation, by Country

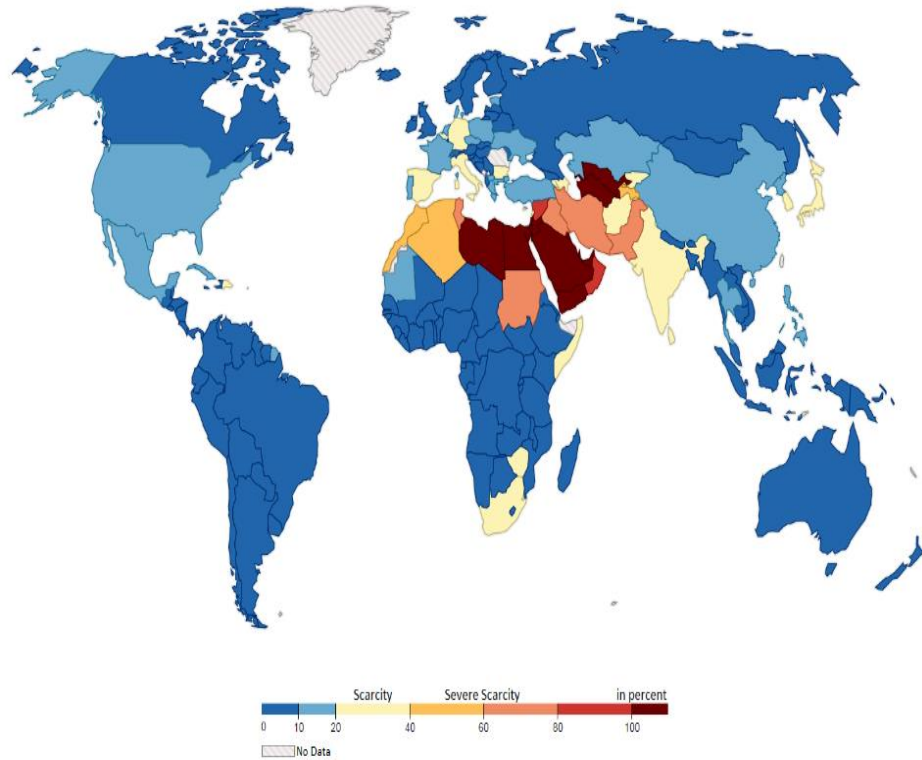


Source: Authors, based on FAO 2016a.

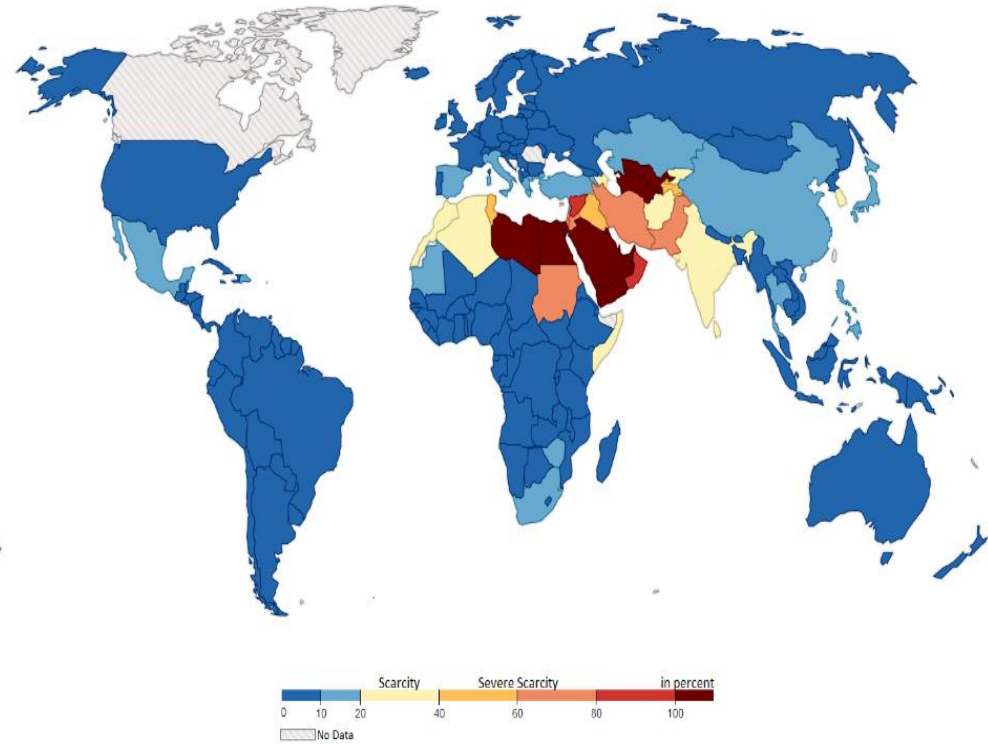
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Total Withdrawals as Percent of Total Renewable Water Resources

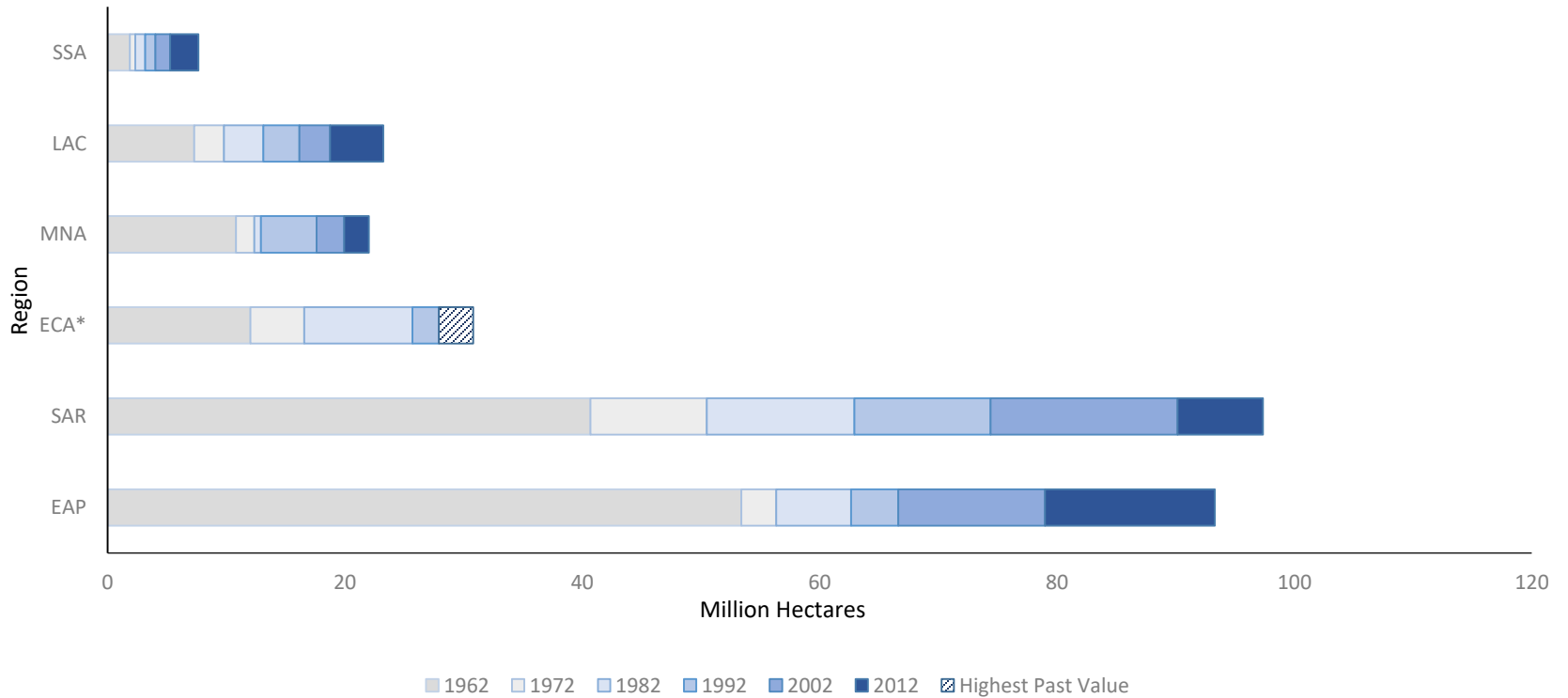


Agricultural Withdrawals as Percent of Total Renewable Water Resources



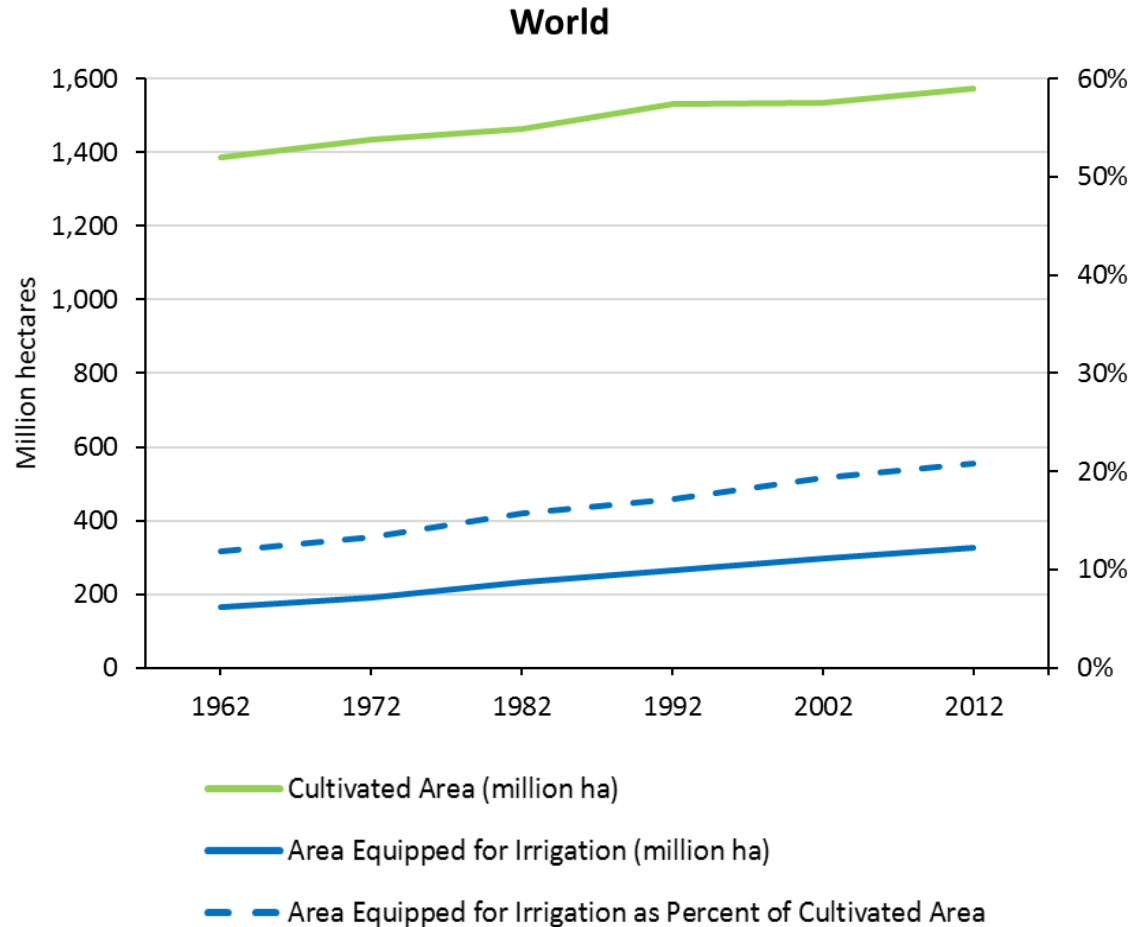
Source: Authors, based on FAO 2016a.

Trends in Area Equipped for Irrigation 1962-2012, by Region



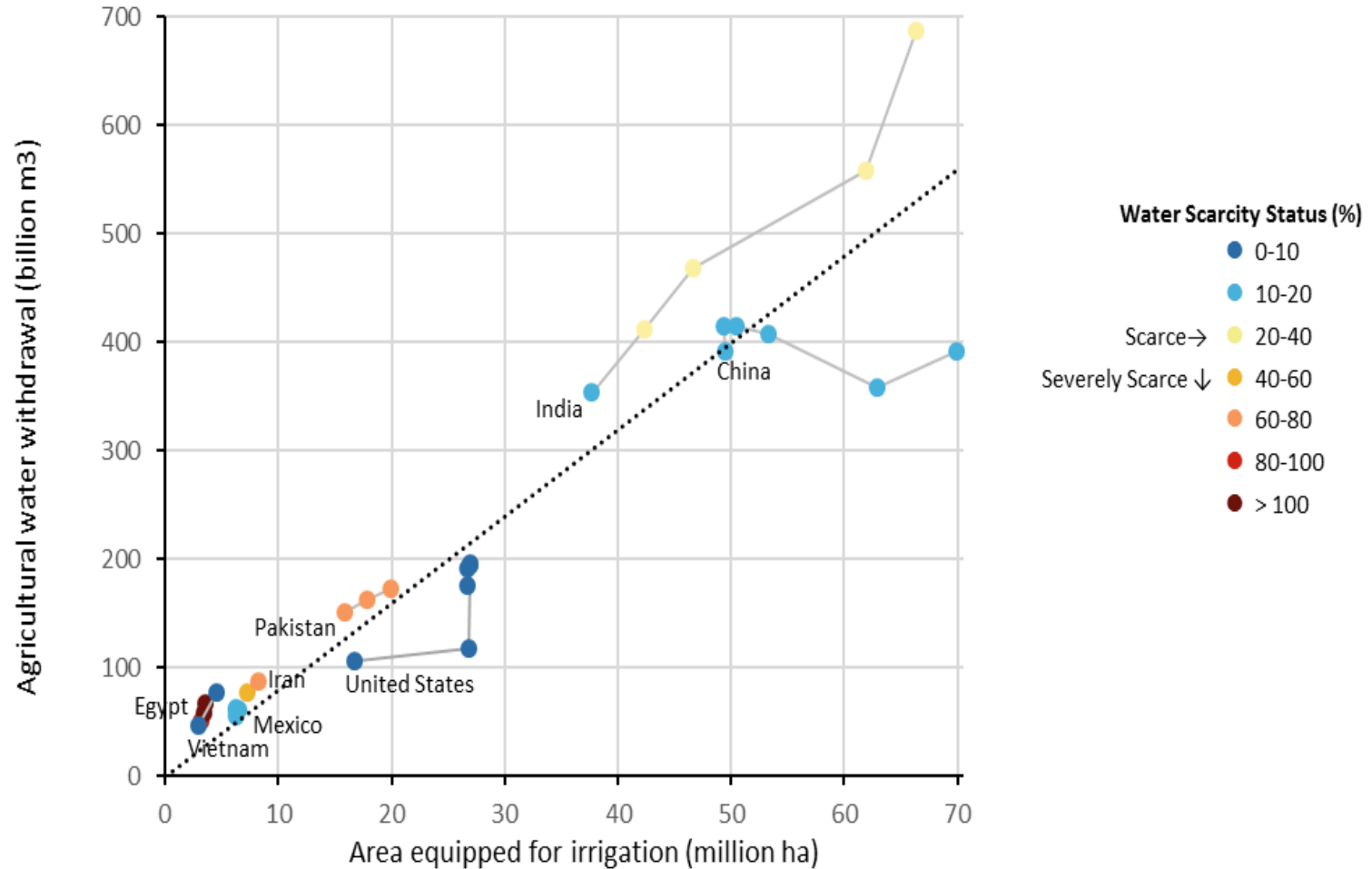
Source: Authors, based on FAO, 2016b.

Area Cultivated and Area Equipped for Irrigation 1962-2012, Global Level



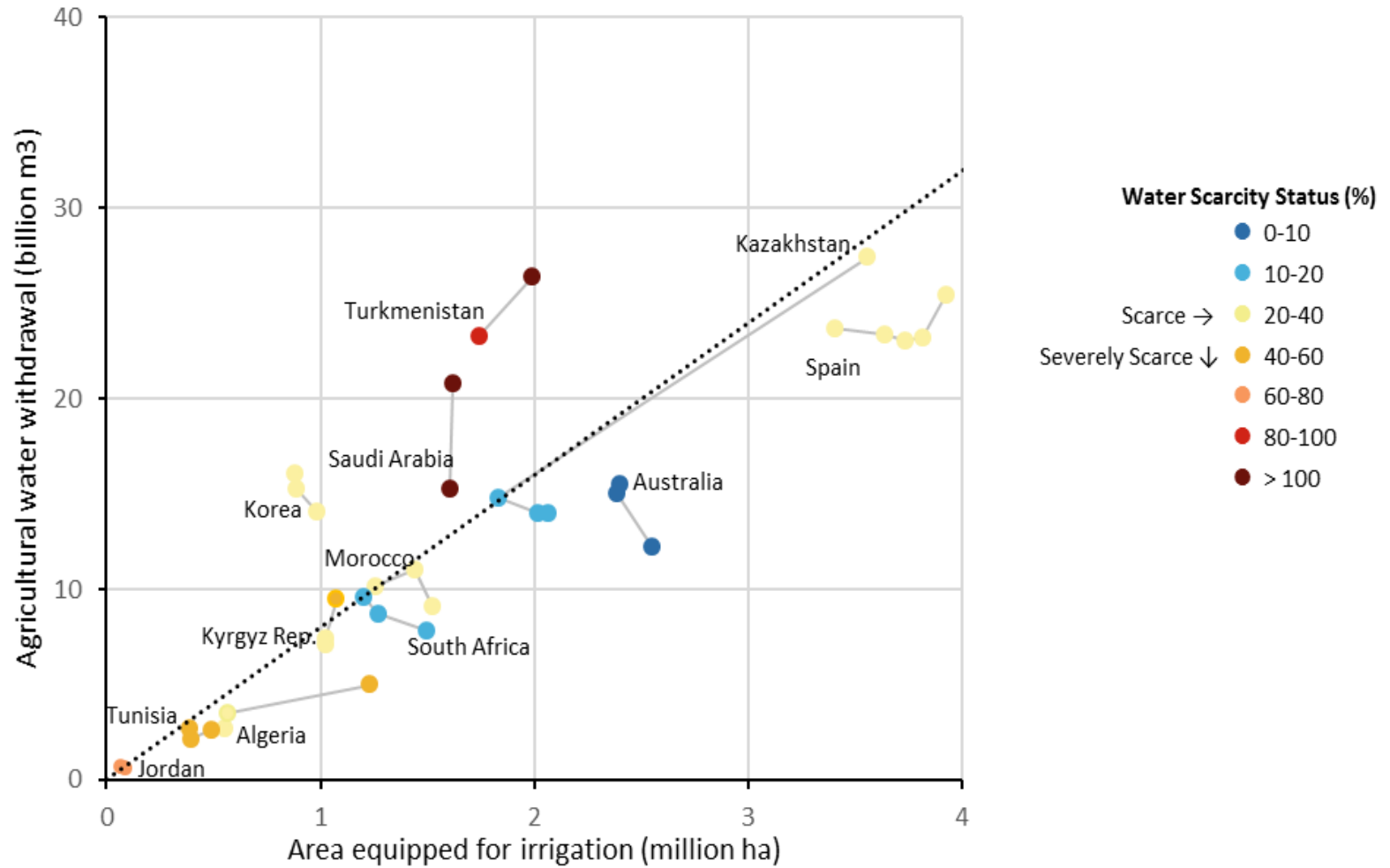
Source: Authors, based on FAO 2016b.

Trends in Agricultural Withdrawals and Area Equipped for Irrigation for Countries with the Largest Agricultural Withdrawals



Source: Authors, based on FAO 2016a, 2016b.

Trends in Agricultural Withdrawals and Area Equipped for Irrigation for Other Countries



Source: Authors, based on FAO 2016a, 2016b.

Trends in Agricultural Withdrawals and Area Equipped for Irrigation for Selected Countries

Agricultural Withdrawals	Area Equipped for Irrigation	
	Increasing	Decreasing
Increasing		
- Countries with Largest Withdrawals	India, Pakistan, Iran, Mexico, Vietnam, Egypt	
- Other Countries	Spain, Turkmenistan, Saudi Arabia, Algeria, Tunisia	Korea
Decreasing		
- Largest Withdrawal Countries	China	United States
- Other Countries	Australia, Morocco, South Africa, Jordan	Kazakhstan, Kyrgyzstan

Source: Authors, based on FAO 2016a.

Some Caveats

Caution needs to be applied when interpreting the trend analyses:

- The use of “area equipped for irrigation” as a proxy for irrigated land may introduce distortions.
- Since data refer to annual amounts and are aggregated at country level, they may hide potentially significant temporal and spatial variations.
- Even if a country shows a reduction in agricultural withdrawals (e.g. as a result of a switch to more capital-intensive irrigation technologies and possibly other interventions), this does not necessarily imply that the amount of water consumed by the crops is reduced—and thus may have no real effect on reducing water scarcity.
- Especially if the irrigated area continues to increase, it is likely that water consumption increases concomitantly—and the effect on water scarcity would be negative, even if agricultural withdrawals decline.

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Some Insights:

- *Trends* in global water withdrawals and consumption *show large increases*, though with declining growth rates during the last four decades. *Water use in agriculture plays a major role.*
- Based on the latest available data, the share of *agricultural consumption* in total consumption amounts to more than 90 percent; the share of *agricultural withdrawals* in total withdrawals amounts to about 70 percent.
- On average, our estimates suggest that 1 m³ of *total withdrawals* is associated with 0.74 m³ of agricultural withdrawals; 1 m² of *area equipped for irrigation* is associated with 0.77 m³ of agricultural withdrawal.
- The modification of a widely used indicator for water scarcity illustrates that *agricultural water use is a key contributor to water scarcity* in many countries, *especially in drier areas.*

5. Concluding Remarks

Some Insights (contd.):

- Our analysis of trend in agricultural withdrawals, area equipped for irrigation, and scarcity levels for selected countries shows that, during the last decades, *most of them continued to increase agricultural withdrawals and expand the area equipped for irrigation*. This was the case even for countries that already suffered from severe water scarcity.
- A few countries show a *reduction in both* agricultural withdrawals and area equipped for irrigation.
- Some countries continued to *expand* the area equipped for irrigation, but *reduced* agricultural withdrawals; however, this may not have helped to reduce water scarcity as agricultural consumption may not have decreased along with withdrawals—consumption tends to increase with an expansion of irrigated land.

5. Concluding Remarks

Overall, this suggests an *insufficient awareness of the link between irrigated land and water scarcity* in many countries' policy debates, plans, and investments.

Much *more effort will be necessary to adapt decisions on land use—and, implicitly, on water use—to* situations of increasingly scarce water.

Many adaptation options are currently not well explored, due in part to the lack of data on the key water measures and how they have changed, or may change, as a result of different interventions.

Given the magnitude of the problem, *this topic must attract increasing attention.*

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