

Coping with water scarcity in agriculture

*Policy-support instruments for food security
and poverty reduction strategies*



*Guido Santini
FAO NRL Division*

Fondazione Eni Enrico Mattei, Venice, 26 September 2013



Outline

1. Defining water scarcity
2. Driving forces behind water scarcity
3. Coping with water scarcity:
 - Policy and management response options

Defining water scarcity

“**Water scarcity**” establishes when the aggregated “**demand**” by the various users, including environment, cannot be satisfied by the existing “**supply**” of the resource

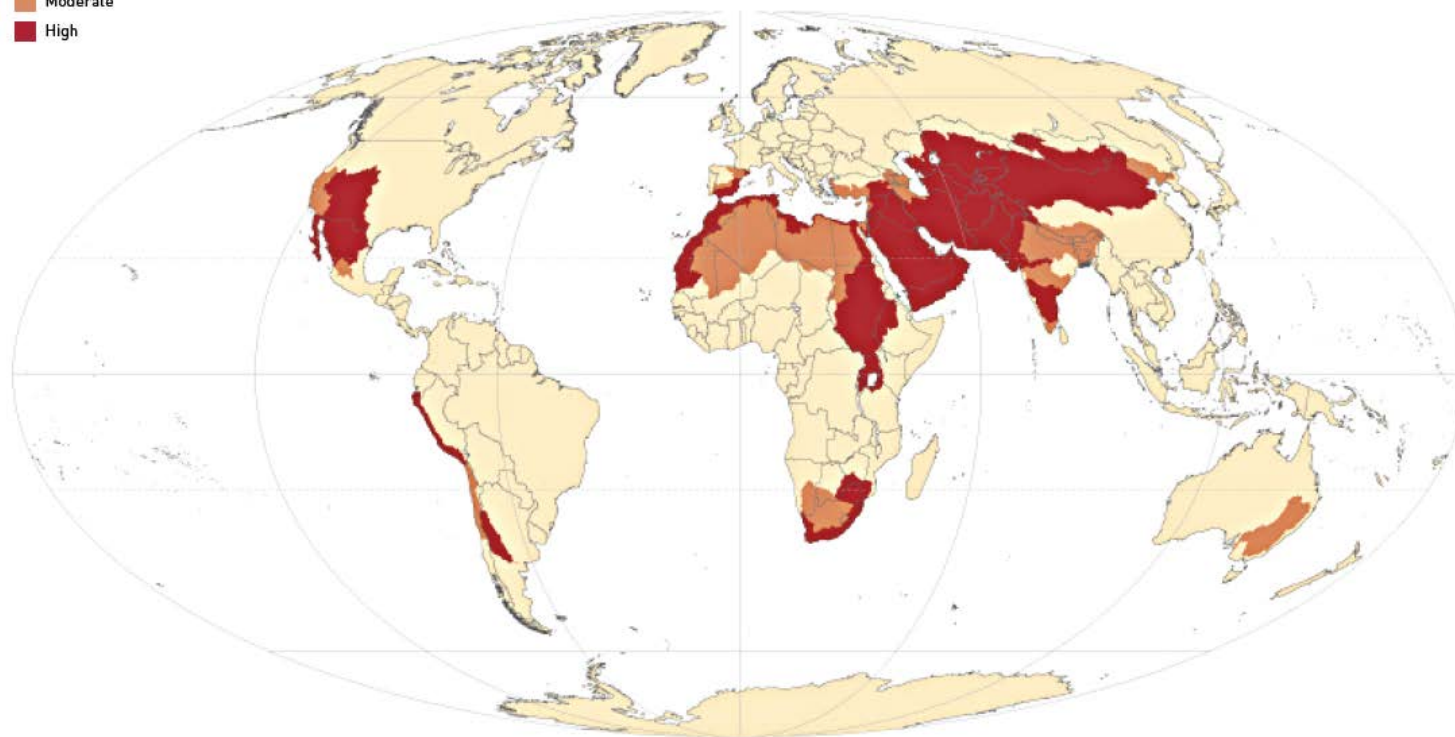
Dimensions of water scarcity

- Physical
- Infrastructural
- Institutional

Physical Water Scarcity

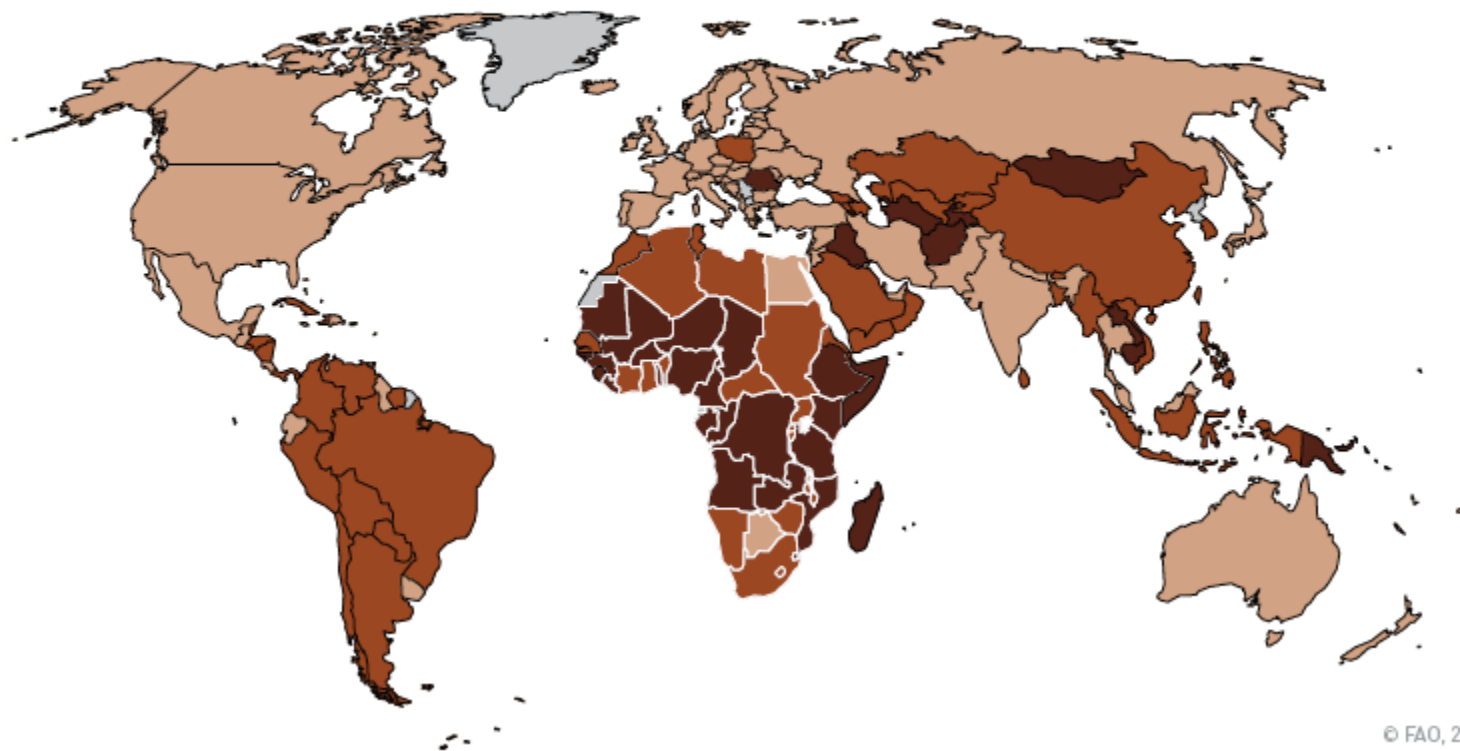
GLOBAL DISTRIBUTION OF PHYSICAL WATER SCARCITY BY MAJOR RIVER BASIN

Low
Moderate
High



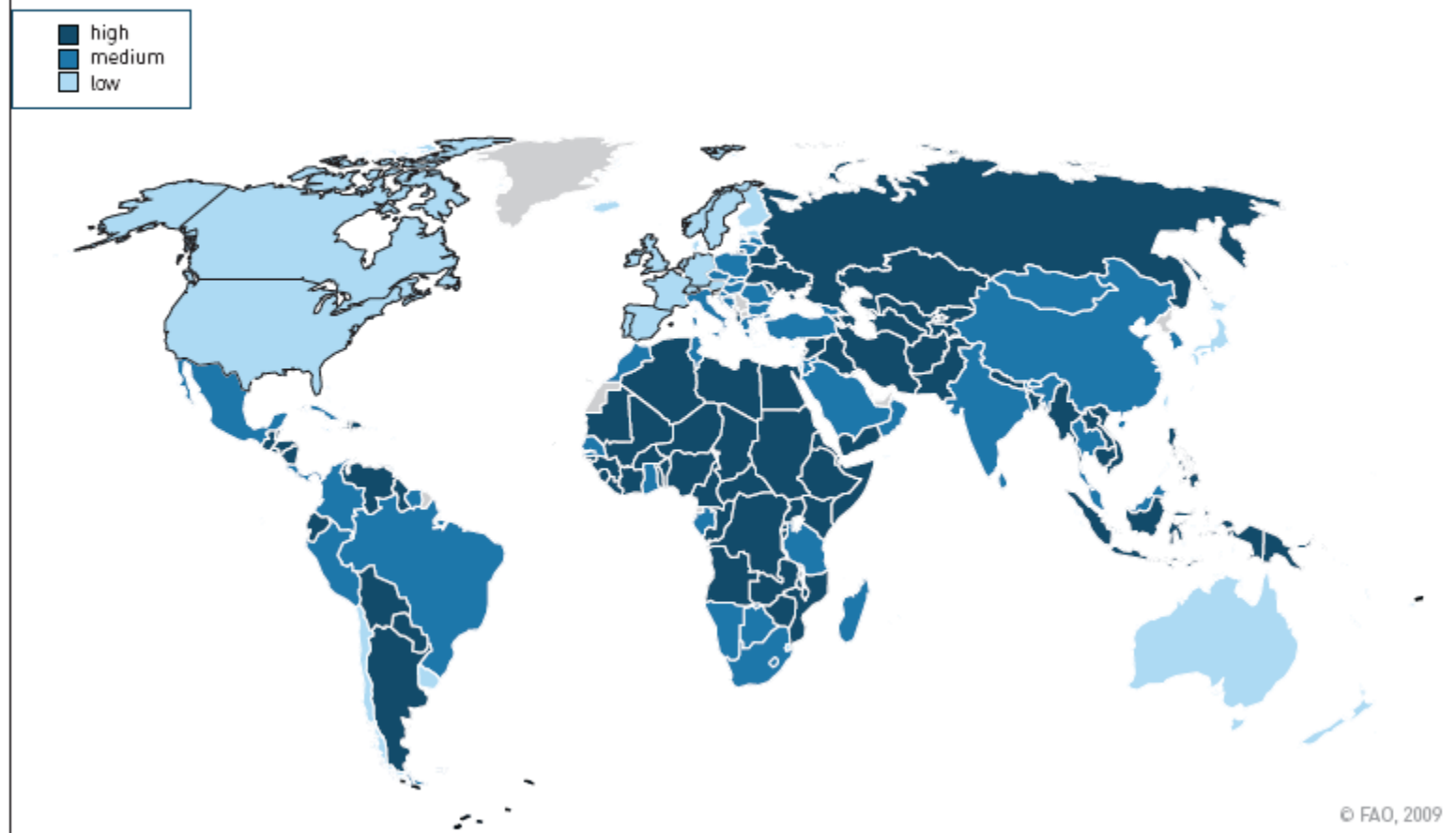
infrastructural water scarcity

- high
- medium
- low



© FAO, 2009

institutional water scarcity



Factors affecting water demand

- Demographic pressure: More demand for food
- Economic development and urbanization:
 - More 'water intensive' diets: meat and dairy products
 - Increased demand for cities and industries, tourism
- Better recognition of water requirements to sustain natural ecosystems



The 'weight' of agriculture

- 70 percent of all withdrawals
- 90 percent of water consumption
- Future: 60% more food to produce by 2050:
 - 1 billion t of cereals
 - 200 million t of meat
- To what extent is water use in agriculture 'negotiable' ?

Coping options

1. Supply enhancement:

- A set of actions consisting in increasing water supply, either through:
 - water resources development (infrastructure, enhancing groundwater supply capacity, etc.)
 - Seawater desalinization or re-use of treated wastewater
 - Reducing inter-annual variability of river flow
 - Water recycling and re-use and pollution control
 - Importing water and inter-basin transfer

2. Demand management:

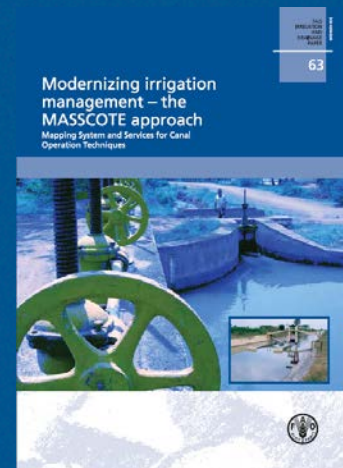
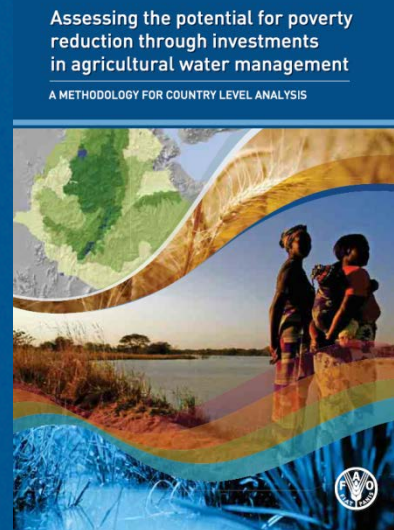
- A set of actions consisting in controlling water demand either by raising the efficiency and productivity of its use or by operating intra- or intersectoral reallocation of its use, reducing losses in the value chain



Options within the *agriculture* domain

- Managing the supply:
 - On-farm water conservation (soil moisture management)
 - Water harvesting
- Managing the demand:
 - Increasing water use efficiency → “waste less water”
 - Improving crop productivity → “more crop per drop”
 - Reallocating water from lower to higher value use
 - Balancing rainfed and irrigated agriculture

Policy-support instruments for food security and poverty reduction strategies





Rationale

- In water scarcity contexts, improving investments in agriculture water management (AWM) is a key element of rural development and poverty reduction strategies
- Decision makers seeks guidance to understand: i) **where** to invest ii) **who** to benefit? iii) **what** typology of investment is most appropriate?
- Improved understanding of the biophysical context (**supply**) and the livelihood context (**demand**) allows for better targeting AWM interventions according the different typologies of beneficiaries



Examples of FAO tools and approaches

- AQUASTAT: Global monitoring, forecasting and reporting on water in agriculture
- Promotion of water accounting methodologies, water audits, policy and investment frameworks
- Improved water technologies to sustain smallholder farmers' livelihoods
- Development of methodologies and tools to enhance water productivity in agriculture (MASSCOTE, AquaCrop, Cropwat)
- AWM Investment planning tool: based on livelihood mapping



AWM investment planning tool

Assessing potential for poverty reduction
through investments in agricultural water
management

A methodology for country level decision support



Scope of the approach

- Identify priorities and constraints by characterizing and mapping the livelihood context
 - Define and locate the different farmer typologies, their needs, strategies and attitude
- Identify and map the areas where water intervention can be the entry point for agriculture and make the difference for livelihoods and food security
- Identify and map interventions to support livelihoods and poverty alleviation
 - Map biophysically suitable areas for specific interventions where have highest impact on smallholders' livelihoods and reach the maximum number of beneficiaries
 - Match suitable areas with areas with highest livelihood demand
- Estimate the potential of specific interventions
 - Quantify potential beneficiaries and extent of application area

Characterize and map the livelihood-demand:

Identify and map priority and constraints



What is a livelihood zone/system?

An area with homogeneous characteristics, where people share similar livelihoods patterns: production, agroecology, constraints, vulnerability, priorities, etc

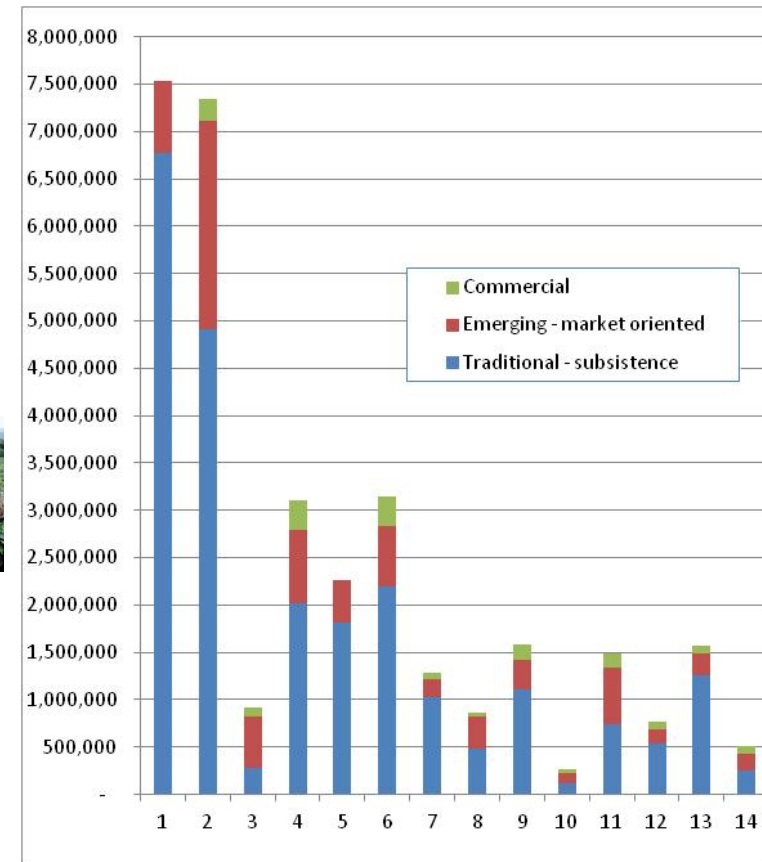
Mapping the livelihood context (Tanzania)

"different people in different places have different needs"



- | | |
|--|--|
| 1: Coffee-banana humid highlands | 8: Tree plantations with crops-pyrethrum and tea |
| 2: Cotton-paddy rice-cattle midlands | 9: Maize-cassava-cashew-simsim southern zone |
| 3: Tobacco-cotton-miombo woodland zone | 10: Rice zone |
| 4: Semiarid sorghum-livestock zone | 11: Sisal-sugar cane cattle zone |
| 5: Pastoral zone | 12: Maize-tobacco southern highlands |
| 6: Tree crops-fishing coastal zone | 13: Rice-maize unimodal zone |
| 7: Lake Tanganyika zone | 14: Rice-maize bimodal zone |

Typology of rural population



Livelihood context - livelihood zones attribute table

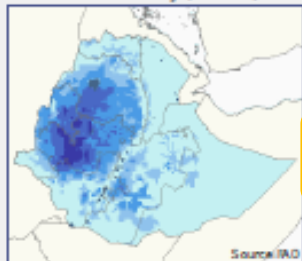
"What are the priorities for rural people?"

Zone	Name - major production systems	Main constraints for development	Water-related constraints and potential
1	Coffee-banana humid zone	Soil fertility, low producers price	Water is plenty. Irrigation is not common. But exceptionally high in Moshi rural and Hai. Irrigation infrastructure is poor and can be improved.
2	Cotton-paddy-cattle zone	Erratic rainfalls, land scarcity, lack of technology	Water is the limiting to crops production in this zone and without water most other agricultural practices applied to crops do not result in significant increase in yield. Water for livestock is also a problem.
3	Tobacco-cotton zone	Low rainfall, tsetse, poor accessibility	Water is very important for agricultural production. Irrigation potential of this zone is limited. There are no perennial rivers and no ground water aquifers with yields sufficient for more than a small area. Rainwater harvesting techniques is the only method
4	Semiarid sorghum livestock zone	Irregular rainfall, tsetse, declining soil fertility	Though irrigation farming is not common in this zone, it's potentiality is high. It is desirable and feasible. Water harvesting techniques can be used.
5	Pastoral zone	Dry lands, animal health, lack of watering facilities	This zone is not well endowed with large potential areas for irrigation. What exist are areas suitable for medium and small scale irrigation. Simanjiro district has the largest land under irrigation. Kiteto district has no potential areas suitable for irrigation. Spring, shallow wells ,gravity pump schemes, hand pump schemes are common.
6

Where to invest for max impact on rural livelihoods (Ethiopia)

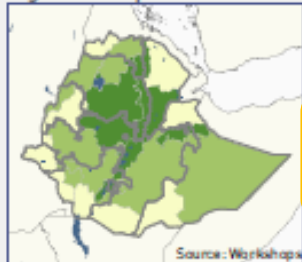
Potential beneficiaries

1. Water availability (runoff)



Where water is available

2. Perception of water as limiting factor for agricultural production



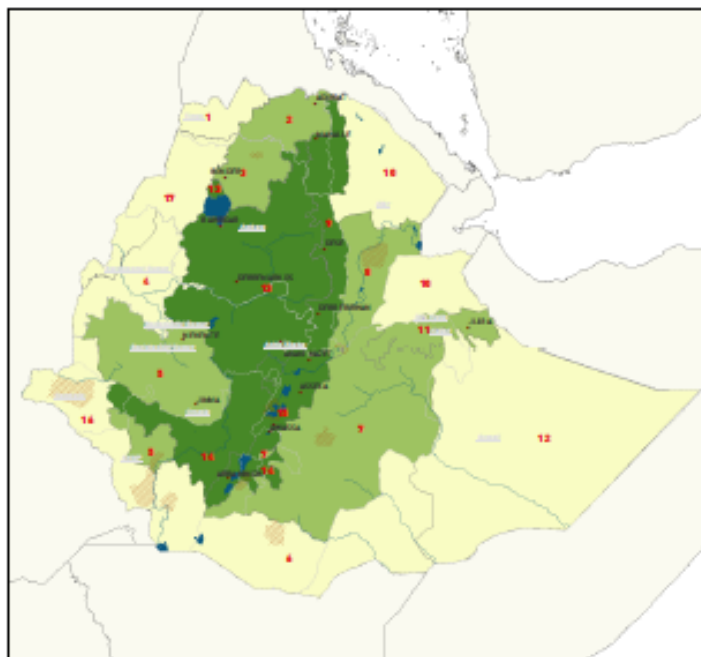
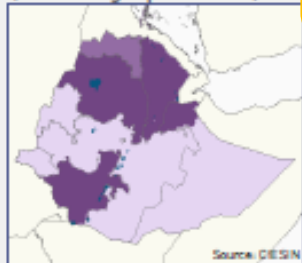
Where water is perceived as critical factor

3. Rural population density



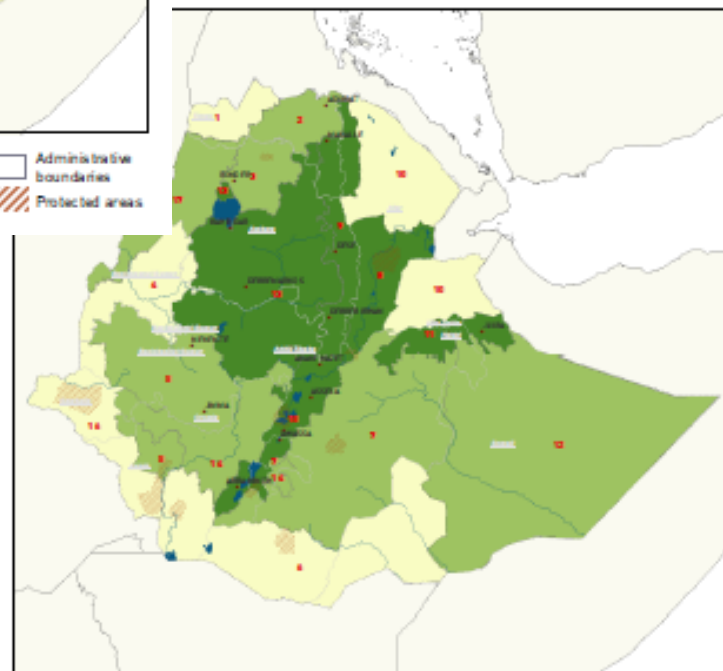
Where the target beneficiaries are

4. Poverty (underweight prevalence)



68 - 113 11 - 68 1 - 11

Administrative boundaries
Protected areas



In Percentage of Rural Population

50% - 80% 15% - 50% < 15%

Administrative boundaries
Protected areas

Ethiopia: Where to invest for maximum impact on rural livelihoods

Livelihood zone		Water availability: IRWR/cp (m ³ /p/y)	Rural population			Perception of water as limiting factor for agricultural production	Potential beneficiaries	
No	Name		Total (,000)	Density (p/km ²)	% poor (underweight)		Person (,000)	in % of rural population
1	Lowland mixed - Sesame livelihood system	1,085	522	30	48.4	low	78	15%
2	Northern mixed midlands livelihood system	406	2,397	112	48.0	medium	1,199	50%
3	Northern cereal pulse mixed livelihood system	1,286	2,194	100	51.5	medium	1,097	50%
4	North West lowland Sorghum/Sesame mixed livelihood system	16,379	729	19	43.4	low	109	15%
5	Western Coffee/Maize livelihood system	3,822	7,262	97	44.2	high	3,631	50%
6	Southern pastoral livelihood system	2,517	1,601	13	44.9	low	240	15%
7	Eastern highland mixed livelihood system	1,379	7,371	56	43.5	medium	3,686	50%
8	Awash pastoral/agricultural system	787	889	25	50.4	high	705	79%
9	Meher/Belg transition livelihood system	492	4,318	117	50.6	high	2,705	63%
10	North-Eastern pastoral livelihood system	843	814	10	50.3	low	122	15%
11	Eastern Chat/Sorghum highland mixed livelihood system	184	3,809	179	42.2	high	1,173	31%
12	"Ogaden" pastoral livelihood system	1,178	2,612	12	43.2	medium	1,306	50%
13	Highland mixed -Teff livelihood system	2,069	17,294	137	48.2	high	13,835	80%
14	Horticultural (Enset/cereal) mixed livelihood complex	994	9,166	187	51.1	medium	4,583	50%
15	Rift Valley livelihood system	468	5,391	186	46.0	high	3,278	61%
16	Gambella agro-pastoral livelihood system	6,645	470	10	43.8	low	70	15%
17	Northern pastoral livelihood systems	6,223	951	22	49.0	medium	475	50%

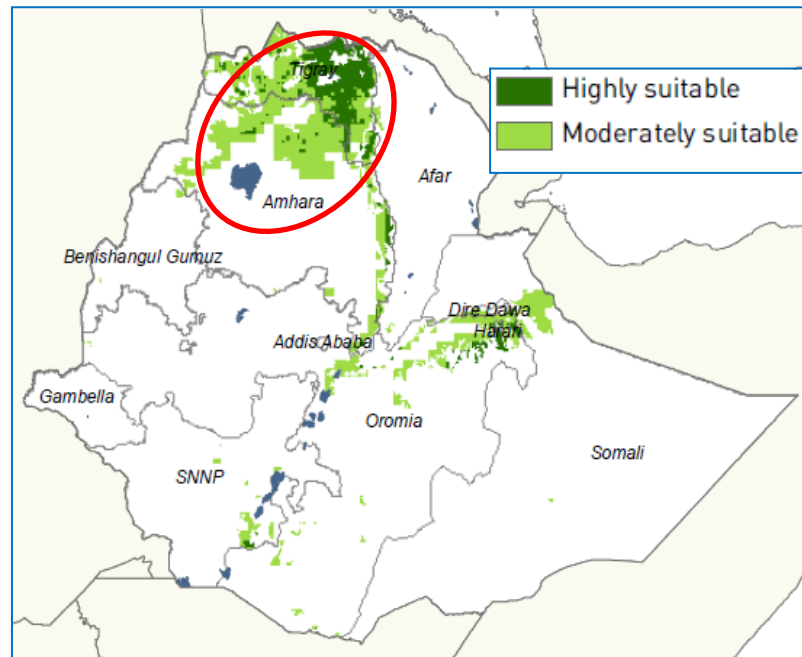
Which interventions and where?

*Matching suitable biophysical conditions (**supply**) with livelihood needs (**demand**) for specific solutions*



Small Reservoirs (Ethiopia)

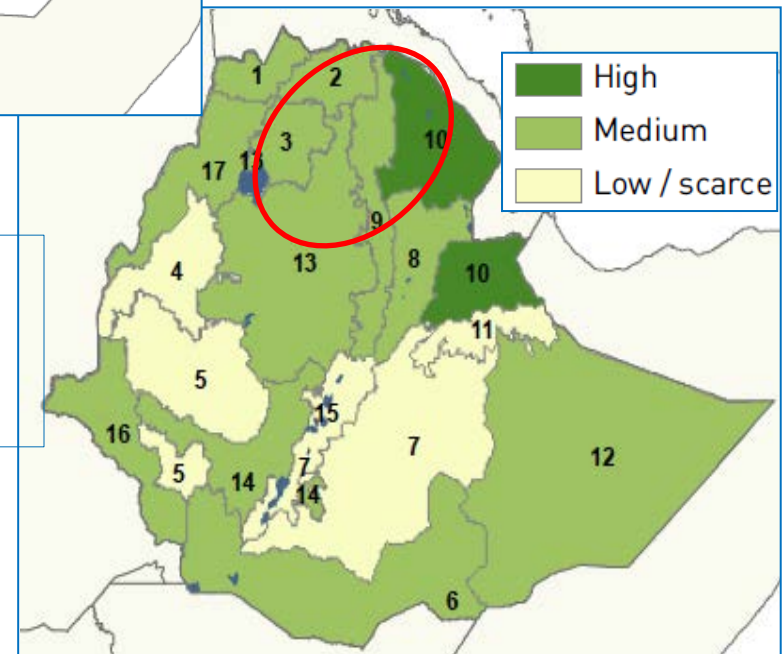
Biophysical suitability



Biophysical criteria

1. Aridity Index
2. Topography
3. Livestock density

Livelihood-based demand



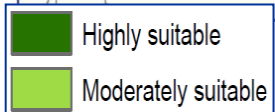
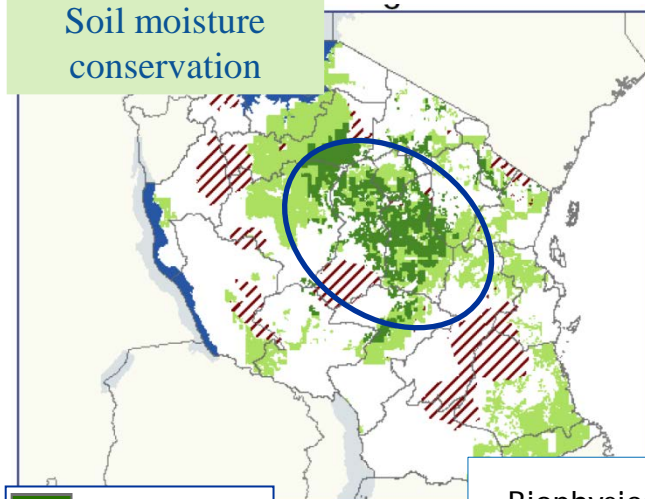
Demand criteria

1. Farmers typology
2. Prevalence of poverty

Tanzania: Soil and water conservation measures

Biophysical suitability

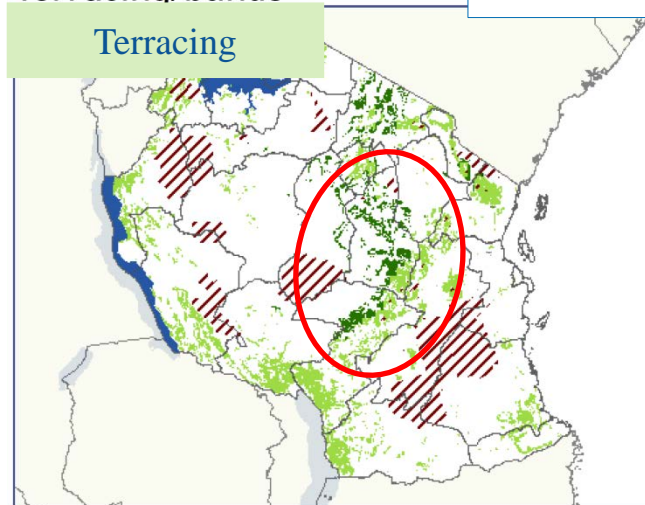
Soil moisture conservation



Biophysical criteria

1. Topography
2. Aridity Index

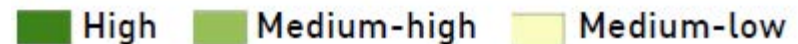
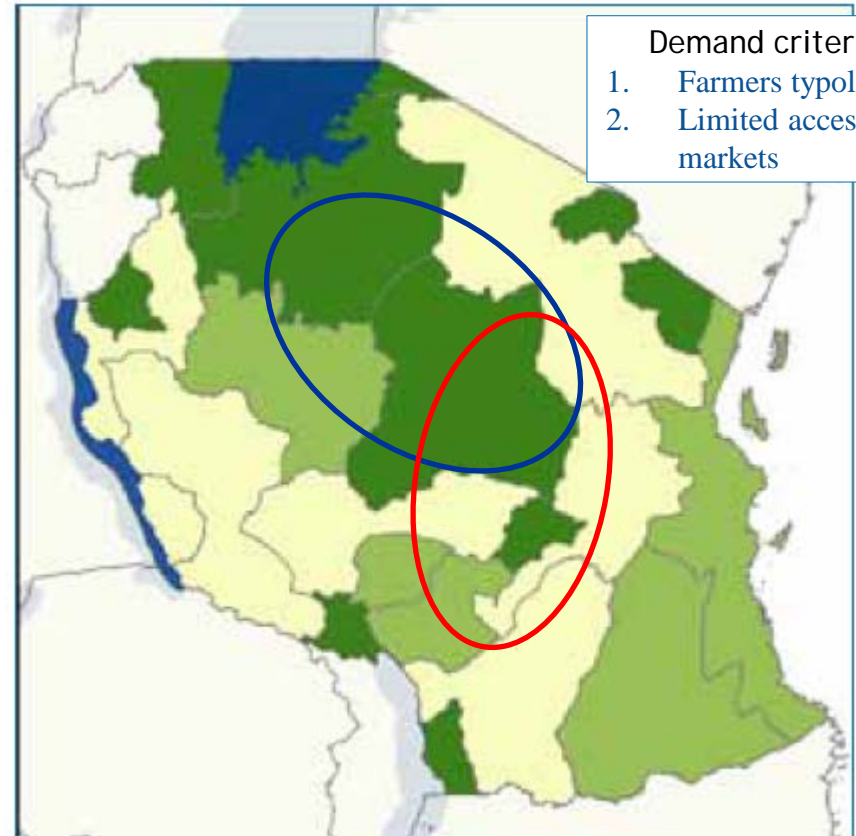
Terracing



Livelihood-based demand

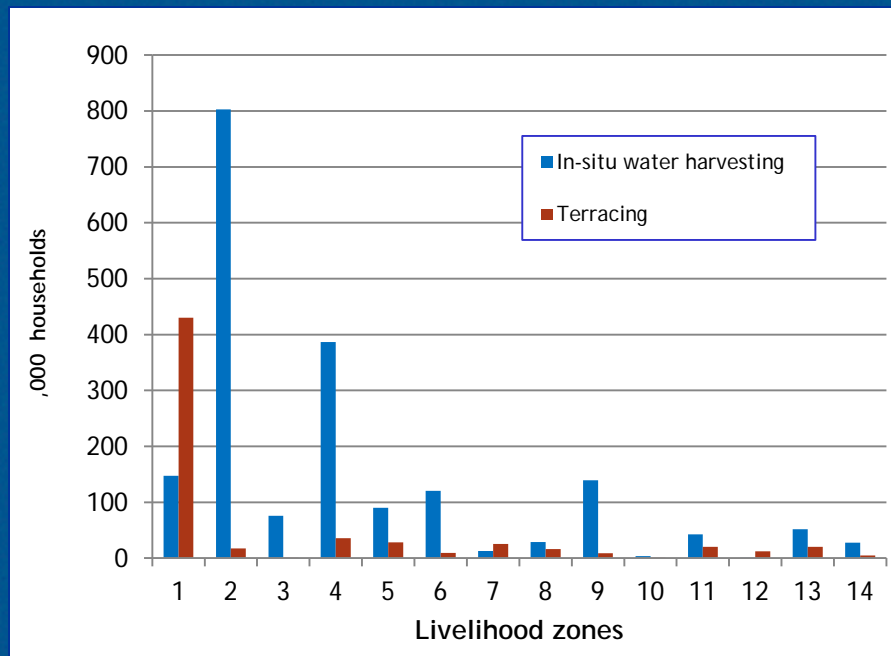
Demand criteria

1. Farmers typology
2. Limited access to markets

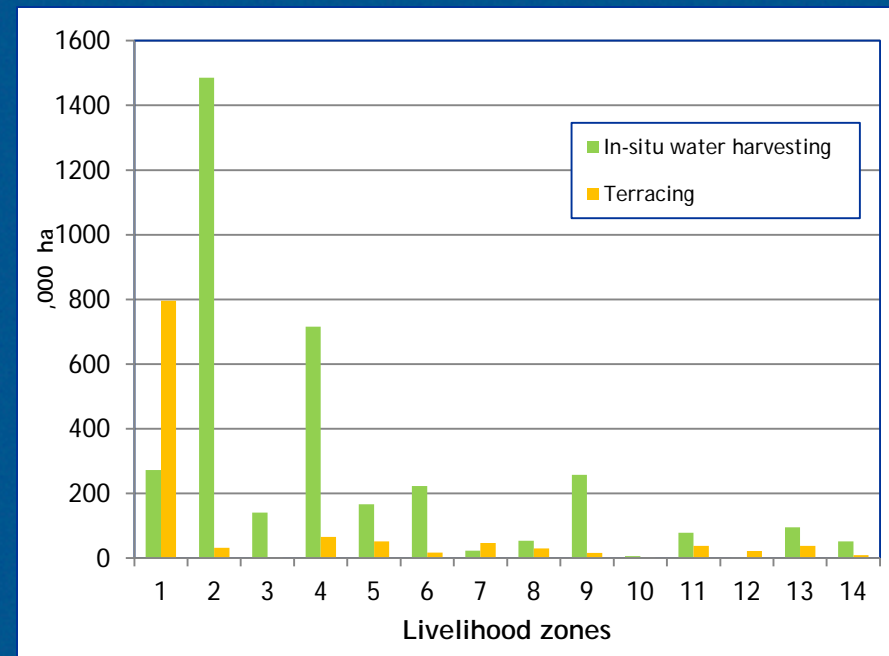


Quantifying the potential (Tanzania)

Potential beneficiaries (,000 households)



Potential application area (,000 ha)



"Conclusions"

- i.** Context-specificity: adapt response to local conditions
- ii.** Role of water: Water is a major factor affecting rural people's livelihoods: as basic human need and major production factor
- iii.** Target: The focus is on traditional smallholders farmers, fishers and herders with little connection to markets Interventions in water primarily focusing on increased resilience of rural farmers
- iv.** Impact: assess the full range of benefits and costs and use systematic and comprehensive decision criteria
- v.** Synergy: ensure policy alignment between water, agriculture and food security. No poverty-reduction effect if "essential conditions for success" are not met.

Thank you!



For more information:

http://www.fao.org/nr/water/projects_agwatermanagement.html