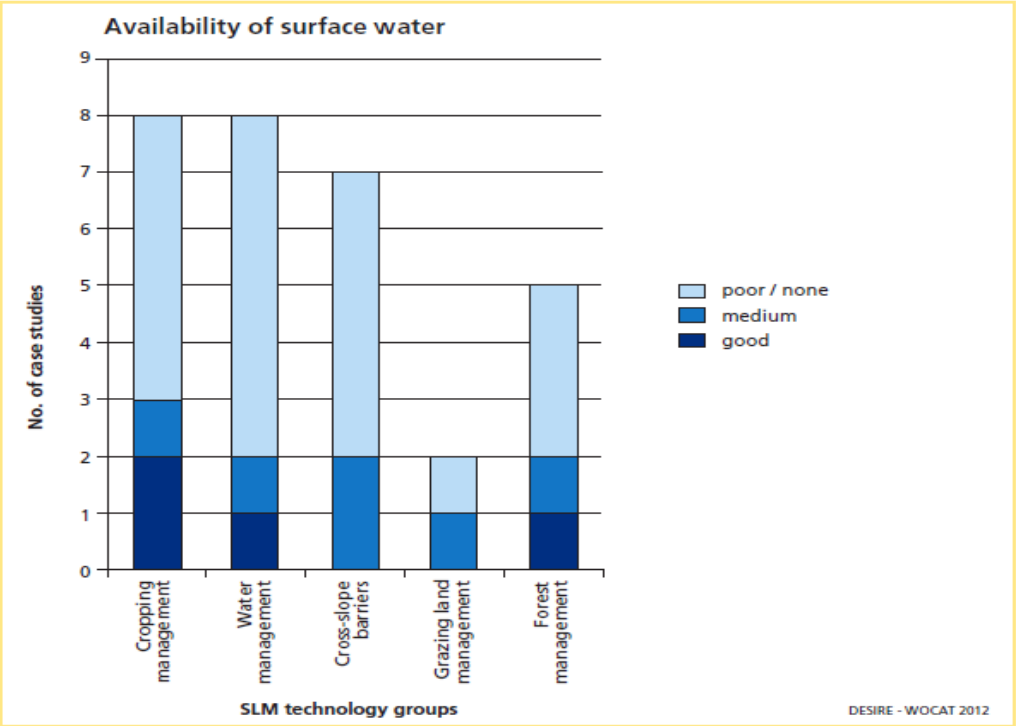
February 2012
Info-brief 11

Greener solutions from the DESIRE Project

Addressing the 6th World Water Forum

Marseilles, France, 12-17 March 2012

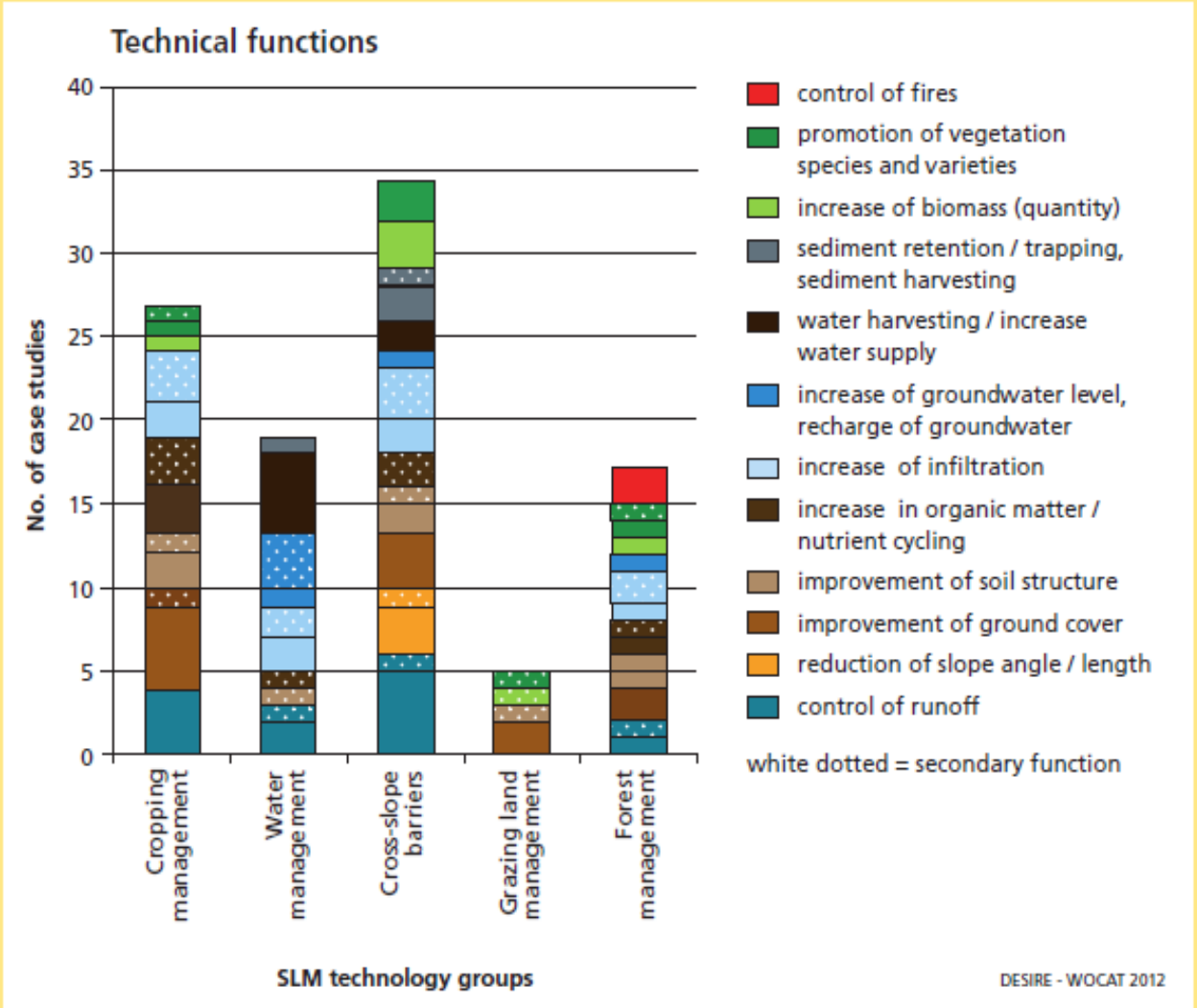
DESIRE has identified and documented various water-related solutions for the sustainable management of drylands. Following the WOCAT terminology used in DESIRE, these form part of the group of Sustainable Land Management (SLM) technologies for water management. Surface water is generally scarce in the DESIRE study areas (see graph below). In response to this scarcity, the technologies developed in DESIRE include rain water harvesting, improved irrigation efficiency and provision of drinking water for domestic and livestock use. These techniques are suitable for different land uses, and are mostly related to crop production through irrigation and water harvesting or water supply systems. There can be combinations of uses for the same technology, such as provision of irrigation and drinking water. The water management technologies mainly address water degradation phenomena, like aridification, but may also address other types of degradation, like chemical soil deterioration (in the case of salinization). On steep slopes erosion and water loss are the main degradation problems requiring mitigation action in the DESIRE study areas.



Availability of surface water in relation to the SLM technology groups. Source: Schwilch et al. (2012)

Sustainable Land Management (SLM) technologies

The SLM technologies documented and tested in DESIRE provide solutions for water-related problems in drylands through several functions, including runoff control, increasing infiltration, groundwater recharge and increasing water supply or water harvesting.



Technical functions in relation to the SLM technology groups. A technology may fulfil several types of functions and the total sum of items displayed is therefore more than the total of 30 technologies. Source: Schwilch et al. (2012)

Runoff control is a key function addressed by most of the SLM technology groups. Related to this function, improving cover and increasing infiltration play a major role, also in order to reduce soil and water losses. Water management technologies in DESIRE were mainly applied on flat to gentle slopes, in response to fertility depletion, vegetation degradation or salinization.

Methodology and questionnaires

The WOCAT (World Overview of Conservation Approaches and Technologies, www.wocat.net) network provides tools for sharing knowledge in land management. The WOCAT questionnaires were applied in DESIRE to document and evaluate SLM technologies and approaches in a comprehensive and standardised way.

DESIRE water management technologies:

Jessour, Tunisia
An ancient runoff water harvesting technique widely practised in the arid highlands

Tabia, Tunisia
Earthen dyke for water harvesting used in the foothill and piedmont areas

Water harvesting from concentrated runoff, Spain
Water harvesting from intermittent streams to nearby fields and terraces during runoff events

Transport of freshwater from local streams, Greece
To replace the traditional form of irrigation (by pumping saline groundwater from wells)

Recharge well, Tunisia
A drilled hole used to allow the direct injection of floodwater into the aquifer.

Drip irrigation, Turkey
Minimum use of water and labour for the optimum irrigation of plants in arid and semi-arid regions

Drip Irrigation, Russia
Gradually applied water into the zone around the steam of the irrigated plant.

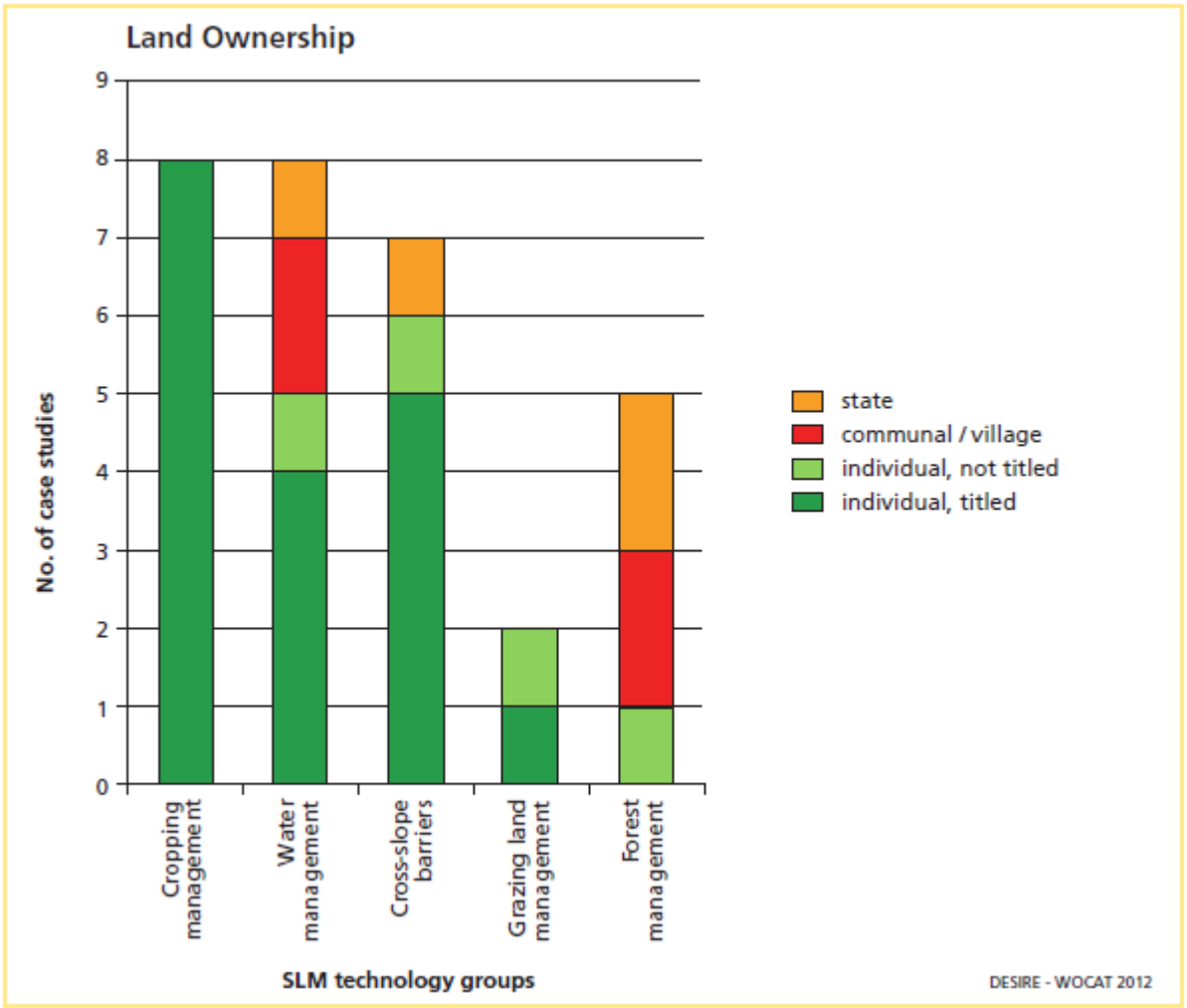
Roof rainwater harvesting system, Botswana
Galvanised iron roof material feeding water into an underground water tank.

The WOCAT questionnaires assessed the tolerance and sensitivity of an applied SLM technology to **climate change**, as perceived by the local SLM specialists. Technologies appeared most sensitive to seasonal rainfall decrease, floods and droughts or dry spells. Water management technologies were assessed as sensitive to droughts, but even more so to floods. Therefore it is a special challenge to have water harvesting structures which are strong enough to withstand the power of floods. In general, most of the technologies are tolerant to the expected climatic variations. In a few areas there might even be an opportunity for increased rainwater availability.

Choices and constraints with SLM technologies

Land users applying water management SLM technologies are mainly small- to medium-scale land users. Almost all DESIRE SLM technologies are applied at the individual or household level, except those of the forest management group. This indicates that the SLM technologies developed and documented in DESIRE are within reach of these users, and that within the smallholder sector, that generates half of the global agricultural production, there is significant and underestimated worldwide potential for investment, innovation and conservation.

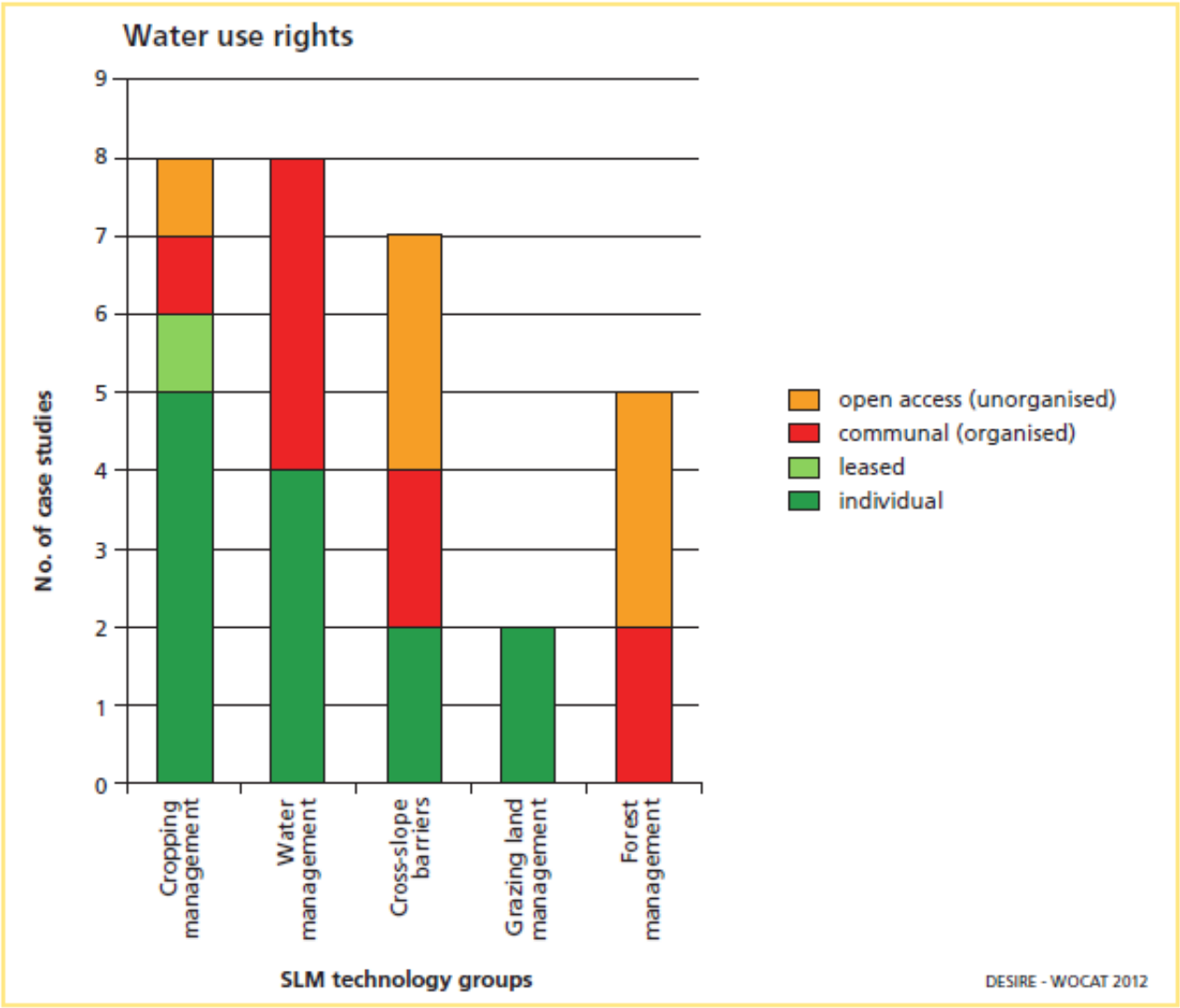
Some SLM technologies for water management developed in DESIRE are in communal and state ownership. This is because these technologies, such as dams and water supply systems, are often large-scale projects carried out by state or communal bodies on public land. An example of this is the case study in Tunisia where the well technology used to recharge the deep groundwater aquifers is mainly exploited by the government agencies. Private irrigated farms are also benefiting indirectly by increased groundwater availability.



Land ownership in relation to the SLM technology group. Source: Schwilch et al. (2012)

Rights to water use

Water rights are regulated for the water management SLM technologies that were tested in DESIRE, either in the form of individual rights or by communal rights.

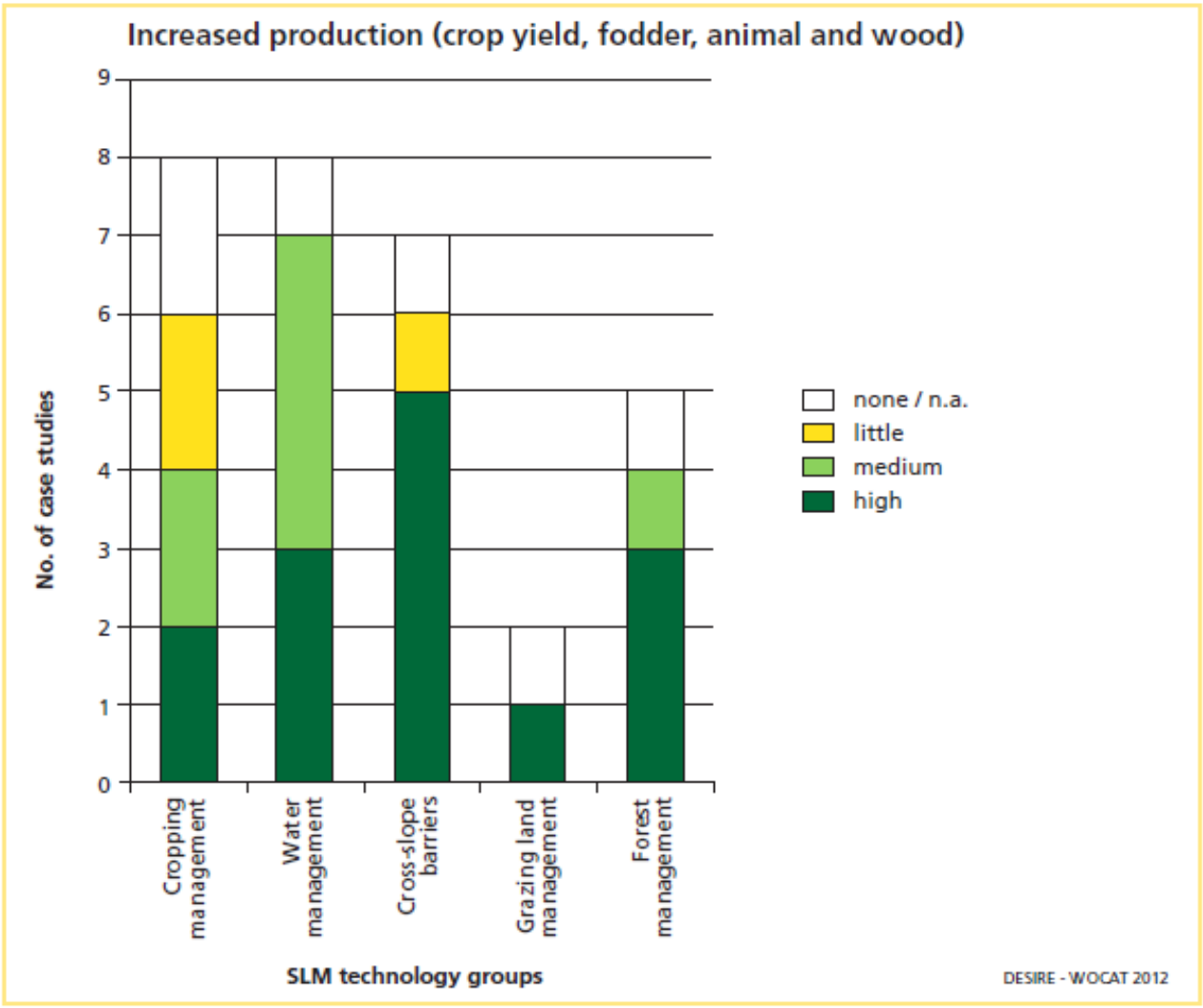


Water use rights in relation to the SLM technology groups. Source: Schwilch et al. (2012)

Difficult situations may arise in open access regimes, which potentially cause conflicts over water use, for instance due to the unequal withdrawal of irrigation water from rivers. In the design and implementation of water solutions using SLM technologies the organisation of water rights should be taken into account. This can be done in the structured participatory learning process that is part of the DESIRE approach. More about using the WOCAT methodology with stakeholders can be found in DESIRE Info-brief 8, "Using land for the benefit of all", to view or download on the DESIRE Harmonised Information System http://www.desire-his.eu/en/booklets-a-factsheets/793-info-brief-8-using-land-for-the-benefit-of-all

Technologies for increasing production

The DESIRE water management SLM technologies resulted in increased agricultural production in all case studies. Water management technologies appeared to be costly, but in many cases also higher benefits were obtained, or the investment did neither reduce nor increase the overall farm income.

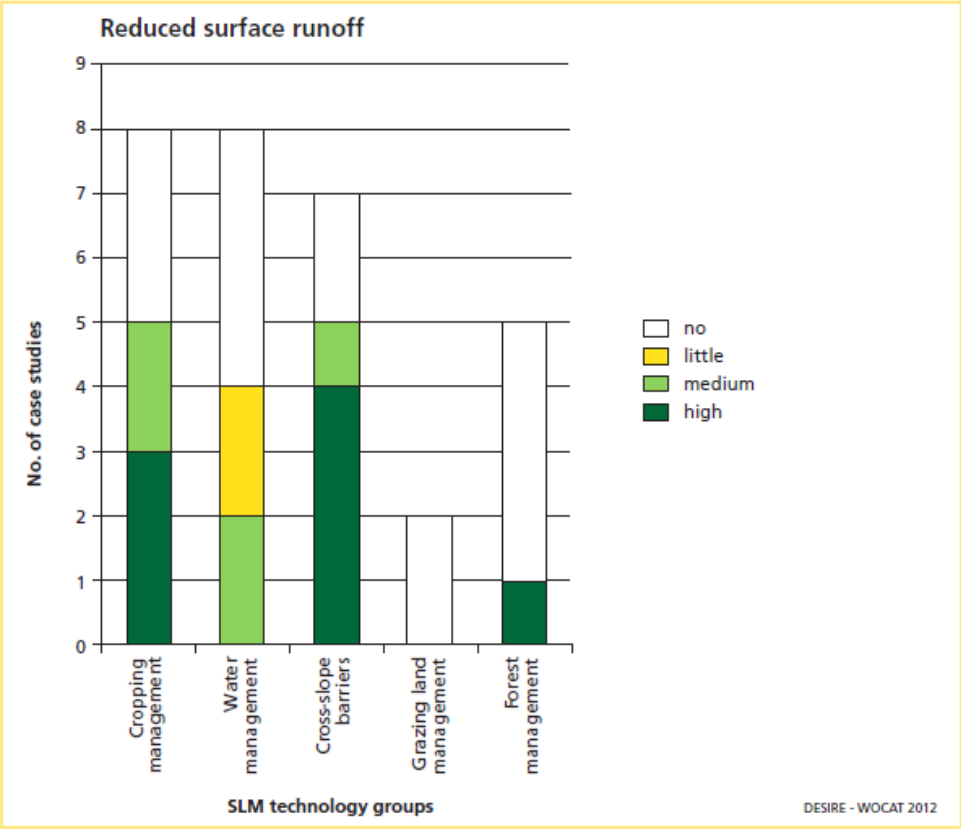


Agricultural production. Source: Schwilch et al. (2012)

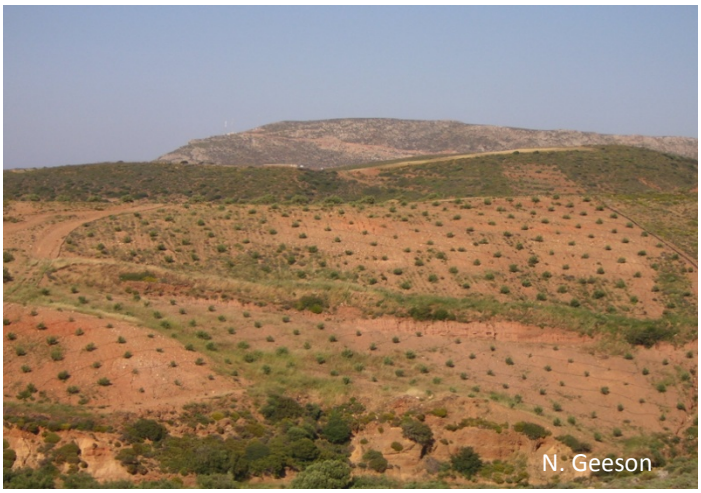
In southern Spain cisterns store water, used for drip irrigation of salad crops

Technologies to reduce surface runoff

Reducing surface runoff is a major concern in drylands in order to conserve rainwater for crops and vegetation, especially during short periods of intense rain storms. The most effective technologies for runoff control on cropland tested in DESIRE were found to be improved cropping management and cross-slope barriers.



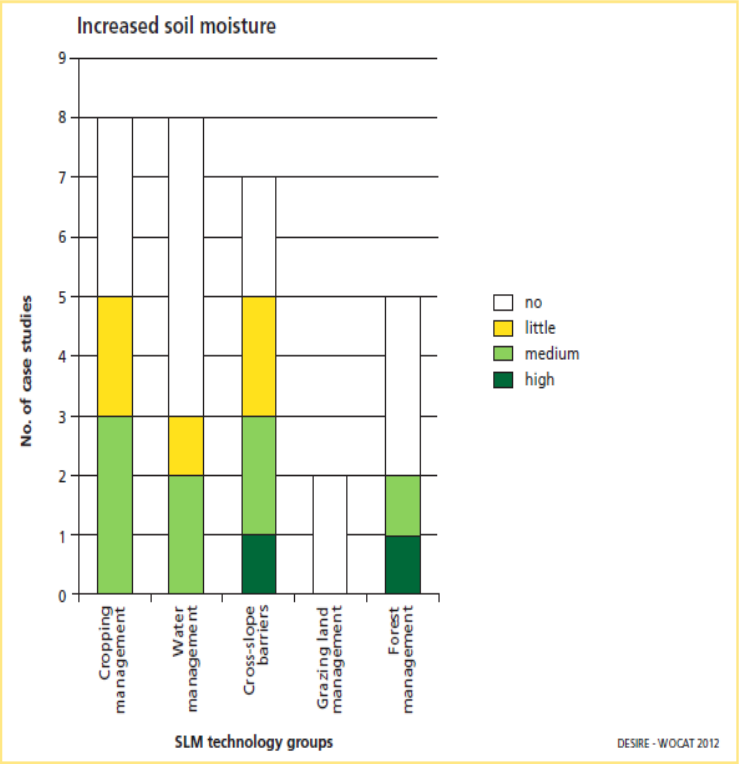
Reduced surface runoff. Source: Schwilch et al. (2012)



Unsustainable land management practice: severe surface runoff and soil erosion on the island of Crete, where land had been cleared for irrigated olives on steep slopes, but without terraces or barriers

Technologies to increase soil moisture

Drylands usually suffer from extreme evaporation losses, which accounts for 40-70% of the already scarce rainfall (Liniger et al., 2011), although evaporation losses are often not seen as a problem. Several of the SLM technologies documented in DESIRE have potential to improve **soil moisture** through in situ conservation of rainwater or irrigation water.



Increased soil moisture related to SLM technology groups.
Source: Schwilch et al. (2012)

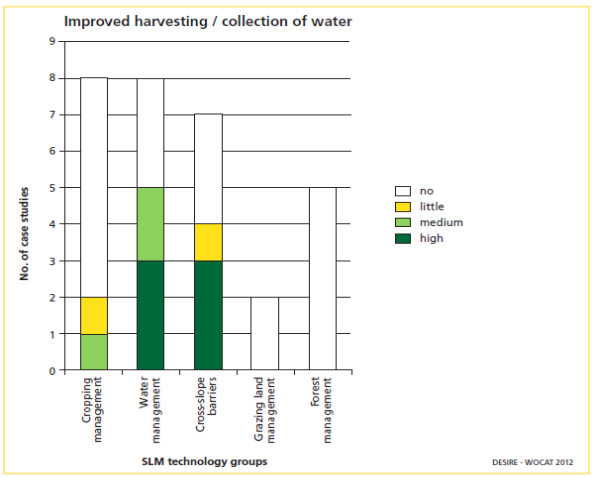
Cropping management and cross-slope barriers perform better in this respect than water management technologies. Improved soil cover management also appeared to reduce evaporation losses. Increase of soil moisture can also be combined with improved water harvesting techniques.

Soil cover with Oxalis helps to increase soil moisture. Photo: Costas Kosmas, Agricultural University of Athens

Water solutions

Water solutions improving water harvesting and the collection of water

Several SLM technologies tested in DESIRE improve the harvesting and collection of water (e.g. the jessour and tabias in Tunisia). The best performing of these are the technologies actually aiming at improving available water, such as the water management technologies and the cross-slope barriers, especially in the areas where availability of surface water was poor before the technology implementation.



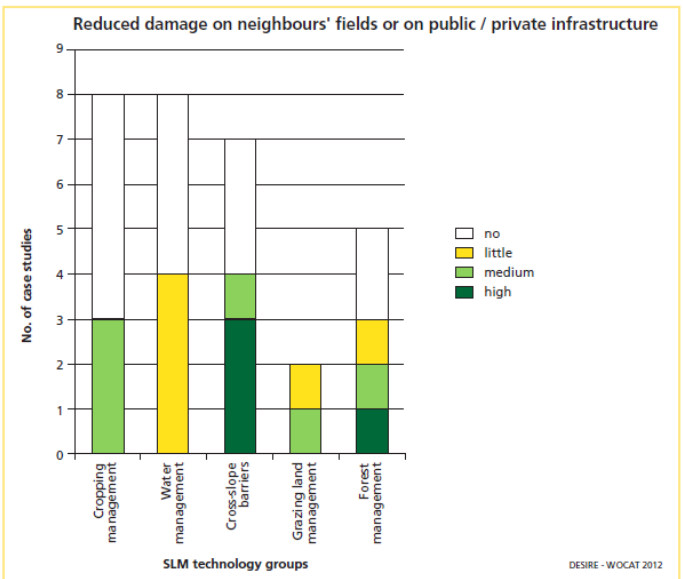
Improved water harvesting. Source: Schwilch et al. (2012)

Jessour and tabia in Tunisia. Source: IRA-Médénine.

Water solutions for reduced downstream flooding and damage

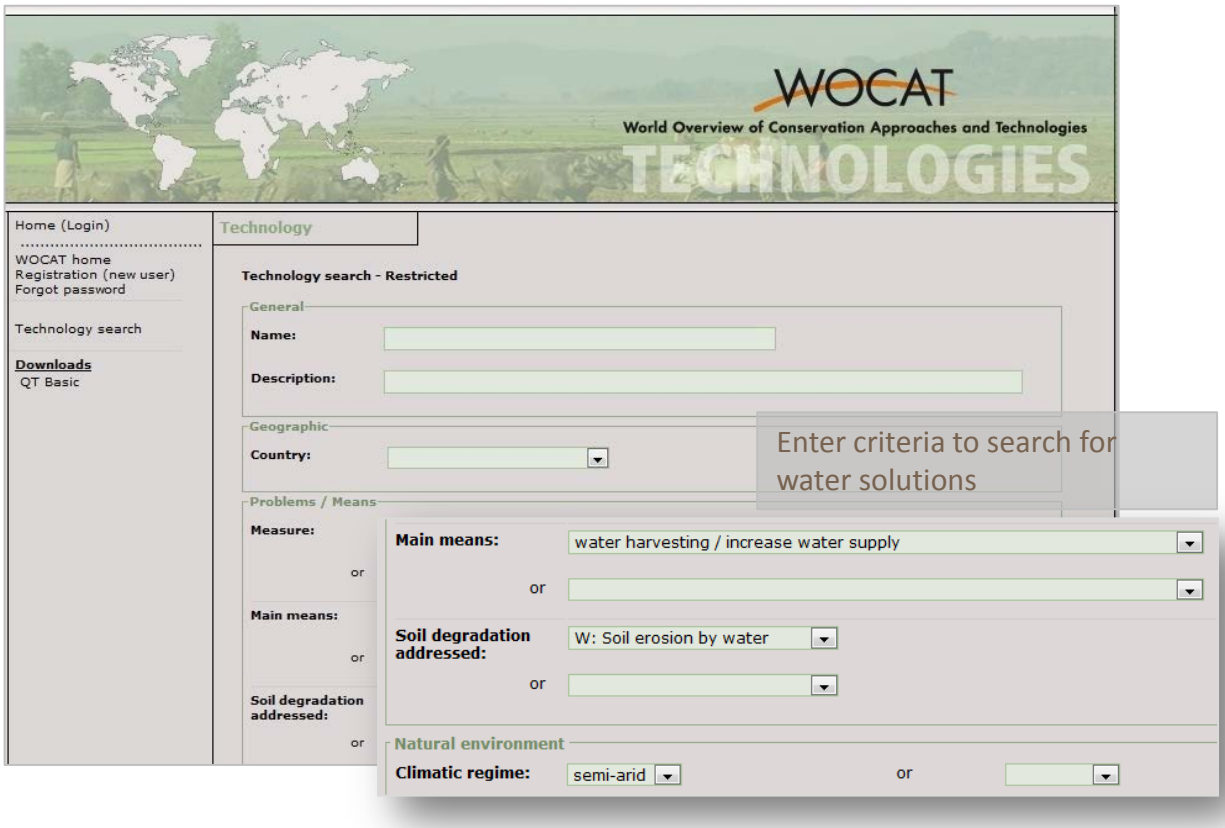
Several groups of SLM technologies tested in DESIRE made some contribution to reducing floods: cross-slope barriers, grazing land practices and forest management practices. For reducing off-site damage to neighbour's fields and public or private infrastructure, cross-slope barriers and forest and cropping management appeared the best performing SLM technologies tested in DESIRE. However, all technology groups showed some reduction of damage off-site, demonstrating that damage caused by excessive water can also be responded to by land management, rather than by water management alone.

Effects of SLM technologies on reduced damage on neighbours' fields or on public / private infrastructure. Source: Schwilch et al. (2012)



Conclusions

DESIRE has identified and documented various water-related solutions for the sustainable management of drylands. These can be retrieved freely from the online WOCAT Databases on Technologies and Approaches: **http://tinyurl.com/6vmjxos**



Further information about the DESIRE Project and the SLM approaches and technologies may be found on the on-line **DESIRE Harmonised Information System**, see: **http://www.desire-his.eu/**.

Written by Gudrun Schwilch and Simone Verzandvoort. Layout by Nichola Geeson

Based on extracts from the DESIRE-WOCAT book "Desire for greener land - Options for Sustainable Land Management in Drylands" (in press, University of Bern - CDE, Alterra, Wageningen UR and ISRIC - World Soil Information) Edited by Schwilch et al. (2012)

Reference: Liniger, H.P., R. Mekdaschi Studer, C. Hauert and M. Gurtner. 2011. Sustainable Land Management in Practice – Guidelines and Best Practices for Sub-Saharan Africa. TerrAfrica, World Overview of Conservation Approaches and Technologies (WOCAT) and Food and Agriculture Organization of the United Nations (FAO)

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http://www.desire-project.eu

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