4rd SWIM Coordination Meeting
15th December 2014, Barcelona, Spain

WADIS-MAR

Water harvesting and Agricultural techniques in Dry lands:
an Integrated and Sustainable model in MAghreb Regions

WADIS-MAR Project

Water harvesting and Agricultural techniques in Dry lands: an Integrated and Sustainable model in MAghreb Regions

Prof. Giorgio GHIGLIERI, Project Coordinator (ghiglieri@unica.it)

State of the Art

Implemented by

UNIVERSITAT DE BARCELONA

OSS

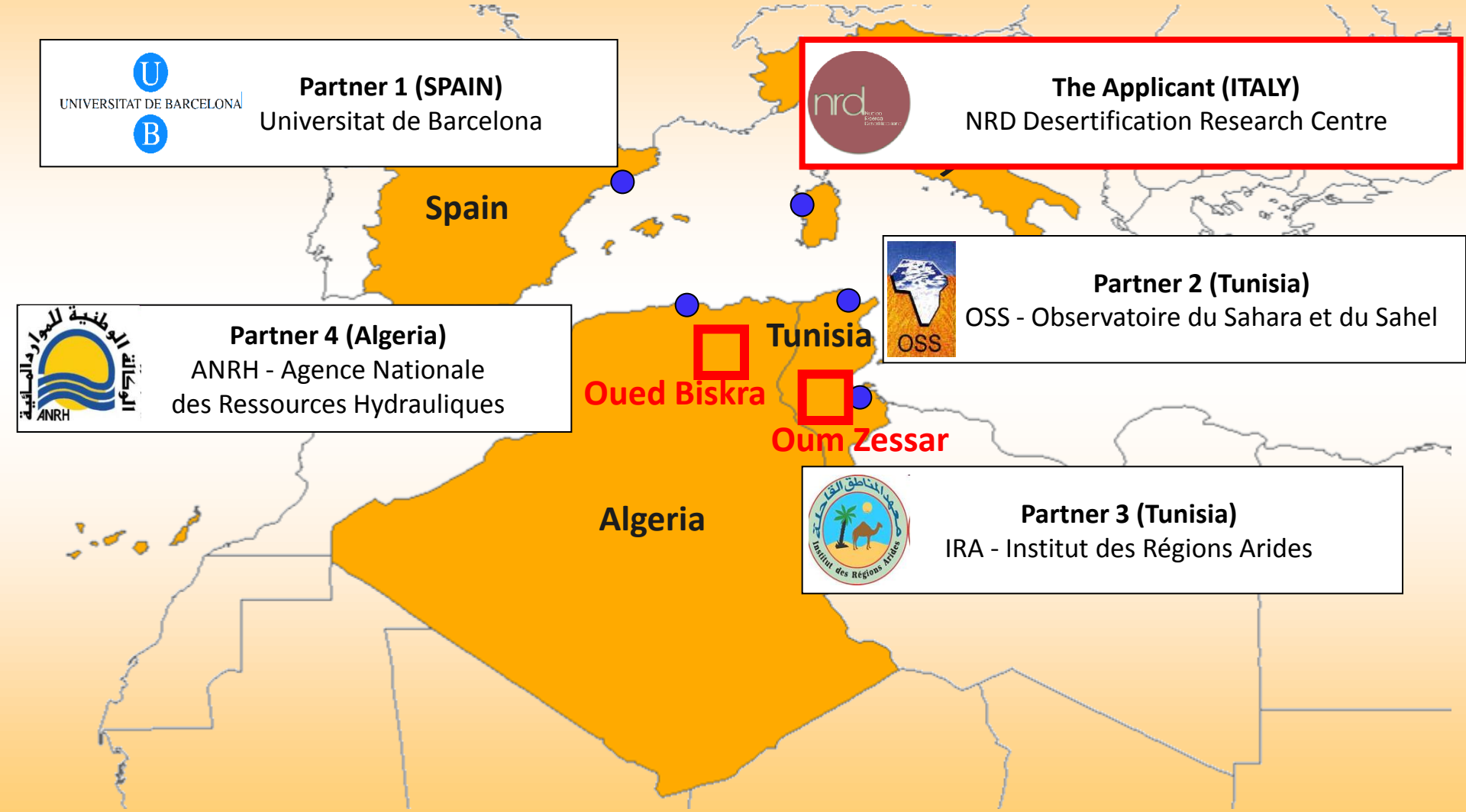
ANRH

WADIS-MAR Partnership, pilot area and duration of the project

WADIS-MAR
Water harvesting and Agricultural techniques in Dry lands: an Integrated and Sustainable model in MAghreb Regions

2012 2013 2014 2015 2016

18 months extension



Partner 1 (SPAIN)
Universitat de Barcelona

The Applicant (ITALY)
NRD Desertification Research Centre

Partner 2 (Tunisia)
OSS - Observatoire du Sahara et du Sahel

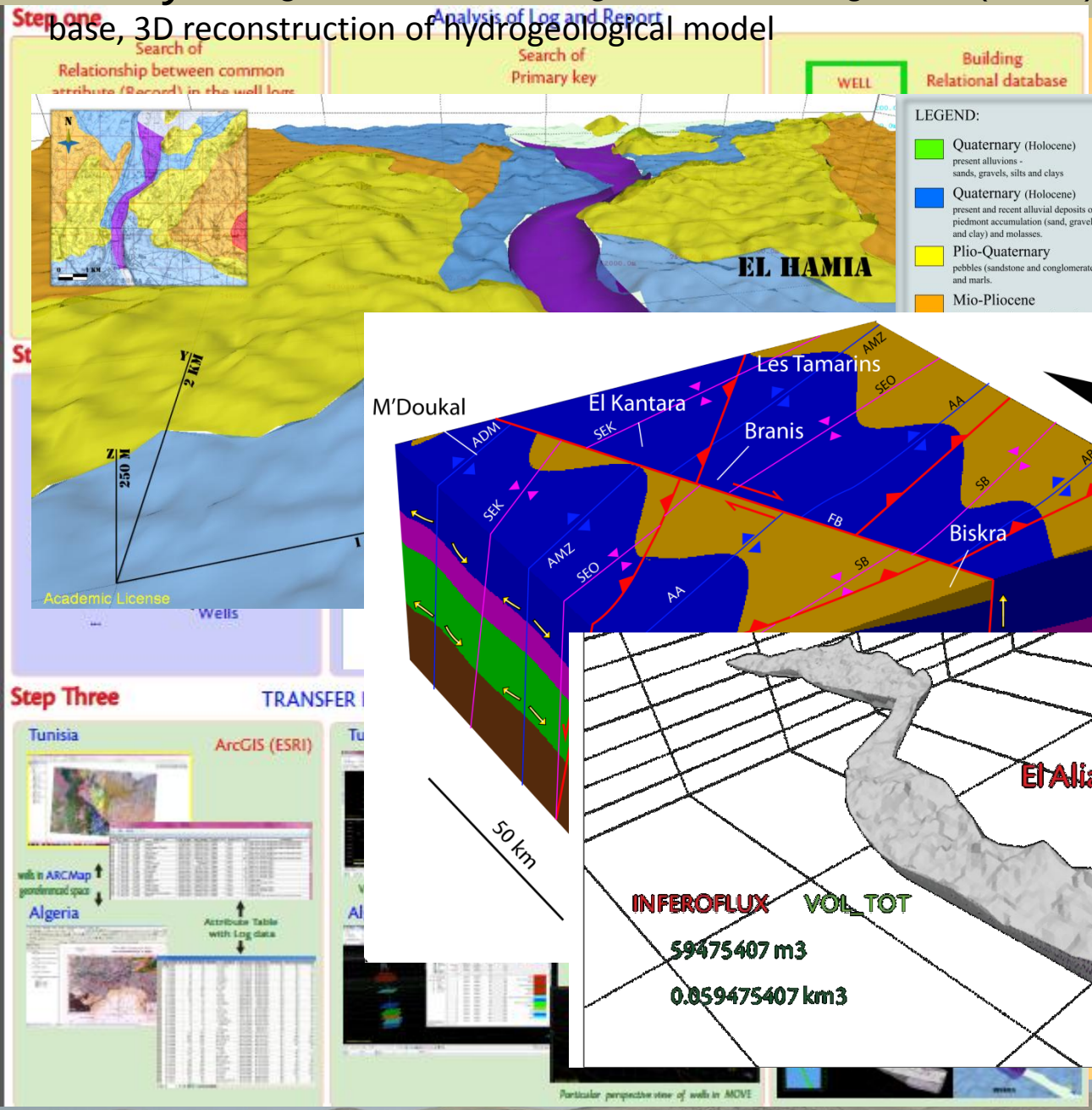
Partner 4 (Algeria)
ANRH - Agence Nationale des Ressources Hydrauliques

Partner 3 (Tunisia)
IRA - Institut des Régions Arides

WADIS-MAR project – short reminder

- General objective
  - to improve living standards of the rural population
  - To combat water scarcity/drought and overexploitation
  - to mitigate on-going desertification processes in the framework of climate change
- Specific objectives
  - to increase water availability through artificial aquifer recharge and evapotranspiration reduction
  - to enhance water quality by reducing pollution caused by unsustainable farm practices
  - to promote water efficient farming systems and the use of more stress-tolerant crops
  - To promote best agricultural practices
- Strategic Approach
  - To apply “soft” modern rehabilitation interventions and promote the use of modern techniques thorugh a bottom-up approach
- Areas
  - **Oued Biskra in Algeria**
  - **Wadi Oum Zessar in Tunisia**

Activity: Integrated Water and Agricultural Management (IWAM) System design. Geo-data base, 3D reconstruction of hydrogeological model



Activity: Field data survey and training

- Hydrogeological, hydrogeochemical and isoto the
gica mical

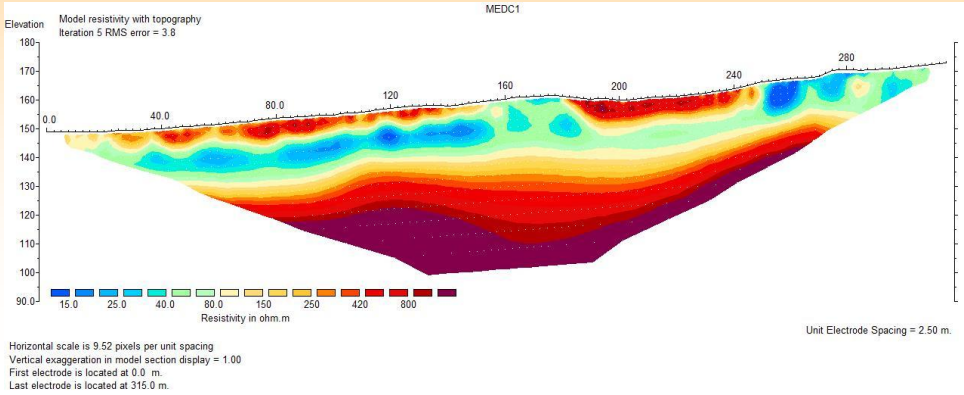
Activity: Field data survey and training

WADIS-MAR
Water harvesting and Agricultural techniques in Dry lands: an Integrated and Sustainable model in MAghreb Regions

Geophysical survey: Tunisia

-geo-electrical profiles

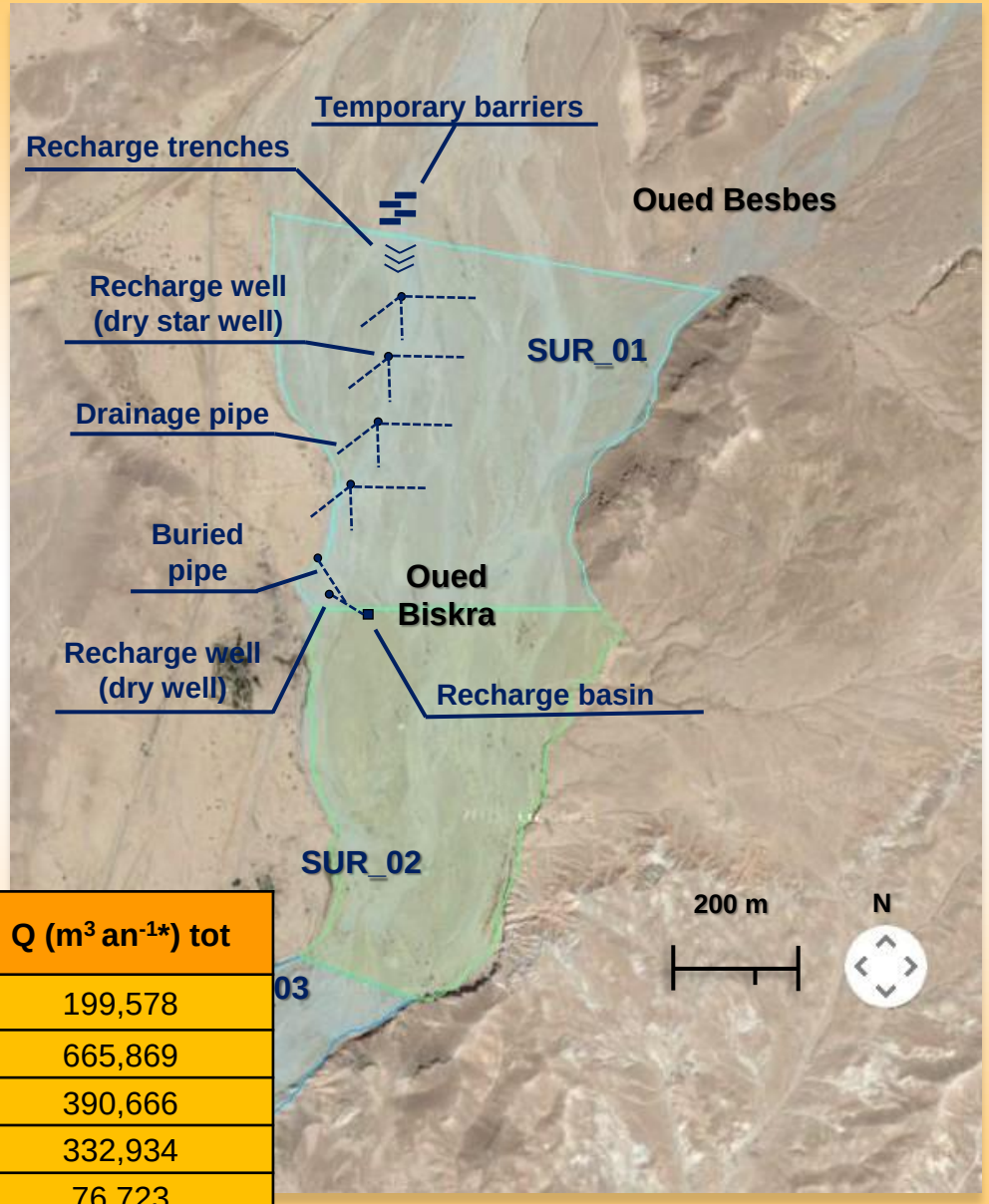
-Production of 2D resistivity tomographies for the definition of the stratigraphy of the area and the related saturation condition of the subsoil



Field and theoretical training

Activity: MAR System design

- ✓ ***Dry star wells*** – Recharge wells equipped with a recharge chamber and three buried drainage pipes aiming at improving the efficiency of recharge.
- ✓ ***Recharge trenches*** – It are arranged perpendicular to the flow direction, disposed in cascade in a v-shape manner, to capture the surface water flow.
- ✓ ***Temporary barriers*** – Weirs made of local stone, placed perpendicular to the flow direction.
- ✓ ***Dry wells*** – This system consists of coupled recharge wells, type dry well, equipped with a recharge chamber, which are connected through buried pipes to an infiltration basin.
- ✓ ***Recharge basin*** – It allows the infiltration of excess water channeled by buried pipes from the recharge wells.



Recharge systems	Q (m^3 an^{-1}*) per unit	Q (m^3 an^{-1}*) tot
Recharge trenches	66,526	199,578
Recharge wells (dry star well)	166,467	665,869
Drainage pipes	97,667	390,666
Recharge wells (dry well)	166,467	332,934
Recharge basin	76,723	76,723
	TOT	**1,665,771**

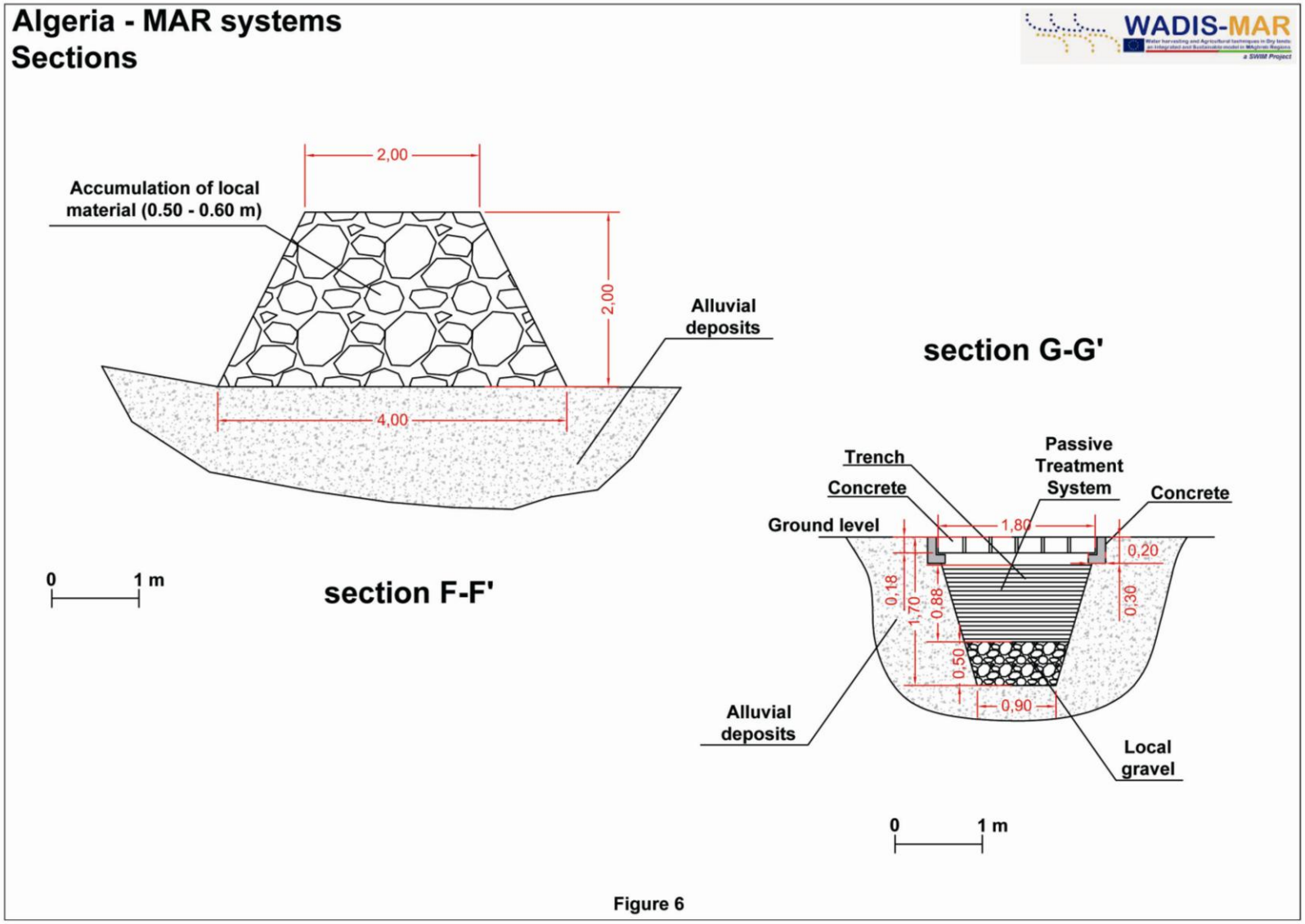

Algeria - MAR systems
Sections
WADIS-MAR
2,00
Accumulation of local material (0.50 - 0.60 m)
2,00
Alluvial deposits
4,00
0
1 m
section F-F'
section G-G'
Trench
Concrete
Passive Treatment System
Concrete
Ground level
1,80
0,20
0,18
1,70
0,88
0,30
0,50
0,90
Alluvial deposits
Local gravel
0
1 m

Figure 6

Algeria - MAR systems
Section C-C'

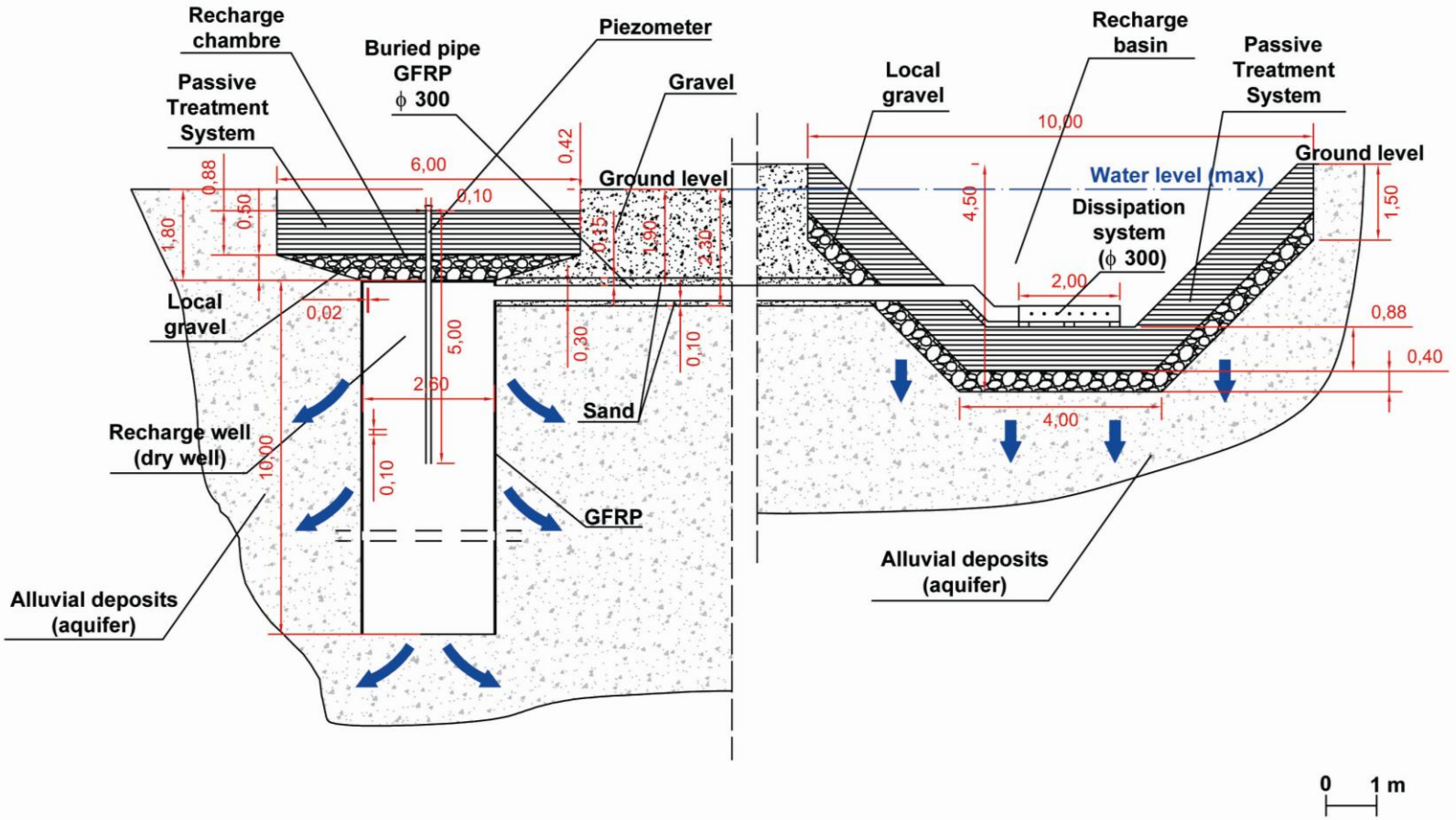
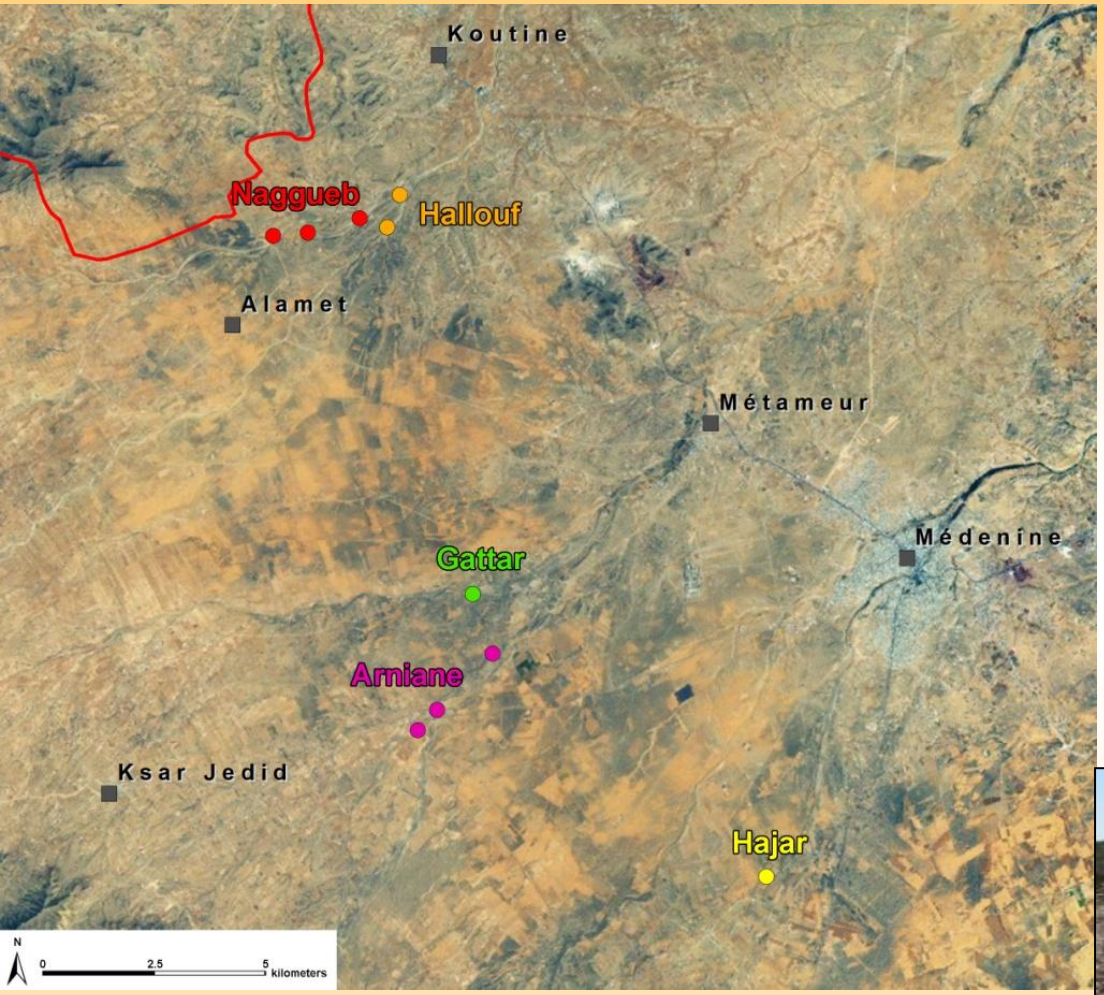


Figure 4

Activity: MAR System design

Tunisia: 5 intervention sites selected to recharge the Triassic aquifer



The design of the managed aquifer recharge system consist of 10 ***recharge wells***, equipped with recharge chambers, placed in the centre of the wadi upstream of existing gabion check dams which usually retains the flooding water during rainy events. We estimate overall an average of 1.2 Mm^3/year.

Recharge systems	Q (m^3 an^{-1}*) per unit	Q (m^3 an^{-1}*) tot
Recharge wells (injection well)	97,667	976,670
Recharge chambres	19,516	195,160
	TOT	1,171,830

Activity: MAR System design

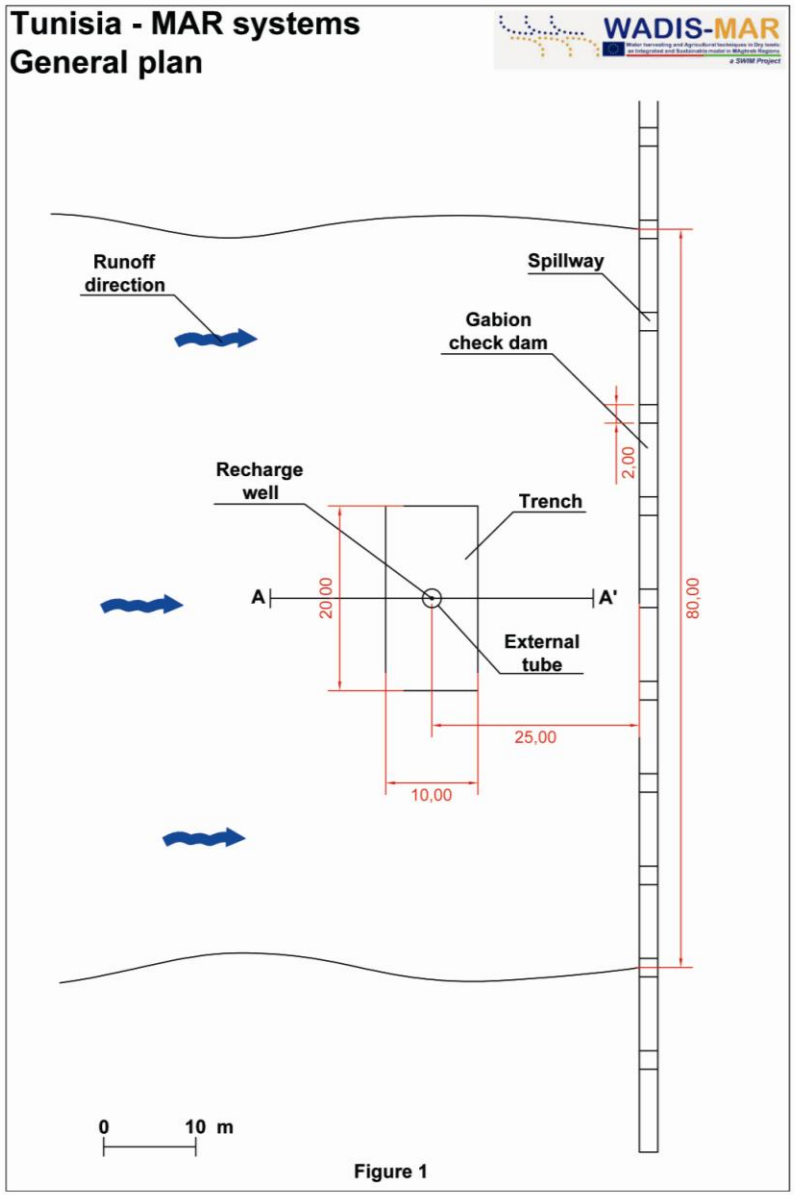


Figure 1

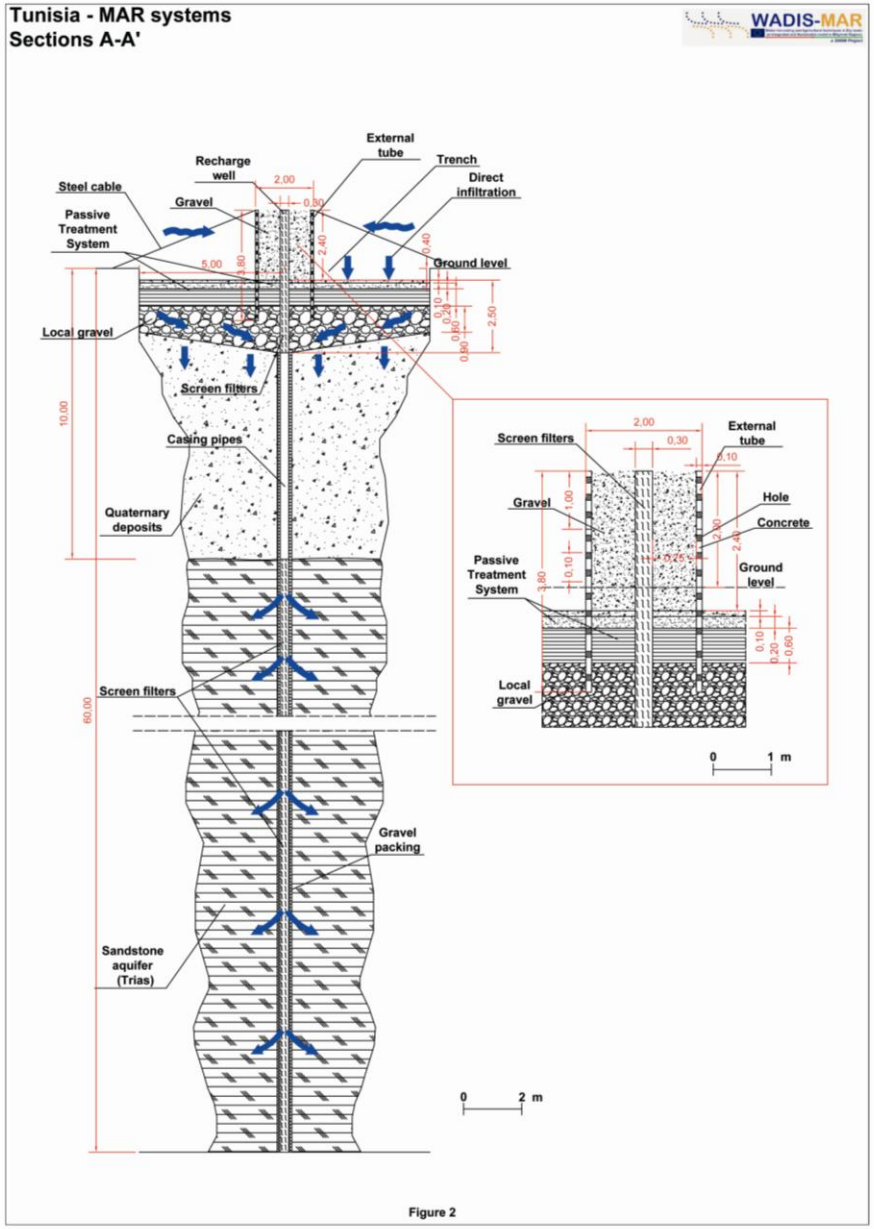


Figure 2

Activity: Public Participatory GIS PPGIS

Activities: Implementation of best agricultural practices

WADIS-MAR
Water harvesting and Agricultural techniques in Dry lands: an Integrated and Sustainable model in MAghreb Regions

Pilot site Bedoui: Evaluation of on-farm irrigation scheduling of drip irrigated vegetable crops under arid conditions of Tunisia (saline water (4.7 g/l) from a shallow well).

Irrigation scheduling methods

Two irrigation treatments based on the use SWB to estimate irrigation amounts and timing were compared to traditional farmer practice.

SWB methods consist in replacement of cumulated ETc when readily available water is depleted with levels of 100% (FI100) and 70% (DI70)

Farmer method (FM) consists in giving fixed amounts of irrigation water with fixed intervals from planting till harvest

Activities: Implementation of best agricultural practices

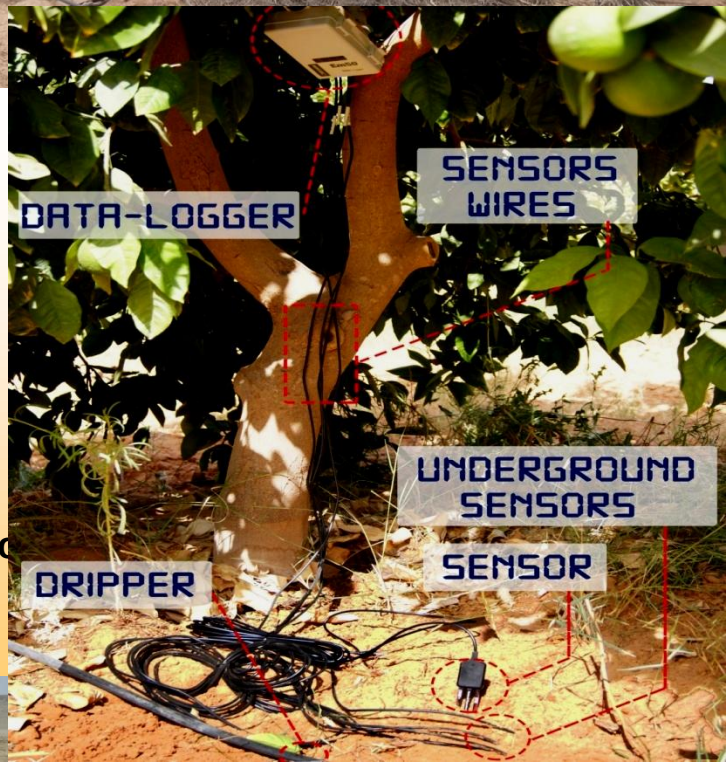
Activities: Evaluation of infrastructure performances

Pilot site Megarine, Médenine: Improved water productivity by deficit irrigation and irrigation scheduling: Implications for saving water in orange orchards.

Irrigation strategies were evaluated according to their impact on:

- **amount of irrigation water saving**
- **stomatal conductance**
- **yield, fruit size, juice content, total soluble solids TSS (Brix), equatorial diameter (ED) and polar diameter (PD) with a digital calliper**
- **water productivity**
- **soil water content (gravimetric method / Sensors)**
- **Soil salinity and water content**
- **Ground canopy cover, stomatal conductance**
- **Yield and its components for all crops were determined fo physiological maturity**
- **Water supplies (I+R) (using water meter and rain gauge)**
- **Water productivity (WP)**

WP (kg/m3) = Yield (kg/ha) / irrigation water (m3/ha)



Awareness raising and capacity building

WADIS-MAR
Water harvesting and Agricultural techniques in Dry lands: an Integrated and Sustainable model in MAghreb Regions

Regional Training Workshop

- (Database and Modelling, field data acquisition, etc.)

Interchange experience and South-South transfer results.

- Several national/governmental institutions where contacted and involved within project activities (i.e. CRDA in TN, ITDAS in DZ, ARPAS in Italy)

Medenine Dec. 2014

Interchange experiences South South

Dissemination

- Participated to several national and international scientific events
- Scientific Paper in ISI International Journals
- WADIS-MAR leaflets, document folders
- Undergraduate/graduate thesis, PhD research programs activated in Italy, Spain and TN
- Synergy/Interaction with other relevant international projects focusing in water governance issues (i.e. CADWAGO; MARSOL)

Major challenges and problems encountered

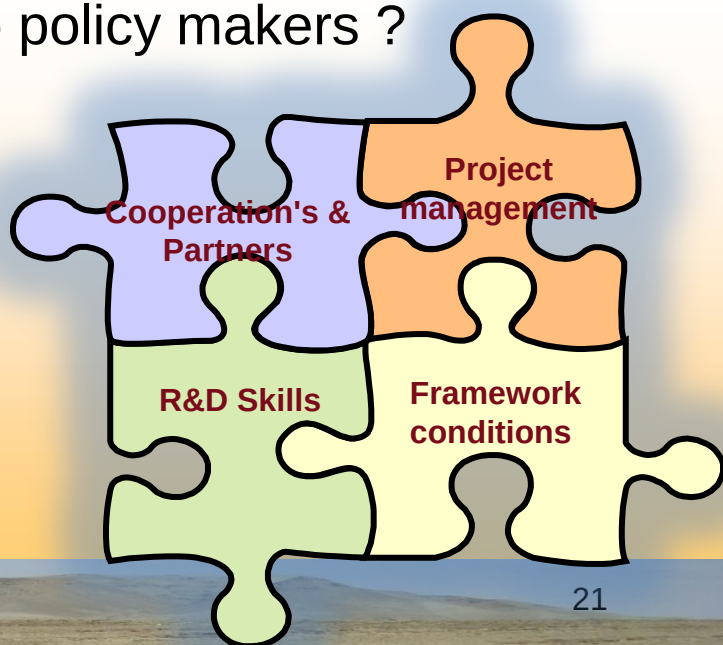
- Problems
  - Internal i.e.
    - Inception phase too long (almost a year)
    - Difficulty of partner's administration to manage the allocated budget (mission travel, tender management, works realization) (impact: almost 1 year of delay; status: not yet solved)
    - Non eligibility of TVA (impact: almost 1 year of delay; status: not yet solved)
    - The administrative/technical capacity of project partners lacks
      - technical planning has been made through the applicant's internal technical and scientific capacity
      - Partner's administrative procedures should always be verified carefully
    - Applicant's administration have cumbersome internal regulations
  - External i.e.
    - Political transition (i.e. in Tunisia)
    - VISA issuing (i.e. in Algeria: short term visas to be reissued every 3 months)
    - Logistics in Algeria: field activities carried out with armed escort
  - EU-related
    - . difficulty to comply EU rules/procedures for tender procurements
      - 6 unsuccessful tenders (in Tunisia), not possible to be applied in Algeria.
    - Partners do not have direct commitment with the EC → they are not directly empowered
      - EC regulations appear very "far" and cumbersome
      - Impact: difficulty in management of budget

Major challenges and problems encountered

- Challenges (related to EU water governance dilemmas)
  - Increasing groundwater resources availability and to improve the quality through technical intervention
    - WADIS-MAR → artificial aquifer recharge efficiency
    - WADIS-MAR → Water use efficiency (agric. sector)
  - Mitigating an unequal distribution of water in space\time
    - WADIS-MAR → decreasing conflicts, involvement of stakeholder in technical decision making (bottom up approach)
    - Gender: to ease woman engagement in WR management
  - Adopting technical/technological adaptation measures to face the increasing water scarcity both in the surface or sub-surface spatial domain
    - Rehabilitation of traditional WHT (i.e. wells, jessours and tabias)
    - Promotion of traditional cultures with an important economic values and support of crop diversification
  - soils quality (mainly salinization) → adopting conservative agricultural practices
  - Empowering and facilitating dialog among different stakeholder involved in the water resources governance
  - Transferring scientific knowledge

Lessons learnt

- The consortium consists of an optimal mix of academics/research and national/international partners;
- Cooperation among partners;
- Cooperation among institutions;
- Active participation of all stakeholders
- In order to have a long-term impact, the duration of donor projects needs to be expanded to ensure the set-up of flexible and stable institutions of cooperation channels
- How to communicate lessons learned to policy makers ?

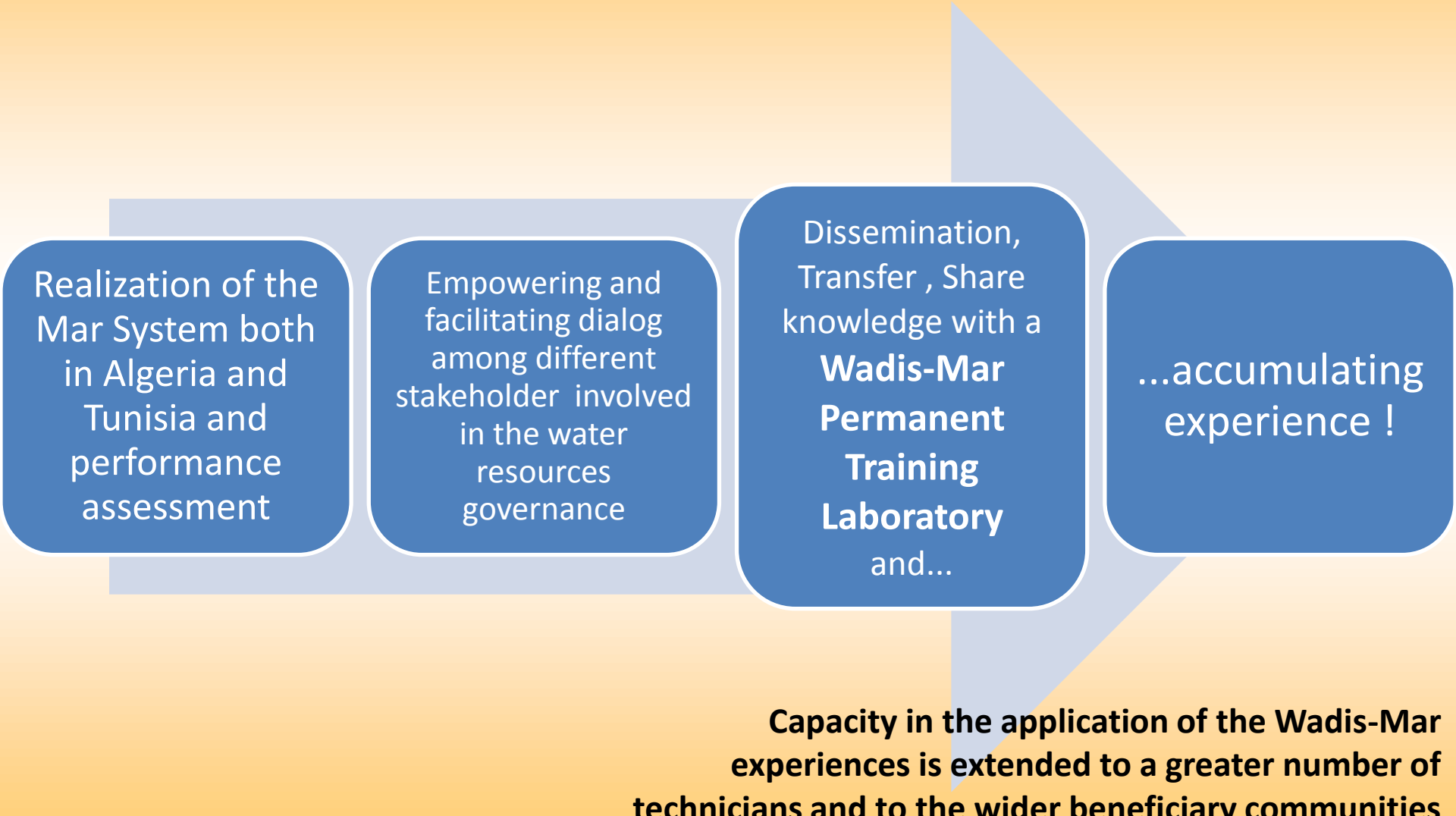


Replication potential of the project

- WM contribution is mainly technical
  - WHT in other sites are already replicated (TN→DZ) and elsewhere replicable
- WM approach creates capacities
  - mainly at early stage of the process (…… and later on to be applied!)
- WM acts within national legal framework/policy/strategy
  - In TN proposed interventions are CES compliant (n 95-70 du 17 juillet 1995)
- WM's contribute to water policy debate:
  - highlights the role of monitoring phase which is not actually emphasized at national level (both in TN and DZ)
  - Water quality: WM has specific dedicated activities
  - WM is enabling institutional connections among gov. institutions that are actully not collaborating (i.e. in DZ)
- WM is supporting, through the farmers, sustainable and successful irrigation management practices
  - → extensions of the experience at local level
  - Low cost and providing affordable products
    - i.e. rehabilitation of existing wells to be used for alternative activities than agriculture (Tunisia)
  - WM is actually setting up its activity of south-south experience sharing
- Proposed solutions are technically and economically sustainable

To be done until the end of the project

Planned activities, though the follows, to enhance dissemination and uptake /replication potential of the results.



Capacity in the application of the Wadis-Mar experiences is extended to a greater number of technicians and to the wider beneficiary communities

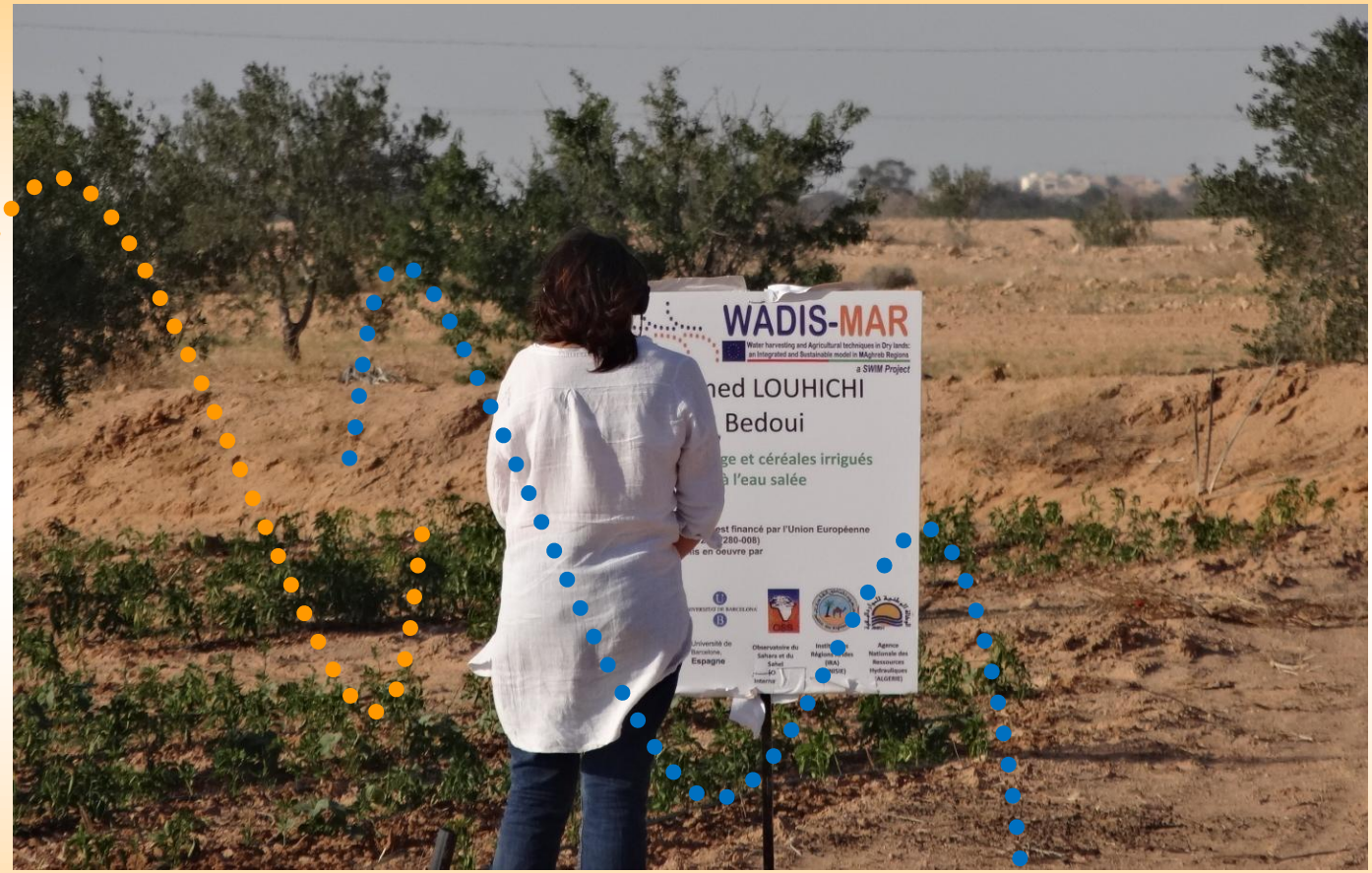
UNISS

UNIVERSITAT DE BARCELONA

Observatoire du Sahara et du Sahel

IRA

ANRH



For additional information please contact:

wadismar@wadismar.eu ; ghiglieri@inica.it

or visit www.wadismar.eu

Thank you for your attention