European Commission

NWRM

Natural Water Retention Measures

www.nwrm.eu

Service contract n°07.0330/2013/659147/SER/ENV.C1

Individual NWRM

Reduced stocking density

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REKK

SLU

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Environment

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I. NWRM Description

Livestock, particularly heavy species such as cattle, can have a number of damaging impacts on soil including compaction, destruction of soil structure (poaching) and loss of vegetation. These impacts can reduce infiltration of water into the soil, resulting in pooling and water logging with consequent impacts of denitrification and nitrous oxide emissions. Soil compaction will also increase the risk of run-off with consequent impacts on water quality and flood risks.

Reduced stocking density will limit soil compaction, thereby facilitating more rapid infiltration during precipitation events and potentially reducing peak flows and sediment runoff. There may also be issues due to management decisions which can increase risks due to livestock without changing stocking levels. For example increased out-wintering of cattle to avoid housing costs will exacerbate risks due to the increased vulnerability of soils during the winter months. The measure may be effectively achieved by moving grazing livestock from high risk areas or by increasing the use of housing. Whether the reduction in pressure is achieved through direct reductions in stocking density, movement from high risk areas or housing, there will be impacts on farm business in terms of direct or opportunity costs.

II. Illustration

Illustration 1: Grazing cattle with evidence of soil damage

Source: © SRUC

III.Geographic Applicability

Land Use	Applicability	Evidence
Artificial Surfaces	No	Not applicable
Agricultural Areas	Yes	Pastures, heterogeneous agricultural land
Forests and Semi-Natural Areas	No	Not applicable
Wetlands	No	Not applicable

Region	Applicability	Evidence
Western Europe	Yes	The measure can be applied in all regions where grazing livestock are present. However, the potential damage caused by high stocking density will also be related to other risk factors including soil types, climate and management practices (e.g. out-wintering). Figure 1 illustrates the density of grazing livestock across Europe. This tends to be higher in North-west Europe precipitation is also likely to be higher. Figure 2 illustrates the distribution of pasture across Europe, again indicating potentially higher risks in North-west Europe.
Mediterranean	Yes	
Baltic Sea	Yes	
Eastern Europe and Danube	Yes	

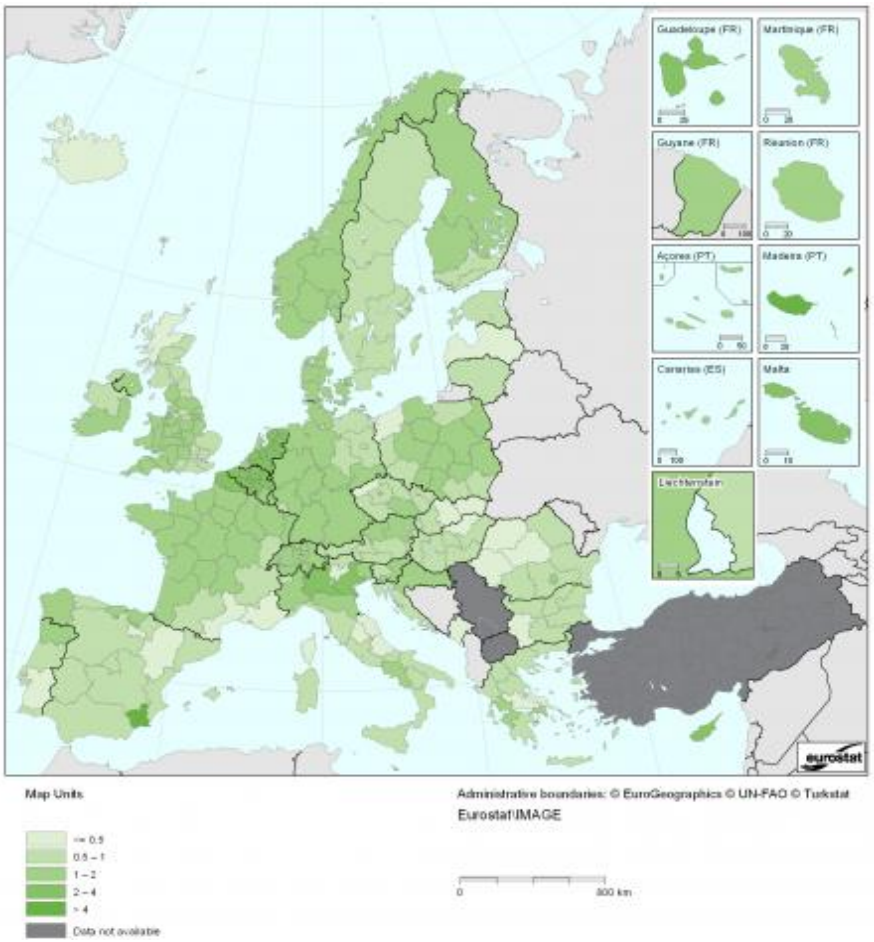

Illustration 2: Density of grazing livestock at NUTS2 level, 2010 (source, Eurostat http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Agri-environmental_indicator_-_livestock_patterns#Livestock_densities)

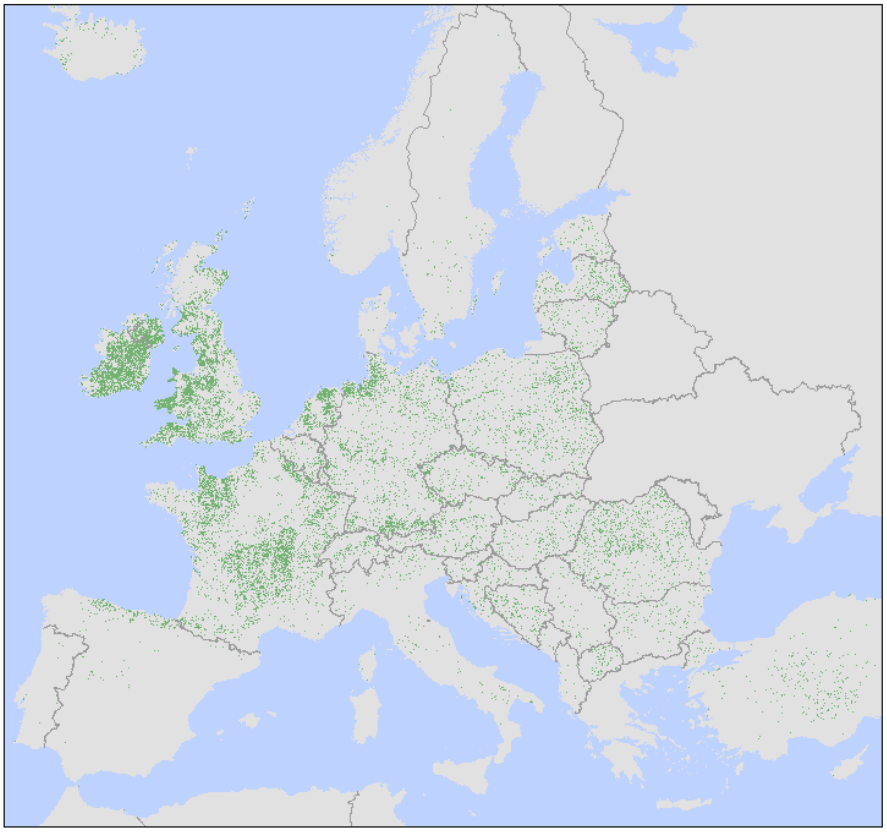

Illustration 3: Corine 2006 Land Cover – Pasture (Source: European Environment Agency, http://www.eea.europa.eu/data-and-maps/data/clc-2006-vector-data-version-3)

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 operates and field/farm scale.					

V. Biophysical Impacts

Biophysical Impacts		Rating	Evidence
Slowing & Storing Runoff	Store Runoff	None	
	Slow Runoff	High	Potential improvements in soil physical properties (compaction, bulk density) resulting from reduced livestock numbers could result in reduced run-off rates through both reduced surface flow (higher soil cover) and greater infiltration (Bilotta et al., 2007) Heathwaite et al (1989) found that livestock over grazing and trampling can reduce infiltration by 80%, whilst Heathwaite et al (1990) report that surface run-off can be doubled at field and hill slope scale.
	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	Reduce pollutant sources	None	
	Intercept pollution pathways	None	
Soil Conservation	Reduce erosion and/or sediment delivery	Medium	Increased vegetation cover resulting from reduced grazing pressure and improved soil structure would result in smaller areas of bare soil. Erosion risk would be reduced. Bilotta et al (2008) report that only at zero stocking rates were water courses found to have suspended solid concentrations in compliance with the EU Freshwater Fisheries Directive guidelines (25 mg/l).
	Improve soils	Medium	Lower livestock numbers could result in reduced levels of poaching. IBERS and SRUC (2014) report poaching rates of 16 to 28% of sacrifice area on beef farms at stocking rates between 2.4 to 6.4 head/ha. Dairy farms had higher poaching levels, 32 to 38%, but for slightly higher stocking densities. These impacts were noted around feeders.

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 production	Negative	Reduced stocking densities would directly reduce the output from fields where the measure has been implemented. However, this might be offset at the broader farm level through increased use of housing. This extent of this impact will be related to other management decisions.
	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	Low	Reduction in soil poaching may increase the infiltration of water into the soil. Heathwaite et al (1989) found that livestock over grazing and trampling can reduce infiltration by 80%.
	Flood risk reduction	Medium	Reductions in surface run-off and increased infiltration may reduce flood risk. Lane (2003) suggests a link between increasing stocking density of sheep during the 1970s and 1980s in the Yorkshire Dales (England) and increasing frequency and severity of flood events

			affecting downstream areas such as the city of York. However, there is a lack of specific evidence on the impact of livestock due to the range of contributing land uses across the relevant catchments (Holman et al., 2002)
	Erosion / sediment control	Medium	Increased vegetation cover resulting from reduced grazing pressure and improved soil structure would result in smaller areas of bare soil. Erosion risk would be reduced.
	Filtration of pollutants	Medium	Pollutants loads may be both reduced due to reduced livestock numbers and filtration increased due to both greater vegetation and infiltration. Bilotta et al (2008) report an increase in sediment related water quality issues with increases in stocking density, implying that these would be mitigated by reduced stocking density. However, residual phosphorus in soils continued to be released even at zero stocking density.
Cultural	Recreational opportunities	None	
	Aesthetic / cultural value	None	
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	Reducing stocking density can contribute to this aim through reductions in soil erosion and sediment delivery.
	Improving chemical status and priority substances	None	

A12: Reduced stocking density

Achieve Good GW Status	Improved quantitative status	None	
	Improved chemical status	None	
Prevent Deterioration	Prevent surface water status deterioration	Medium	Reduced stocking density can contribute to this aim by reducing both overall pollutant loads and increasing filtration of those pollutants.
	Prevent groundwater status deterioration	None	
Floods Directive			
Take adequate and co-ordinated measures to reduce flood risks		Medium	Catchment level changes in livestock management together with other agricultural measures is likely to be necessary to impact on 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	Reduced stocking density contributes to this objective through the reductions in soil erosion and consequent sediment delivery.
More sustainable agriculture and forestry		Low	Reduced stocking density can improve sustainability particularly with respect to soil quality. However, if the viability of livestock production in marginal areas is reduced as a result there may be a risk of land abandonment with negative environmental impacts. Alternatively changes in management to offset reduced stocking rates on pastures (e.g. more housing) may result in greater intensification. These outcomes may vary spatially.
Better management of fish stocks		None	
Prevention of biodiversity loss		Low	Reduced stocking density may reduce pressure on biodiversity. However, outcomes such as land abandonment or more displaced but more intensive production may present risks to traditional biodiversity.

VIII. Design Guidance

Design Parameters	Evidence
Dimensions	
Space required	
Location	
Site and slope stability	
Soils and groundwater	
Pre-treatment requirements	
Synergies with Other Measures	Can be combined with measures on Meadows and Pastures and Controlled traffic farming (to reduce soil compaction on pastures).

IX. Cost

Cost Category	Cost Range	Evidence
Land Acquisition	0	Not required
Investigations & Studies	0	Not required
Capital Costs	0	No direct capital costs. But If reductions in stocking density are offset by increased housing then capital costs may be incurred. For cattle these might range from €860 to €2500 per head for a straw bedded solid floor house depending on space provision per animal (slurry and feed storage would be additional).
Maintenance Costs	0	No direct maintenance costs. As with capital costs these would be indirect and depend on the management changes in response to reduced stocking density on pastures.
Additional Costs	0	There would be a direct opportunity cost from reduced output. However, this may be offset by management changes which could involve either less intensive production, or greater intensity elsewhere on the farm.

Values in £ converted at £1 = €1.20

X. Governance and Implementation

Requirement	Evidence

XI. Incentives supporting the financing of the NWRM

Type	Evidence
Rural development programme payments	Grazing management including the removal of livestock at sensitive times (assuming impacts are not increased elsewhere) was included in the 2007-13 Rural Development Programme. Payments across the EU averaged €168/ha with a range from €2/ha to €450/ha.

XII. References

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