## Water harvesting in agriculture (runoff farming)

A water cellar in China.

Water harvesting is the collection of runoff for productive purposes. Instead of runoff being left to cause erosion, it is harvested and utilized. In the semi-arid drought-prone areas where it is already practised, water harvesting is a directly productive form of soil and water conservation. Both yields and reliability of production can be significantly improved with this method.

Water harvesting (WH) can be considered as a rudimentary form of irrigation (in some areas water harvesting for agriculture is called runoff farming). The difference is that with WH the farmer (or more usually, the agro-pastoralist) has no control over timing. Runoff can only be harvested when it rains.

The basic water harvesting systems involve an external contributing area to induce runoff. This area is physically or chemically treated for maximizing runoff. The water is diverted into a receiving area comprising of cultivated plots, individual trees or small terraces. The contributing area may lie in the agricultural field (a system sometimes referred to as "conservation bench terrace") or outside the field in the natural watershed system. In the Avdat photo the small valley is a water-shed system experiencing flash flood once or twice a year. The size ratio between the contributing and the receiving areas is determined by the expected rainfall events, crop water requirements,

soil characteristics and topography. The resulting yield increase in the receiving (crop) area is proportional to the amount of water gained.

In regions where crops are entirely rainfed, a reduction of 50% in the seasonal rainfall, for example, may result in a total crop failure. If, however, the available rain can be concentrated on a smaller area, reasonable yields will still be received. Of course in a year of severe drought there may be no runoff to collect, but an efficient water harvesting system will improve plant growth in the majority of years.

Sources: Critchley, W, Siegert,K. Chapman,C. and Finkel, M (1991). Water harvesting. FAO, Rome.

and Plant stress

Other resources:

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R. K. Sivanappan (1995). Technologies for water harvesting and soil moisture conservation in small watersheds for small-scale irrigation. In Irrigation Technology Transfer in Support of Food Security. (Water Reports - 14), FAO, Rome.

Prinz, D. and Malik, A.H (2003). Runoff farming. WCA, InfoNET.

Examples of water harvesting and moisture control measures provided by WOCAT:

(To get full access please visit and register at http://cdewocat.unibe.ch/wocatQT/)

| Technology code | Country | Name | Description |
|---|---|---|---|
| BOT04 | BOT | Roof rainwater harvesting system | A roof of galvanised iron (corrugated iron) with the dimensions 7mx6m is constructed on a support of... |

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|---|---|---|---|
| CHN40 | CHN | Zero Tillage | No tillage with residual mulching is developed to minimally disturb soil structure, directly to sow ... |
| CHN41 | CHN | Subsoiling | Subsoiling with mulching is one of the conservation tillage technology, it is to deep till to loose ... |
| CHN42 | CHN | Auto-Flowing Slurry Dam | Falling water filled dams distribute widely in the middle reaches of the Yellow River, they are used... |
| CHN45 | CHN | Zhuanglang loess terraces | The Loess Plateau in north-central China is characterised by very deep loess parent material (up to ... |
| CHN46 | CHN | Small Watershed Comprehensive Development | Over several decades of SWC practices, a successful experience of SWC has been concluded, that is Sm... |
| CHN47 | CHN | Check Dam | Check dams are built in the gully systems to harvest water and sediment. Usually many check dams are... |
| CHN49 | CHN | Caragana Korshinskii Planting a kind of SWC vegetative technology | Caragana korshinskii is a kind of perennial and drought resistant shrub being used to protect soil f... |
| ERI001f | ERI | Irrigation de crue | L'irrigation de crue a une longue histoire en Erythrée et est encore à la base des moyen d'exi... |
| ETH01 | ETH | Trashlines | Trashlines are constructed seasonaly by the family members using maize and/or sorghum straws. It has... |
| ETH037f | ETH | Irrigation par les crues et le ruissellement | L'utilisation agricole du ruissellement et des crues est une pratique traditionnelle |

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|---|---|---|---|
| | | | de récolte d... |
| ETH04 | ETH | Hillside Terracing | Hillside terraces are up to 1 metre wide and constructed at about 2-5 m vertical inteals. Hillside t... |
| ETH10 | ETH | Trashlines | Trashlines are formed of sorghum, maize or teff straw placed in to form a rectangular basin. The mai... |
| ETH13 | ETH | Area closure | The degraded land is closed from human and animal interfrances for at least 3-5 years. Inorder to en... |
| ETH24 | ETH | Stone faced level bund | Description:- is constructed from soil embankment at the upper part. The layer of regular sheped st... |
| ETH34 | ETH | DireDawaTraditional Checkdam | It is an enbankment placed in the gully. It is constructed with stones. The purpose is to conserve a... |
| ETH35 | ETH | Chat Ridge bund | A contour line is maked and a pit (trench) is dug and the soil embanked on about 75x50 cm. Chat cutt... |
| ETH37 | ETH | Runoff/floodwater farming | Flood water and runoff water is diverted by means of channel/ditches and conveyed to cultivated fiel... |
| ETH38 | ETH | Sweet Potato Ridge | Sweet potato ridge are constructed from the soil dug out of the furrow. Farmers make the furrow and ... |
| ETH39 | ETH | Earth checks for Gully reclamation | Active deep gullies are plugged by digging earth from the bottom as well as gully sides and embanked... |
| ETH40 | ETH | Rehabilitation of degraded lands | The SWC technology comprises a |

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|---|---|---|---|
| | | | combination of measures, which include agronomic, vegetative, structu... |
| ETH45 | ETH | Microcatchments and ponds | Microcatchments for crop fields involve the construction of physical measures which trap rain water ... |
| IND03 | IND | Sunken streambed structure | Dohs are rectangular excavations in seasonal streambeds, which are intended to capture and hold runo... |
| IND08 | IND | Farm pond | A farm pond comprises of excavated portions of 12 x 12 x 3 m with the steps at 0.6m depth each. The ... |
| IND09 | IND | Holistic demonstration | Holistic demonstration was taken in the upper reach, middle reach and lower reach (2 hectares each) ... |
| IND14 | IND | Forest catchment treatment | Forest catchment treatment aims to achieve production and environmental benefits through a combinati... |
| IND17 | IND | Dug-Out Well | The area is located at the foot-slopes on the major drainage line of the watershed. The technology a... |
| KAZ04 | KAZ | Water-conservation technology at cultivation of the cotton in south. K | It is applied for watering on furrow at ploughed cultures. It is intended for decrease in irrigatin... |
| KEN031f | KEN | Travail du sol de conservation à grande échelle | Le travail du sol de conservation (ou zéro labour) sur les exploitations céréalières commerciale... |
| KEN11 | KEN | Road runoff system - Mwingi | Diversion channel to harvest run off water from the road catchment. Individually constructed and mai... |

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|---|---|---|---|
| KEN13 | KEN | Pitting - Machakos experience | The pitting is started at the top of the eroded slope or below a cutoff drain which interced all run... |
| KEN19 | KEN | Retention ditch Murang'a | constructed at zero gradient with closed ends, wide and deep to hold all expected runoff. The purpos... |
| KEN20 | KEN | Kitui Sand dams | The dams are usually constructed where there is a rock bar in the river bed. The dam wall is raised... |
| KEN22 | KEN | Water Harvesting and Enlarged Structures | A soil bund for soil erosion reduction. Achieved by excavation of ungraded channels which are used f... |
| KEN31 | KEN | Conservation Tillage for large scale cereal production, Kisima, Kenya | Description. Use of tractor-drawn equipment to minimise soil disturbance when growing wheat and bar... |
| KEN32 | KEN | Water harvest | Water harvest enhances extra moisture and reduces risk of crop failure. It can either be external or... |
| MEX002 | MEX | Land reclamation with native Agave and trees through participative action for economical benefits | Rehabilitation of degraded land is done using native agave (Agave inaequidens) and native (mainly) t... |
| NEP13 | NEP | Rehabilitation of degraded communal grazing land | An area of heavily degraded grazing land was rehabilitated by establishing eyebrow pits to control a... |
| NEP18 | NEP | Rooftop rainwater harvesting system | Many households in Nepal’s midhills suffer from water shortages during the pronounced dry season. ... |
| NEP22 | NEP | Plastic-lined conservation pond to | Water harvesting technology is very useful in areas where there is limited |

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|---|---|---|---|
| | | store irrigation water | rainfall for long periods... |
| NIG02e | NIG | Planting pits and stone lines | The combination of planting pits (tassa) with stone lines is used for the rehabilitation of degraded... |
| PER01 | PER | Rehabilitation of ancient terraces | The level bench terrace system in the Colca valley of Peru dates back to 600 years AD. Since then th... |
| PHI04 | PHI | Small Water Impounding Project (SWIP) | Small Water Impounding Project (SWIP) is a water harvesting and storage structure consisting of an e... |
| PHI05 | PHI | Small Farm Reservoir (SFR) | The small farm reservoir (SFR) is a small water impounding earth dam structure to collect rainfall ... |
| RSA09 | RSA | Combating of invader plants & bush packing | The technology is applied in areas under the 'Working for Water' projects that are run by the Nation... |
| RSA23 | RSA | Earth dam for stockwater | Bulldozers were used to build earth dams and to move the soil to construct bankments and spillways i... |
| RSA45 | RSA | Water Harvesting & Basin tillage | The technique consists of the construction of a 1 m wide basin with a 2 m wide runoff area. They ar... |
| SEN002e | SEN | Low-Pressure Irrigation System 'Californian' | The principle of the Californian system is to convey water to the crops through fixed underground ri... |
| SEN002f | SEN | Système Californien d'irrigation à basse pression | Le principe du système californien consiste à distribuer l'eau aux cultures par des tuyaux soute... |
| SPA04 | SPA | Water harvesting from | Water shortage is often considered one |

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|---|---|---|---|
| | | concentrated runoff for irrigation purposes | of the most limiting factors for sustainable agriculture in l... |
| SYR01 | SYR | Stone Wall Bench Terraces | Stone wall bench terraces in the hill ranges of western Syria comprise an ancient indigenous technol... |
| SYR03 | SYR | Furrow-enhanced runoff harvesting for olives | The Khanasser Valley in north-west Syria is a marginal agricultural area, with annual rainfall of ab... |
| TAJ107e | TAJ | Irrigation of orchards by using low cost drip irrigation technique | The system consists of a reservoir and polyethylene irrigation tubes and emitters installed along th... |
| TAJ112e | TAJ | Rehabilitation of iron water gates to improve distribution of irrigation water | This technology is based on the rehabilitation of iron water gates which regulate the water flow int... |
| TAJ112r | TAJ | Реабилитация гидротехнических затворов для улучшения подачи оросительной воды | Данная технология основана на реабилитации железных г... |
| TAJ348e | TAJ | Roof Top Rain Water Harvesting - Concrete Tank | A 16 cubic metre concrete tank situated in the shadow of the house constructed to retain rainwater t... |
| TAJ348r | TAJ | Система сбора дождевой воды с крыш с использованием - бетонной цистерны | 16м3 бетонная цистерна, расположенная в тени дома, и соо&#65533;... |
| TAJ372e | TAJ | Drip irrigation using polyethylene sheeting and intermittent cloth strips. | Drip irrigation with polyethylene film was used in areas with extreme conditions who have poor irrig... |
| TAJ372r | TAJ | Капилный орощения при использование полиэтиленовой плиенки | Выращивание хлопка много воды занимает и частных земе&#65533;... |

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|---|---|---|---|
| TAJ394e | TAJ | Spiral water pumps | A Spiral tube water pump is a method of pumping water by using an undershot water wheel which has a ... |
| TAJ397e | TAJ | Water wheel pump system | After the end of the Soviet era the mass irrigation system fell into disrepair, and many of the orch... |
| TAJ397r | TAJ | Насосная станция с водоподъемным колесом | После окончания Советского периода, большая часть оро&#65533;... |
| TAJ398e | TAJ | A woollen water retention bed installed under the roots of a tree irrigated by a pipe feed. | A bed of wool is placed within the hole before a fruit sapling is planted. The wool is fed water via... |
| TAJ398r | TAJ | Шерстяное основание водоудержания, уложенное под корнями деревьев, орошаемых подводящей трубой. | Основание из шерсти укладывается в яму до посадки саже... |
| TAJ399e | TAJ | Natural spring catchment protection | The technolgy consists of digging of a pit around the spring outlet and placing a 15cm perforated pl... |
| TUN13 | TUN | Cistern | Cisterns were traditionally used to provide drinking water. In the cistern system, runoff water is c... |
| TUR03 | TUR | Drip Irrigation | In drought regions, fruit trees, grape yards, vegetables and other field crops such as maize, sugar ... |
| TZA05 | TAN | Small pit cultivation for maize sorghum and millet | on a hill and foot slope pits of 9'' cubical are dug in line across the slope. On digging, soilis th... |
| ZAM001e | ZAM | Small Earth Dams | Small earth dams are water harvesting storage structures, constructed across |

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|---|---|---|---|
| | | | narrow sections of vall… |
| ZAM001f | ZAM | Petits barrages en terre | … |
| ZIM001f | ZIM | Agriculture de conservation et de précision | L'agriculture de conservation et de précision (ACP) est une technologie qui associe quatre princi… |