European Commission

NWRM

Natural Water Retention Measures

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Individual NWRM

Traditional terracing

ACTeon environment research & consultancy

Office International de l'Eau

amec foster wheeler

BEF LATVIA

enveco Environmental Economics Consultancy

I.A.CO Ltd Environmental & Water Consultants

institute IMDEA water

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I. NWRM Description

Traditional terraces consist of nearly level platforms built along contour lines of slopes, mostly sustained by stone walls, used for farming on hilly terrain. By reducing the effective slope of land, terracing can reduce erosion and surface run-off by slowing rainwater to a non-erosive velocity. This also increases the degree if infiltration and improves soil moisture. However, abandonment of traditional terracing can result in high levels of erosion and run-off due to the lack of maintenance of stone walls. Abandonment can also change the nature of local flora and fauna; this may not be beneficial, for example the spontaneous regeneration of vegetation can present a risk of wild fire spread on sloping land.
This measure focuses on existing or traditional terracing as it involves less disturbance of the terrain than modern terracing such as significant levelling or cutting using heavy machinery. As the measure is highly labour intensive and costly to implement the focus of the measure would be in maintaining existing terracing rather than expansion.

II. Illustration

Illustration 1: Example of traditional terracing in montane area

III. Geographic Applicability

Land Use	Applicability	Evidence
Artificial Surfaces	No	
Agricultural Areas	Yes	Arable land, vineyards and orchards
Forests and Semi-Natural Areas	No	
Wetlands	No	

Region	Applicability	Evidence
Western Europe	No	
Mediterranean	Yes	Traditional terracing was developed to mitigate the high risk of soil erosion due to high intensity rainfall events in the Mediterranean region, in particular where increasing demand for agricultural products resulted in deforestation and land conversion of hillsides (Garcia-Ruiz, 2010)
Baltic Sea	No	
Eastern Europe and Danube	Yes	Terracing has been used for vineyards in countries such as Hungary (European Commission, 2006)

IV. Scale

	0-0.1km^2	0.1-1.0km^2	1-10km^2	10-100km^2	100-1000km^2	>1000km^2
Upstream Drainage Area/Catchment Area	✓	✓				
Evidence	This measure is applied at field level, over hillsides limiting the upstream drainage area.					

V. Biophysical Impacts

Biophysical Impacts		Rating	Evidence
Slowing & Storing Runoff	Store Runoff	High	The traditional terracing in the Veneto case study reports that runoff storage was increased by 50%.
	Slow Runoff	High	Dorren and Rey (no date) report that a study in Canada found that terracing could reduce runoff by 25% of growing season rainfall.
	Store River Water	None	
	Slow River Water	None	
Reducing Runoff	Increase Evapotranspiration	None	
	Increase Infiltration and/or groundwater recharge	None	
	Increase soil water retention	None	
Reducing Pollution	Reduce pollutant sources	None	
	Intercept pollution pathways	None	
Soil Conservation	Reduce erosion and/or sediment delivery	High	Dorren and Rey (no date) report on the outcomes from a number of studies: • Canada: soil loss reduced from 20 t/ha/yr to <1 t/ha/yr (~95%) • Malaysia: soil loss reduced from 63 t/ha/yr to 1.4 t/ha/yr (~98%) The most important erosion reducing activity was the maintenance of existing terrace walls, without this soil loss is a major risk.
	Improve soils	None	
Creating Habitat	Create aquatic habitat	None	
	Create riparian habitat	None	
	Create terrestrial habitat	None	

Climate Alteration	Enhance precipitation	None	
	Reduce peak temperature	None	
	Absorb and/or retain CO_2	None	

VI. Ecosystem Services Benefits

Ecosystem Services		Rating	Evidence
Provisioning	Food provision	None	
	Water Storage	None	
	Fish stocks and recruiting	None	
	Natural biomass production	None	
Regulatory and Maintenance	Biodiversity preservation	None	
	Climate change adaptation and mitigation	None	
	Groundwater / aquifer recharge	None	
	Flood risk reduction	Medium	There is no direct evidence of flood risk reduction, although the reduction in runoff of 25% reported by Dorren and Rey (no date) indicates a benefit.
	Erosion / sediment control	High	Dorren and Rey (no date) report on the outcomes from a number of studies: • Canada: soil loss reduced from 20 t/ha/yr to <1 t/ha/yr (~95%) • Malaysia: soil loss reduced from 63 t/ha/yr to 1.4 t/ha/yr (~98%) The most important erosion reducing activity was the maintenance of terrace walls, without this soil loss is a major risk.
	Filtration of pollutants	Medium	By increasing infiltration rates, traditional terracing may provide filtration benefits, but no evidence was found.
Cultural	Recreational opportunities	None	

	Aesthetic / cultural value	High	Traditional terracing contributes to the cultural heritage and landscape character of areas where it is implemented. Abandonment may result in homogenisation of these landscapes and undesirable land use change (Duarte et al, 2008)
Abiotic	Navigation	None	
	Geological resources	None	
	Energy production	None	

VII. Policy Objectives

Policy Objective		Rating	Evidence
Water Framework Directive			
Achieve Good Surface Water Status	Improving status of biological quality elements	None	
	Improving status of physico-chemical quality elements	None	
	Improving status of hydromorphological quality elements	Medium	Traditional terracing contributes to this objective by reducing soil erosion and consequent sediment delivery
	Improving chemical status and priority substances	None	
Achieve Good GW	Improved quantitative status	None	
	Improved chemical status	None	
Prevent Deterioration	Prevent surface water status deterioration	Medium	Traditional terracing contributes to this objective by reducing soil erosion and consequent sediment delivery
	Prevent groundwater status deterioration	None	
Floods Directive			
Take adequate and co-ordinated measures to		High	By reducing runoff, traditional terracing can contribute to reduced flood risks in areas of high slopes.

reduce flood risks		
Habitats and Birds Directives		
Protection of Important Habitats	None	
2020 Biodiversity Strategy		
Better protection for ecosystems and more use of Green Infrastructure	Medium	Traditional terracing contributes to this objective by stabilising soils on sloping land and reducing the impacts of runoff and soil erosion.
More sustainable agriculture and forestry	Medium	Traditional terracing contributes to the sustainability of agriculture by maintaining soil cover of slopes and reducing impacts from runoff.
Better management of fish stocks	None	
Prevention of biodiversity loss	Medium	Preservation of traditional terracing can protect the established biodiversity associated with that system. Abandonment can change the character of local flora and fauna.

VIII. Design Guidance

Design Parameters	Evidence
Dimensions	
Space required	
Location	
Site and slope stability	Traditional terracing can be applied across a wide range of slopes. Duarte et al (2008) report that traditional terraced based olive production in the Mediterranean occurs on moderate (>15%) to steep (>25%) slopes.
Soils and groundwater	
Pre-treatment requirements	
Synergies with Other Measures	Traditional terracing can be used in conjunction with other measure that reduce soil erosion risk such as reduced/zero tillage and cover crops where there cropping is practiced on the terraced land.
Design recommendations	

IX. Cost

Cost Category	Cost Range	Evidence
Land Acquisition	0	The measure relates to existing land use and structures
Investigations & Studies	0	The measure relates to existing land use and structures
Capital Costs	0	The measure relates to existing structures, however Kuhlman et al (2010) report that construction cost for new terracing using heavy machinery would be €893/ha/yr (annualised figure).
Maintenance Costs	200	Kuhlman et al (2010) report this as the cost of maintenance of existing terracing (€/ha/yr).
Additional Costs		

X. Governance and Implementation

Requirement	Evidence
Measures to reduce abandonment of marginal land	The risk to the benefits provided by traditional terracing come from potential abandonment, particularly of more marginal land. Rural development measures may need to be targeted to avoid this in regions at risk.

XI. Incentives supporting the financing of the NWRM

Type	Evidence
CAP Pillar I 'Greening Measures'	Terraces are considered as Ecological Focus Areas (EU Regulation 1307/2014 , Article 46) so can be used to claim single payments on holdings where EFA are required (arable areas >15ha).
CAP Pillar II Rural Development Programme	Maintenance of terraces is potential a measure funded under Article 28 of EU Regulation 1305/2013 'Agri-environment-climate'

XII. References

Reference
Dorren L and Rey F (no date) A review of the effect of terracing on erosion. http://eusoils.jrc.ec.europa.eu/projects/scape/uploads/103/Dorren_Rey.pdf
Duarte F, Jones N and Fleskens L (2008) Traditional olive orchards on sloping land: Sustainability or abandonment? Journal of Environmental Management 89: 86-98.
European Commission (2006) Modern land terracing results in highly negative landscape impacts. http://ec.europa.eu/environment/integration/research/newsalert/pdf/40na3.pdf
Garcia-Ruiz JM (2010) The Effects of land uses on soil erosion in Spain: A review, Catena 81: 1-11.
Kuhlman T, Reinhard S and Gaaff A (2010) Estimating the costs and benefits of soil conservation in Europe, Land Use Policy 27(1): 22-32.
Traditional terracing in the Veneto case study