SESSION 4: BUILDING CLIMATE RESILIENT PRACTICES IN WATER MANAGEMENT

Training workshop on the identification and development of climate change no-regret actions in the water sector, 3-5 October 2012, Amman

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Objectives of Session 4

- **Goal:** Increase the understanding on the various types of adaptation measures in water resources management at all levels
- **Learning Objectives:**
  - Understand the water resources management measures based on no-regrets options available to address vulnerability to climate change
  - Strategize the use of different policies and instruments to build climate resilience
  - Promote adaptation at the appropriate level.

Outline

1. Context
2. Typology of no-regret adaptation measures
3. Examples of no-regret adaptation measures
4. No-regret adaptation policies in the Mediterranean countries: where do we stand?
5. Discussion

1. Context

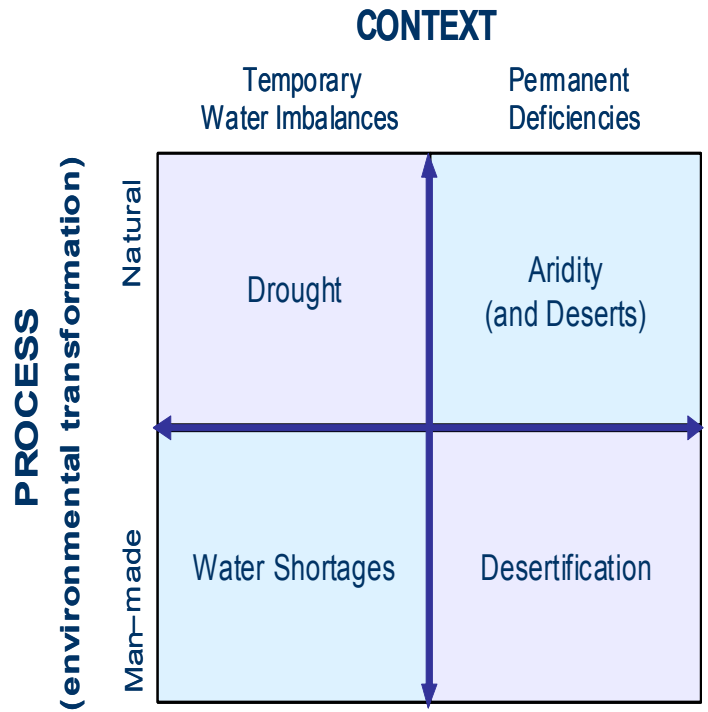
Expected impacts of climate change on water in the Mediterranean

- Decrease of « green » water, on average
- Increased risks of edaphic droughts during spring and summer months, mainly impacting vegetation
- Increased risks of hydrologic droughts during the autumn and winter months, impacting aquifers recharge and rivers flows
- Increased risks of floods
- Increased risks on water quality

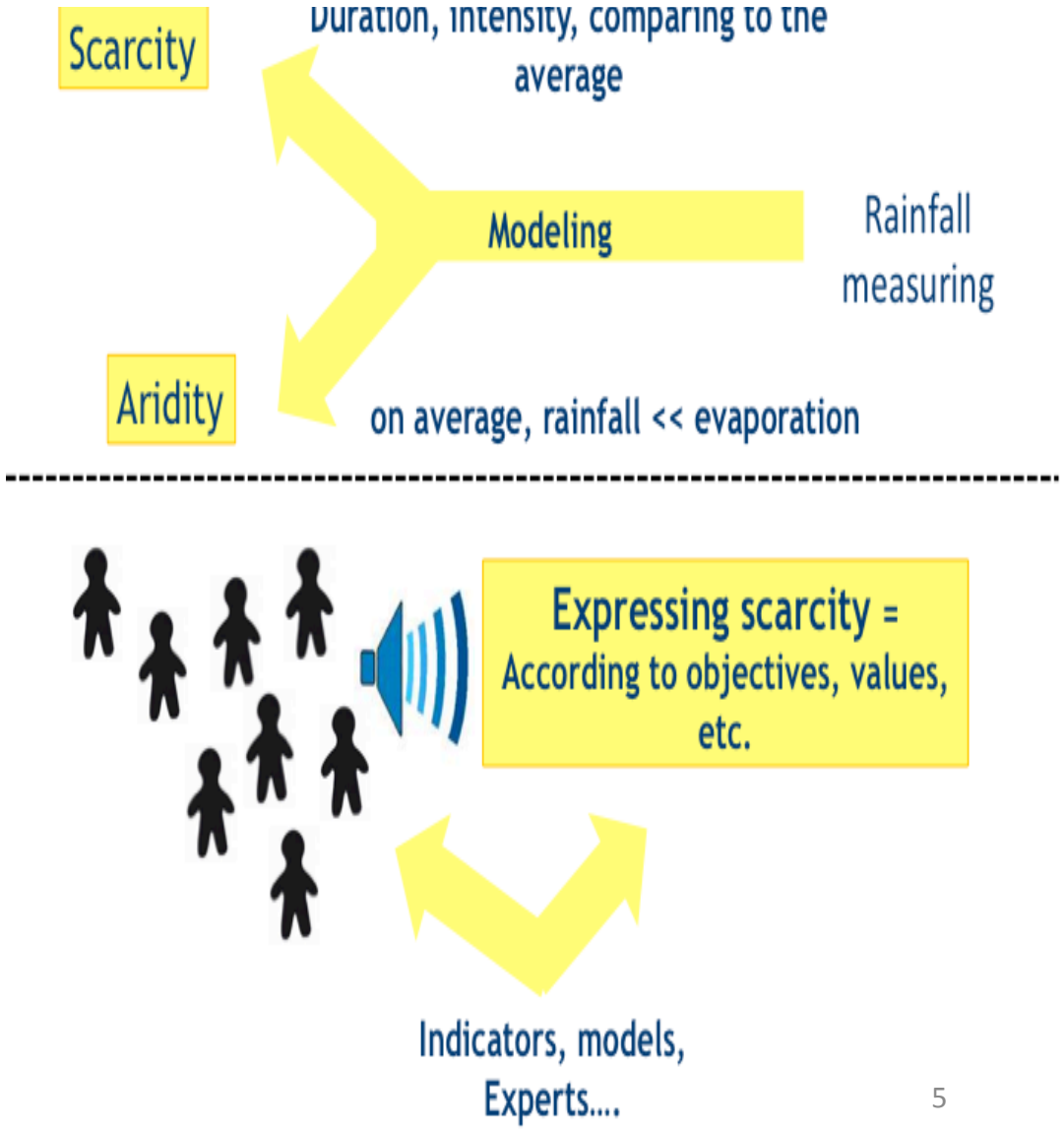
1. Context

Scarcity and drought: some definitions

Typology of water stress condition



Source: Vlachos, 1982



1. Context

Water scarcity: Indicators and controversies over the relations between water and society

Demographic pressure? Food needs?
Which rooms of maneuver for national governments ?

✓***Water scarcity represented and to be managed by governments at national scale***

(Falkenmark, Shiklomanov indicators)

Food self-sufficiency policies?
Inter-states water wars?

✓***Water scarcity represented and to be managed at international level through food trade and inter-states cooperation mechanisms***

(Virtual water)

A matter of social adaptation to scarcity?
(institutions, economy, property regimes, …)

✓***Stimulating adaptation capacity***

(Water poverty index, index of Turton & Ollson)

Source: Fernandez, 2008

2. Typology of adaptation measures

2.1. General typologies

- Autonomous / Planned
- Reactive / Anticipatory
- Natural systems / Human systems
- Hard / Soft technologies
- Traditional / Modern technologies
- Regret / No-regret measures

Categories:

  - Robust policies
  - Technological and structural measures
  - Risk-sharing and spreading

2. Typology of adaptation measures

2.2. Specific typology

A. Dealing with water supply and demand imbalances, on average

a. Managing water quantity: supply driven and demand driven measures

b. Resilience to water quality degradation

c. Valuing the service provided by water-related ecosystems

B. Dealing with an increased risk of extreme weather events:

a. Flooding

b. Droughts

3. Examples of measures

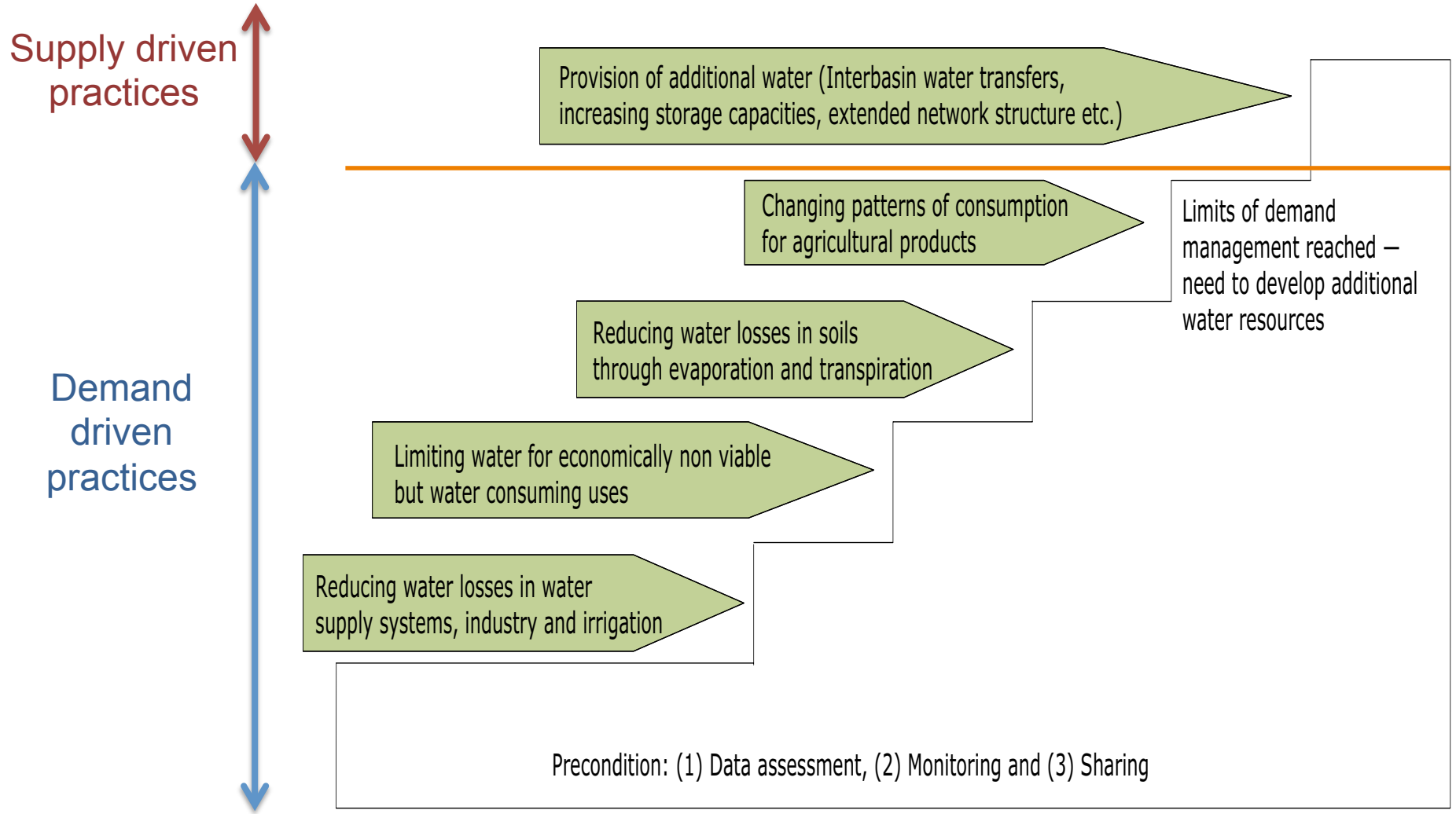
A. Dealing with water supply and demand imbalances (average)

- Precondition
- Managing water demand : reducing leakages, changing farming practices
- Increasing water supply: the case of rainwater harvesting
- Resilience to water quality degradation
- Valuing the service provided by aquatic ecosystems

B. Dealing with an increased risk of extreme weather events

- Flooding
- Droughts

3. Examples
A. Dealing with water imbalances



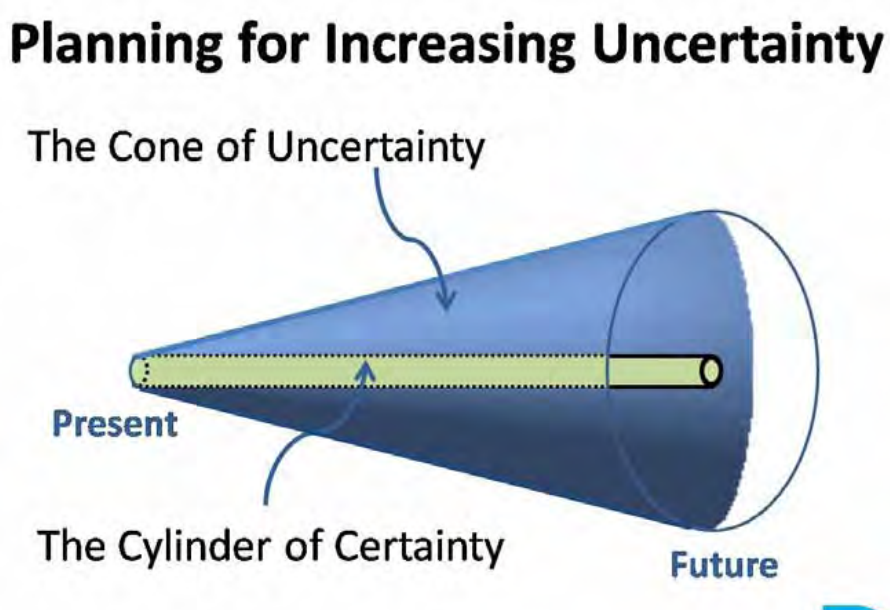
Source: Adapted and complemented from Falkenmark, 2007.

3. Examples
A. Dealing with water imbalances

Precondition: Data assessment, monitoring, sharing and planning

Need to:

- Invest in hydrometric monitoring systems & early warning systems
- Develop water strategic foresight planning



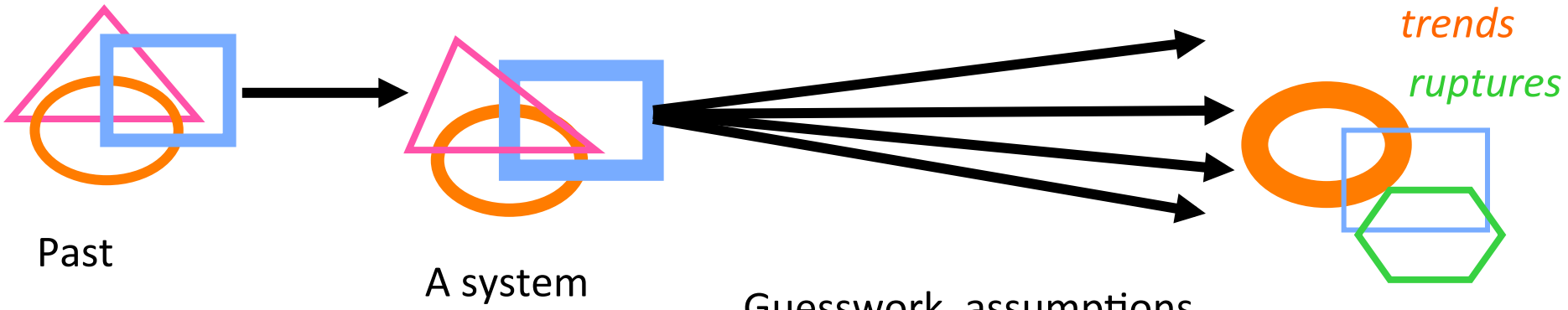
→Robust: not event-driven, cross-sectoral integration of development policy goals

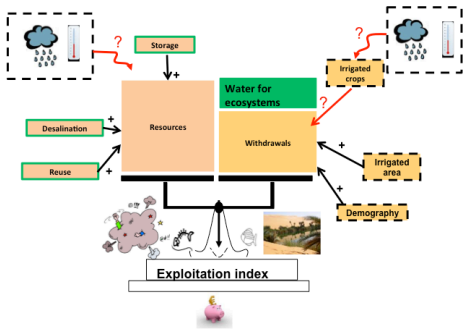
→Flexible: not based on one scenario only

→Adaptive: able to function under uncertainty and adjust the management approach based on the outcomes of implemented strategies and new realities

3. Examples
A. Dealing with water imbalances

Precondition: Building contrasted scenarios





How to reduce the gap between water supply and demands in the future?

3. Examples
A. Dealing with water imbalances

Reducing water losses

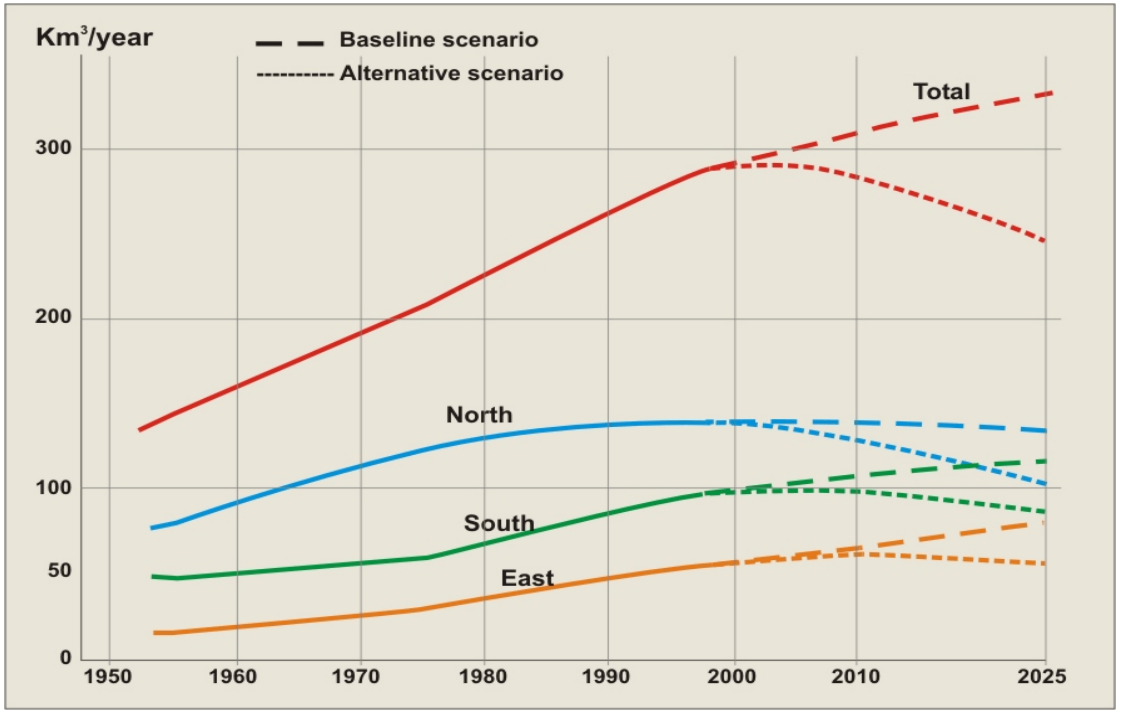
Losses & misuses in 2005: ~110 km³/y

40% of total water demand

Plan Bleu future studies on water in the Mediterranean

Potential water savings in 2025: ~ 86 km³/y

25% of total water withdrawals (330 km³/y)



Source:
Plan Bleu, 2005

3. Examples
A. Dealing with water imbalances

Precondition: comparing advantages & disadvantages of various possible measures

Comparative economic analysis of water savings and increasing supply across the Mediterranean (Fernandez & Mouliérac, 2010):

✓ Most effective solutions: network leakage reduction when initial distribution efficiency is low & AD > 0.

✓ Increasing end users efficiency: Water saving devices are effective, particularly when the water price is high & only if AD > 0,

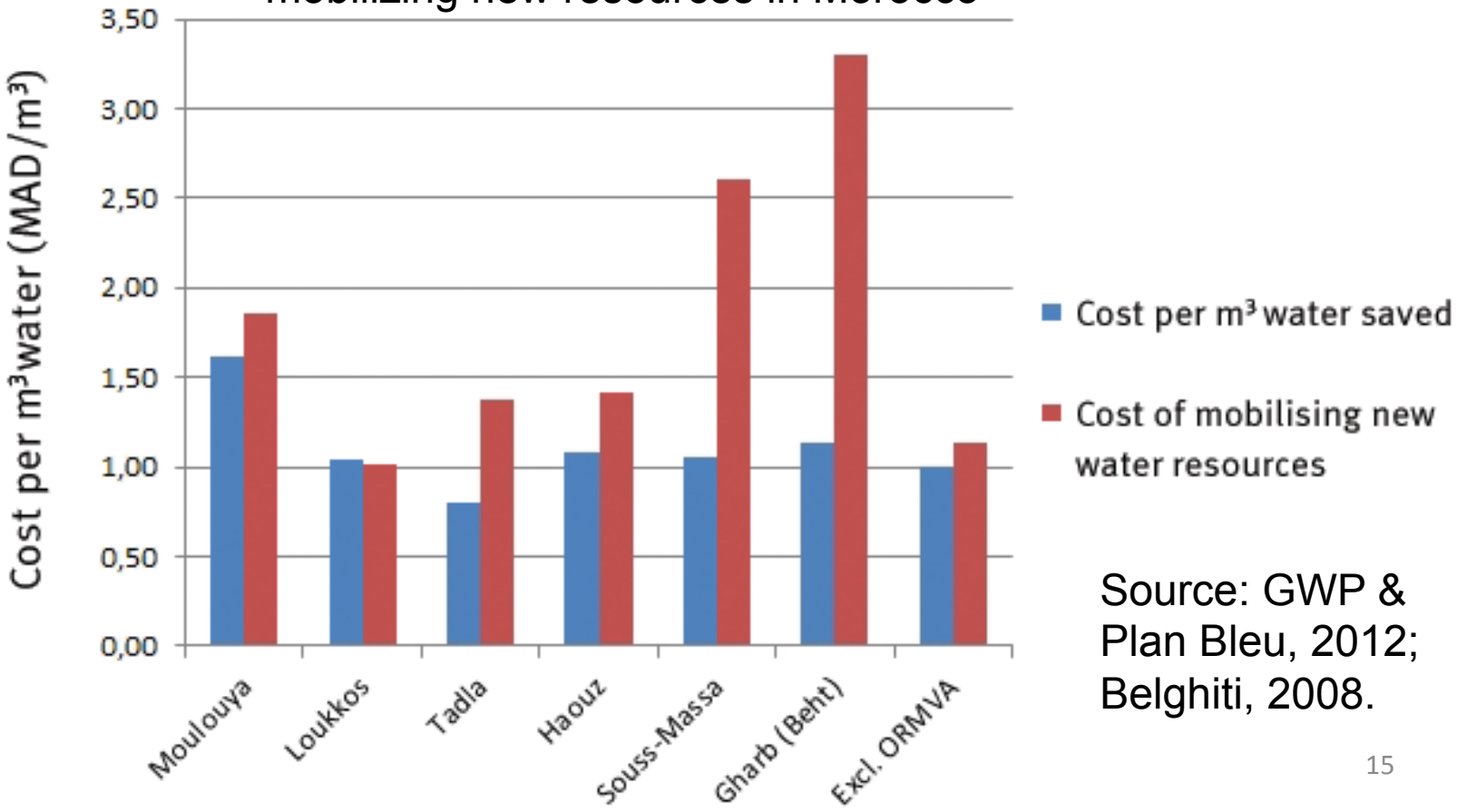
✓ Reallocating water from existing dams can be effective.

✓ Supply driven alternatives (desalination or water transfers) are the least effective solutions.

3. Examples
A. Dealing with water imbalances

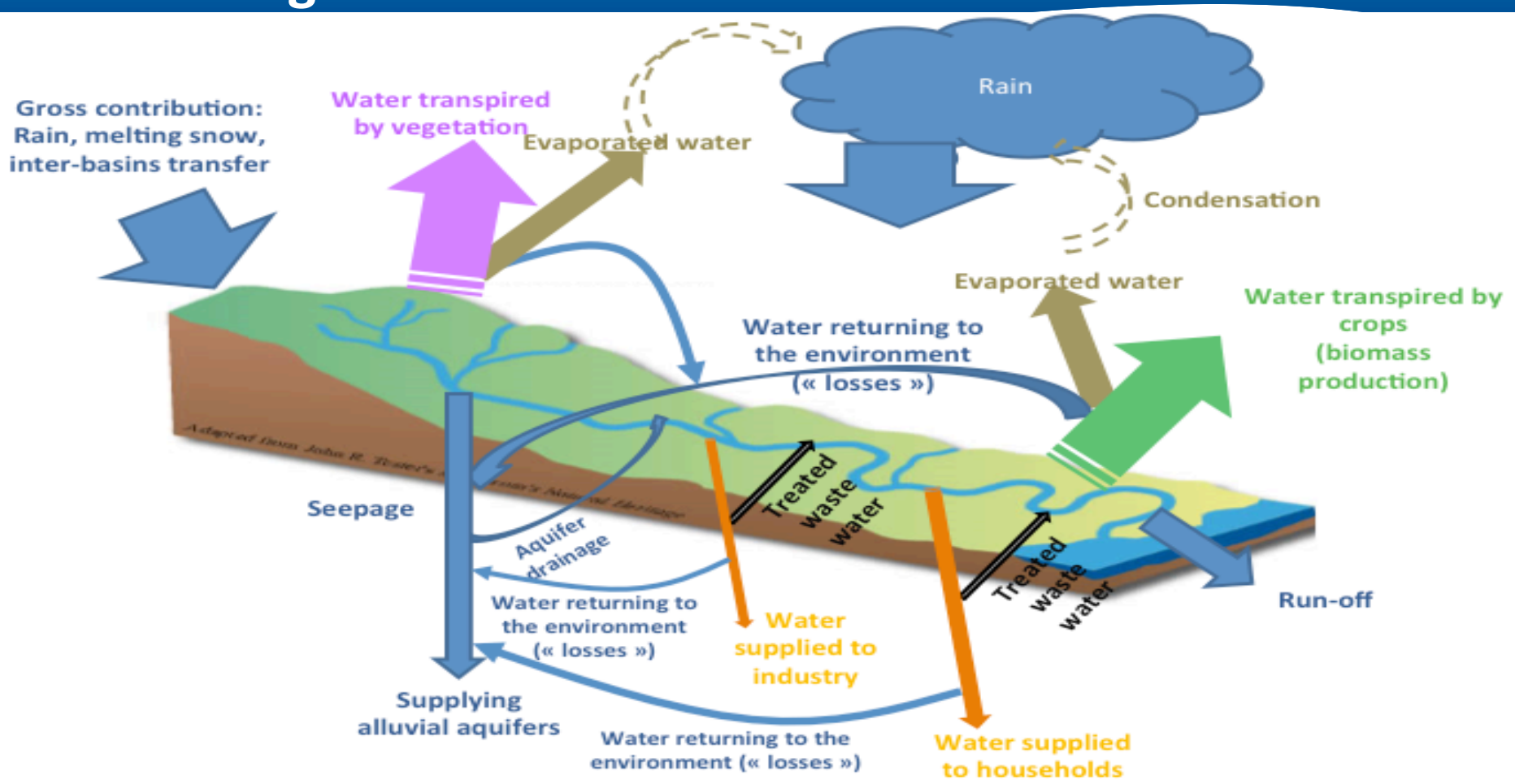
Precondition: comparing advantages & disadvantages of various possible measures

Comparing costs per m3 of water saved by converting to localized irrigation with mobilizing new resources in Morocco



Source: GWP & Plan Bleu, 2012; Belghiti, 2008.

3. Examples
A. Dealing with water imbalances



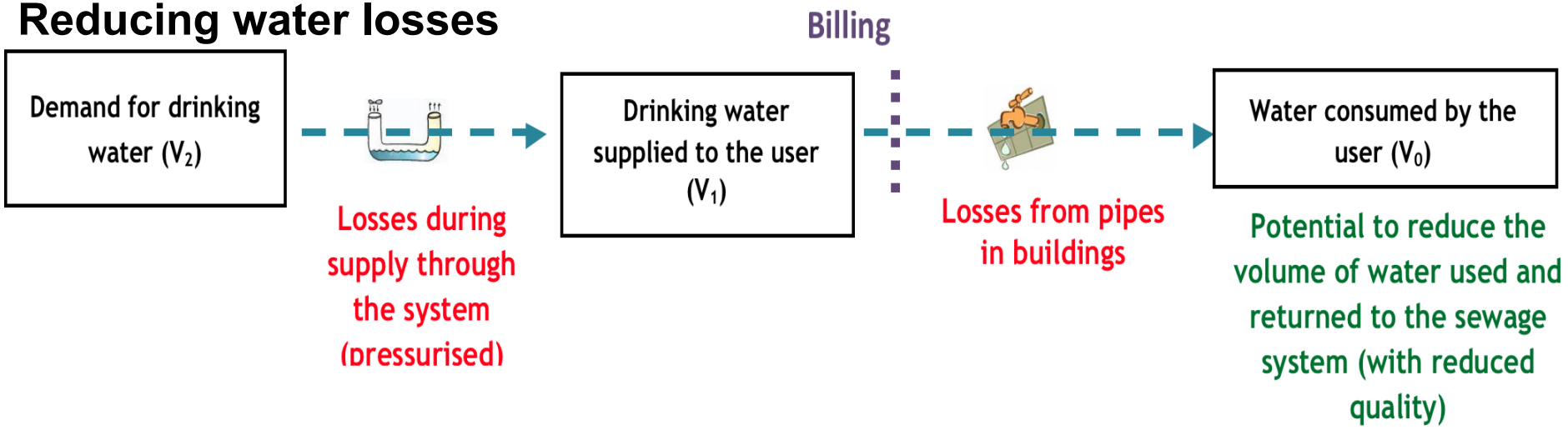
How to increase water use efficiency?

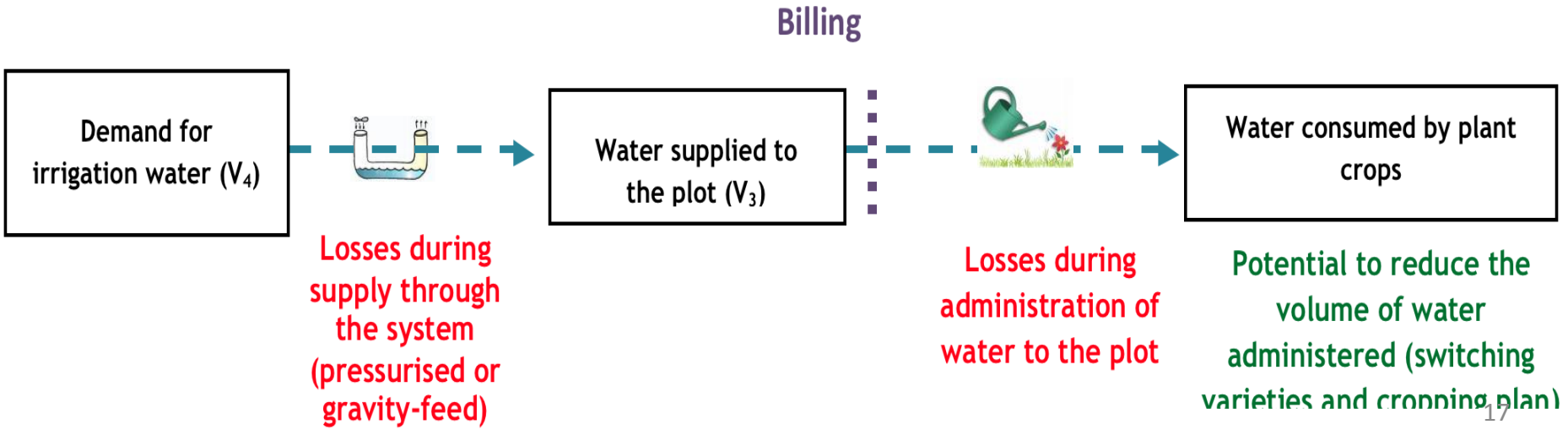
- Rainfed / irrigated agriculture (Blue water & green water)
- Dry & wet savings at drainage basin scale

Source: Fernandez & Moulierac, 2010.

3. Examples
A. Dealing with water imbalances

Reducing water losses

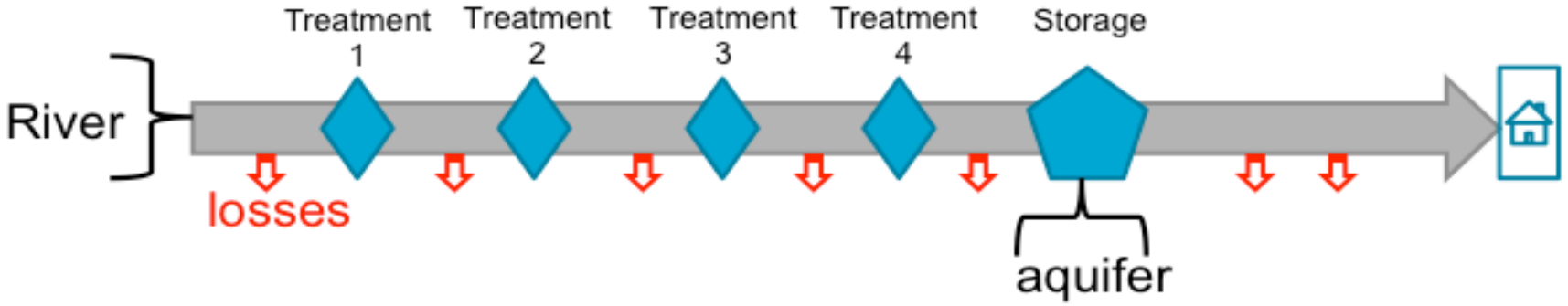




Source: Fernandez & Moulierac, 2010; Thivet & Blinda, 2008

3. Examples
A. Dealing with water imbalances

Reducing water losses in drinking water supply systems



Leakage reduction

Additional demand to be met without resizing the network > 0

Water saved is distributed & billed

Benefits for the Network Manager

Additional demand to be met without resizing the network = 0

Water saved is not withdrawn and made available for other users

Benefits for other users

Low impacts on present drinking water end users

Source: Fernandez & Moulierac, 2010.

3. Examples
A. Dealing with water imbalances

Reducing water losses in drinking water supply systems

Loss from pipes in collective housing (water which returns to the environment)

Losses reduction

Low water use efficiency: unconsumed water used by households, which goes back into the sewage system where it is treated before returning to the environment (rivers)

Domestic appliances replaced by more water efficient versions

Savings: Unbilled volumes

- Less abstraction
- Increase in price of water for the user

- New households connected to the system
- Potential drop in price for the user

Source: Fernandez & Moulierac, 2010.

3. Examples
A. Dealing with water imbalances

Changing farming practices

Crop development

Develop new crop varieties, including hybrids, to increase the tolerance and suitability of plants to temperature, moisture and other relevant climatic conditions: adoption of drought resistant crops, changing planting dates and cultivars

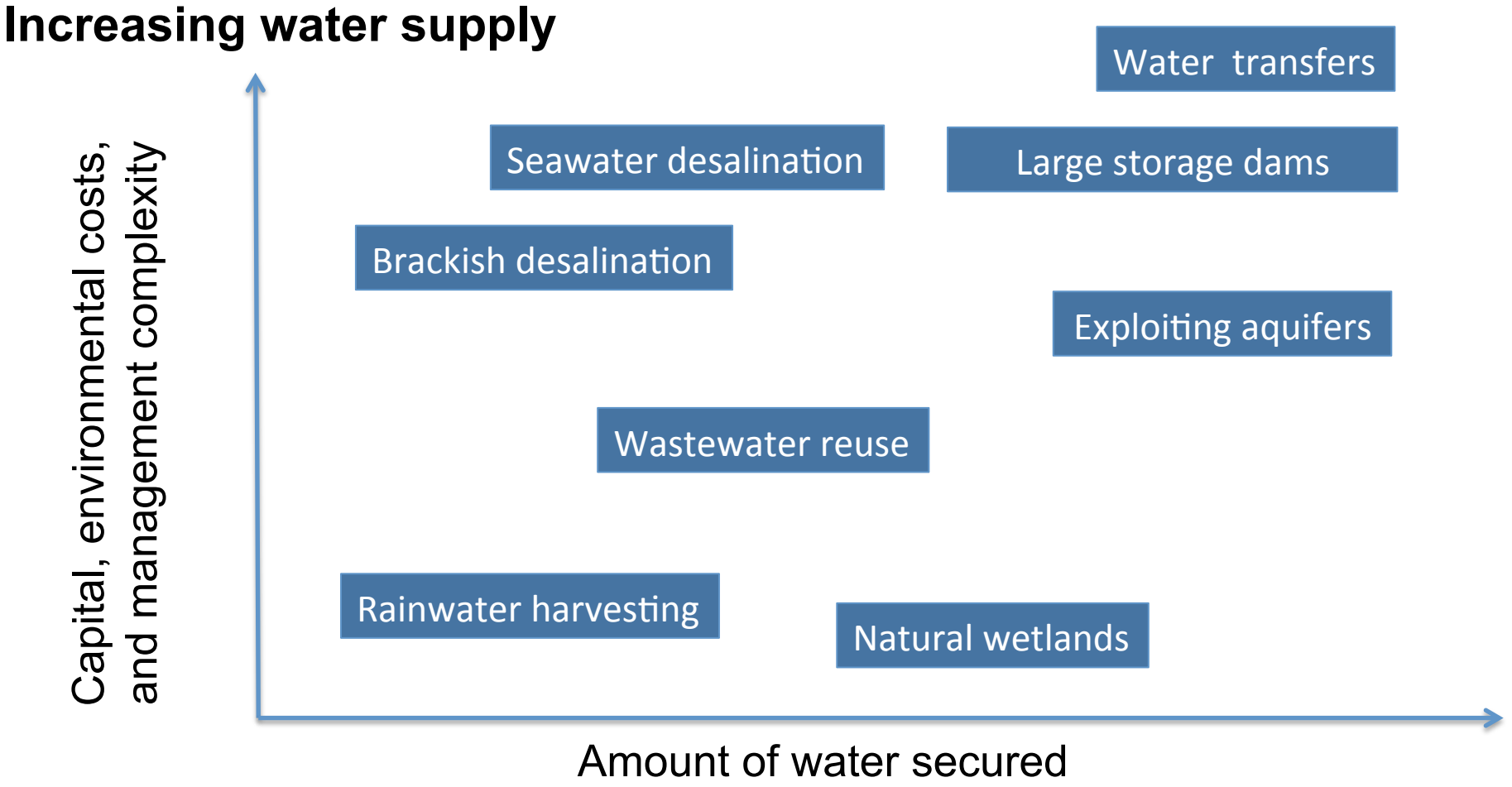
Resource management innovations

- Develop water management innovations to address the risk of moisture deficiencies and increasing frequency of droughts: mulching, minimum tillage and maintenance of cover crops

Farm production

- Diversify crop types and varieties, including crop substitution, to address the environmental variations and economic risks associated with climate change
- Diversify livestock types and varieties to address the environmental variations and economic risks associated with climate change.
- Change the intensification of production to address the environmental variations and economic risks associated with climate change.

3. Examples
A. Dealing with water imbalances



Other important criterion lie in the sensitivity of the various solutions to uncertainty (weather variability, energy costs, etc.)

3. Examples
A. Dealing with water imbalances

Increasing water supply: the case of rainwater harvesting
Valuing green water

= Collection and concentration of rainwater and runoff for irrigation, domestic and livestock consumption, groundwater recharge…

It can:

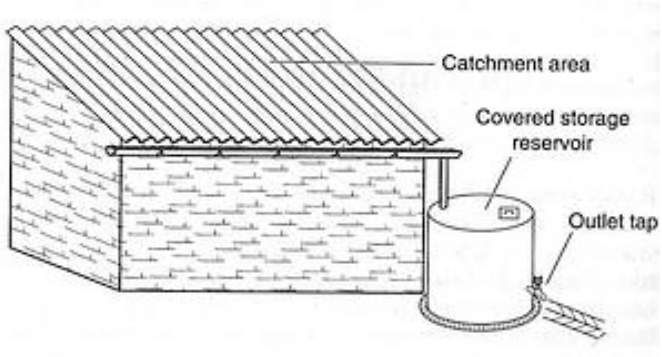
- Improve living conditions, allow intensification (a link between rainfed and irrigated agriculture)
- Substitute groundwater use and contribute to its recharge
- Reduce flooding, soil erosion risks

Different methods and applications, according to the ratio collecting/receiving area :

- Micro-catchments: Rooftop systems, On-farm systems
- Macro-catchments: long-slope systems and floodwater spreading systems

3. Examples
A. Dealing with water imbalances

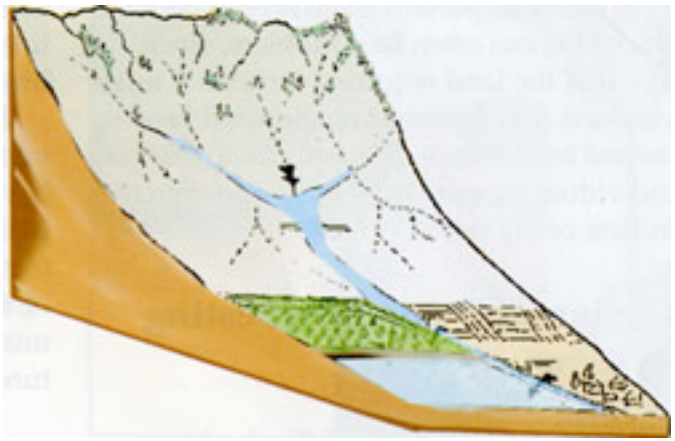
Increasing water supply: the case of rainwater harvesting



Rooftop systems
(water storage in tanks, jars, cisterns)

Sand-ditch water harvesting in Jordan

Jessour in Tunisia



Long-slope systems

3. Examples
A. Dealing with water imbalances

Resilience to water quality degradation

- Managing point pollution: Water reclamation and reuse

- Managing non-point pollution: Improving the coordination between land and water management thanks to buffer strips, retention ponds, farming nutrient management plans, integrated pest management techniques…

- Water Safety Plans (WHO), an integrated approach to manage water quality from catchment to consumer including (i) system assessment, (ii) operational monitoring; and (iii) management plans, documentation and communication.

3. Examples

A. Dealing with water imbalances

Valuing the service provided by ecosystems

- Upper watershed management to maintain water storage;
- Allocation of water to ecosystems through the application of environmental flows;
- Restoration of flood plains;
- Preserving wetlands to foster natural water treatment and flows regulation

Jordan's Azraq wetland

3. Examples
B. Extreme weather events

Dealing with an increased risk of flood

Strategy	Options
Reducing flooding	Dams & reservoirs Dikes, levees, & flood embankments High flow diversions Catchment management Channel improvements
Reducing susceptibility to damage	Flood plain regulation Development and redevelopment policies Design and location of facilities Housing and building codes Flood-proofing Flood forecasting & warning
Mitigating the impacts of flooding	Information & education Disaster preparedness Post flood recovery Flood insurance
Preserving the resources of flood plains	Flood plain zoning & regulation

B. Increased risk of extreme weather events

Dealing with an increased risk of drought

- **Preventive or strategic measures:**
  - hydrological planning domain
  - main objective: reinforcing the structural system to increase its response capacity towards droughts
- **Operational (tactical) measures:** during pre-alert and alert statuses

Control and information measures in pre-alert and conservation resources measures. applying water restrictions

- **Organizational measures:**

Creating coordination protocols among administrations and public and private entities directly linked to the problem (esp. public supply)

- **Follow-up measures:**

Watching out for the compliance and application of the DMP and its effects

B. Criteria to help selecting adaptation measures

Source: EC,2009

Criterion	Sub-criteria	Guiding questions to be asked
Effectiveness of adaptation	Adaptation function	Does the measure provide adaptation in terms of reducing impacts and exposure, anhancing resilience or opportunities
	Robustness to uncertainty	Is the measure effective under different climate scenarios and different socio-economic scenarios?
	Fleixbility	Can adjustments be made later if conditions change again or if changes are different from those expected today?
Side effects	No-regret	Does the measure contribute to more sustainable water management and bring benefits in terms of also alleviating already existing problems?
	Win-win (ot win-lose)?	Does the measure entail side-benefits for other social, environmental or economic objectives? E.g. does it: • Contribute to closing the gap between water availability and demand? • Affect the delivery of other water related objectives (e.g. river flows)? • Create synergies with mitigation (e.g. does it lead to decreased GHG emissions)?
	Spill-over effects	Does the measure affect other sectors or agents in terms of their adaptation capacity? Does the measure cause or exacerbate other environmental pressures?

B. Criteria to help selecting adaptation measures

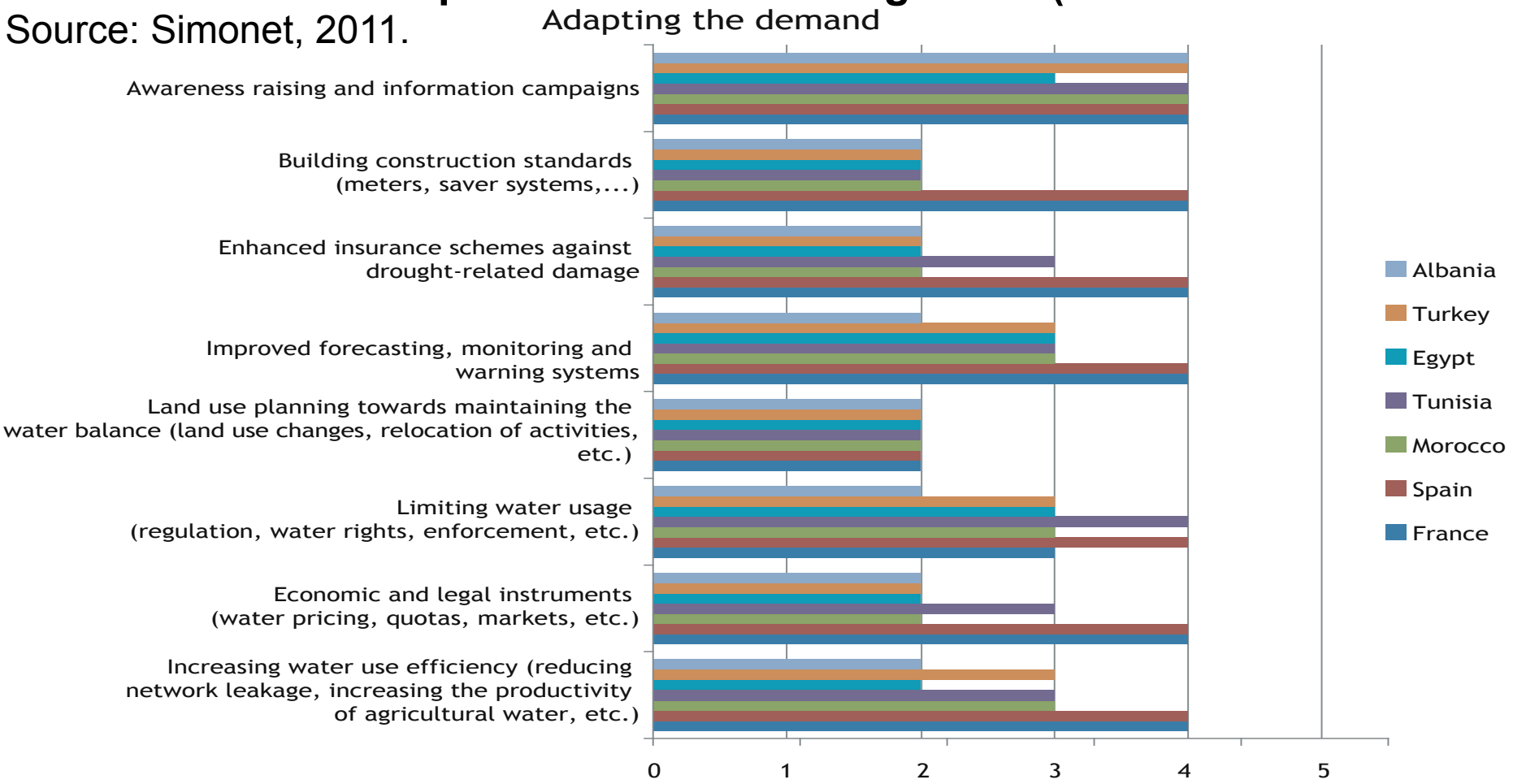
Source: EC,2009

Criterion	Sub-criteria	Guiding questions to be asked
Efficiency/costs and benefits	Low regret	Are the benefits the measure will bring high relative to its costs? (if possible consider also distributional effects, as well as non-market values and adverse impacts on other policy goals)
Framework conditions for decision-making	Equity and legitimacy	Who wins and who loses from adaptation? Who decides about adaptation? Are decision-making procedures accepted by those affected and do they involve stakeholders? Are there any distributional impacts of the climate change impacts or of the adaptation measures?
	Feasibility of implementation	What barriers are there to implementation? • Technical • Social (number of stakeholders, diversity of values and interests, level of resistance) • Institutional (conflicts between regulations, degree of cooperation, necessary changes to current administrative arrangements)
	Priority and urgency	How vulnerable are the water uses, the ecosystem and the region? Are there other trends to consider, e.g.. Demographic trends? When are the climate change impacts expected to occur? At what timescales does action need to be taken?

4. Adaptation policies in the Mediterranean countries: where do we stand?

Operational risks management (technical instruments)

Source: Simonet, 2011.



Legend of the X-axis: 1 : Non-existent and not planned ; 2 : planned but not yet in place; 3 : currently being drawn up and/or implementation still limited ; 4 : in place and implementation advanced ; 5 : in place and implementation highly advanced

4. Adaptation policies in the Mediterranean countries: where do we stand?

Operational risks management (technical instruments)

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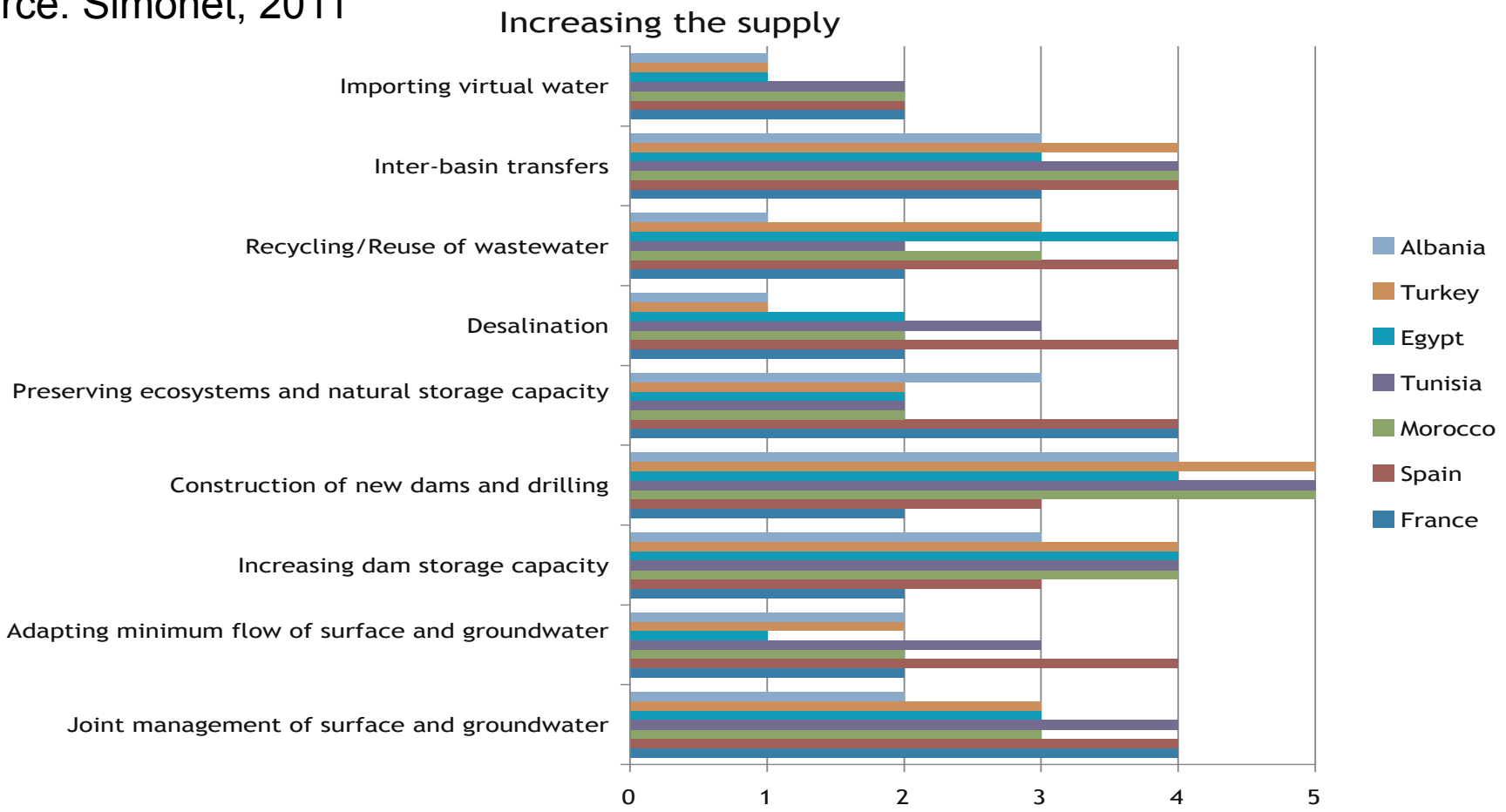

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Thank you for your attention

5. Q&A, Discussion

1) What types of measures are being implemented or favored in your country?

2) What are the challenges to implement water demand management measures in your country ?

3) Are the costs of the various solutions being estimated and taken into account for water planning? How?

4) How is uncertainty concerning future water supply considered for water planning? How are future water demands considered for water planning?