Monthly rainfall erosivity in Euskadi

General information

Description	Rainfall erosivity is a factor of soil loss by water erosion. Rainfall erosivity is crucial to be considered at a monthly resolution for the optimization of land management (seasonal variation of vegetation cover and forestry support practices) as well as natural hazard protection (landslides and flood prediction).	
Geographical area	Euskadi	
Date	December 2018	
Authors (affiliation)	Gartzia-Bengoetxea, N. & Arias-González, A. (NEIKER)	
Contact e-mail	ngartzia@neiker.eus	
Tool type	Map/remote sensing	
Tool format	Cartography layers (SIG)	
Language	Spanish	Other regional language
Risk management plans to which the tools can be added	Soil degradation risk management plan	
Risk management plans link	https://plurifor.efi.int/wp-content/uploads/WP2/plans/Soil-degradation-plan_ES.pdf	
This tool is…	☒ a new tool	☐ an improved tool
Original tool of which this one is an improvement	none	

Topic

Risk	Soil degradation		
Risk component	☐ hazard	☐ impact	☒ vulnerability
Risk area	Risk planning		
Risk phase	Prevention		
Risk phase (alternative terms)	Prevention		
Level	Regional		
Sendai priorities	☒ Priority 1: Understanding disaster risk ☒ Priority 2: Strengthening disaster risk governance to manage disaster risk ☒ Priority 3: Investing in disaster risk reduction for resilience ☐ Priority 4: Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction		
Contribution to Sendai targets	☐ Reduce global disaster mortality ☐ Reduce the number of affected people ☒ Reduce the direct disaster economic loss ☐ Reduce disaster damage to critical infrastructure ☐ Increase the number of national and local disaster risk reduction strategies ☐ Enhance international cooperation to developing countries ☒ Increase availability of and access to multi-hazard early warning systems and disaster risk information and assessment		

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Description and analysis

Summary

Soil erosion prediction is of crucial importance for appropriate land management and soil use. Rainfall is one the main drivers of soil erosion. The erosive force of rainfall is expressed as rainfall erosivity. Rainfall erosivity considers the rainfall amount and intensity, and is most commonly expressed as the R-factor in the USLE model and its revised version, RUSLE (Panagos et al., 2015). The rainfall erosivity variability affects agriculture, forestry, hydrology, water management, and ecosystem services. Consequently, neglecting the seasonal variability of rainfall erosivity and as a result the intra-annual soil loss variability, may lead to improper decision making (Wang et al., 2002).

Place in national/regional policy

At this moment, this tool is not considered in any policy in any region.

Goals and achievements

In Communication 2006 [Communication (COM(2006) 231)], the European Commission underlined that little public awareness of the importance of soil protection. Measures to improve knowledge and exchange information and best practices are needed to fill this gap. This tool has been prepared to help forest resource managers plan, to prescribe and implement sound forest practices that comply with sustainable forest management that protect soils.

Stakeholders involved

None

Implementation stage

The tool will be available to any interested party in Geoeuskadi, the geoportal of Spatial Data Infrastructure of Euskadi.

State of technical knowledge

The Rainfall Erosivity Database has been developed from high temporal resolution rainfall data collected from 81 stations from the Basque Country. Database includes data at 10 min resolution from 2003-2016. The Rainfall Intensity Summarisation Tool (RIST) software (USDA, 2014) was used to calculate the R-factor.

Regulatory and/or socio-economic contexts

At present little regulatory context but potentially important socio-economic benefits by helping forest planners to identify seasons of the forest most at risk of soil erosion and to evaluate the overall level of risk of forests in the region. R-factor can also be used to draw conclusions about soil vulnerability, flood hazards, natural hazards, or probability of droughts (Panagos et al., 2015).

Impacts of the tool

To date, very little impact because the tool has not been adopted by forest resource managers. Efforts will be made to increase the impact by discussing with forest authorities how the tool can be incorporated in normal operating procedures.

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Implementation requirements and durability

Description of the implementation steps

1. Development of Rainfall Erosivity Database for the Basque Country:
   Precipitation data have been collected at 10 min time interval from 81 weather stations around Basque Country with 14 year data per station (2003-2016).
2. The Rainfall Intensity Summarisation Tool (RIST) software (USDA, 2014) was used to calculate monthly R-factor for each weather station.
3. Support covariates were DEM (Digital Elevation Model) at 5 m resolution, and monthly average precipitations and monthly average temperature extremes developed by NEIKER in Escenarios II (Klimatek) project.
4. Spatial approach was based on Multivariate Adaptive Regression Splines.
5. Tool available to download (not implemented yet)

Governance

Input layers were developed for research purposes of NEIKER. NEIKER does not accept any liability whatsoever for any error, missing data or omission in the data, or for any loss or damage arising from its use. NEIKER agrees to provide the data free of charge but is not bound to justify the content and values contained in the databases.

Regulatory framework

The tool is advisory only to assist regional planners and all parties involved in risk management in the Basque Country. There is no regulatory framework at present.

Human resources requirements

In order to analyze the resulting data and interpret the maps at different levels of susceptibility, personnel with technical knowledge is needed.

Financial requirements

Low level of financial requirement for installation because the maps have been created and additional maps will be created by NEIKER.

Technical requirements

Maps can be viewed in the free-software QGIS (https:/qgis.org/en/site/) or in Geoeuskadi, the geoportal of Spatial Data Infrastructure of Euskadi.

Priorities identified for successful implementation of the tool (political, technical, human, financial…)

The priority is to increase public awareness of the need of soil protection. As the protection of forest soil is an issue of increasing concern to Central European forestry (Thees and Olschewski, 2017), South Western plantation forestry should also address this issue.

Soil protection must not be seen as a barrier to forest activity. When forest operations protect soil, the manteinance of productivity is assured, the surrounding ecosystems such as streams and rivers do not receive high loads of sediments and social perception of forest operations is gained. Protecting soils is a win win solution.

Challenges or risk factors (legal, financial, safety…) expected during the implementation and solutions proposed

The main challenge is to incorporate the maps in the decision making process. To increase public awareness of the need to protect soil, forest authorities might foster the use of this kind of tools. The porper use of forest machinery may be expensive and this may rise the price of the harvested wood to compensate for it.

Additional and non-formal experiences to help the implementation of good practice

This maps can be used as stand alone within GIS. Little experience is required in assessing the maps. The main challenge is to ensure end-users understand the origins of the maps and their limitations.

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SWOT analysis

Strengths	Weaknesses
• Replicable, comparable and can be extended to model other regions to identify erosion-prone areas • Easy to integrate into map based management systems or any GIS	• Model is not yet integrated in the current management systems used in any region • Precipitation data at high resolution is not always available.
Opportunities	**Threats**
• Allows to identify erosion-prone seasons that can be operated without causing damage through site-specific planning and implementation of forest operations. • Seasonal patterns of erosivity can also be used in water management, natural hazards, or probability of droughts	• Difficulties in persuading people to use the maps because they add complexity to existing decision making.

Lessons learnt

Evaluation process, if exists (internal or external)

The collaboration of BCAM (Basque Center for Applied Mathematics) has been essential for the development of this tool.

Assessment of results (quantitative and qualitative) and comparison with main goals

Monthly R-factor for Basque Country has been developed in collaboration with Dr Dae-Jin Lee and Maria Xose Rodriguez-Alvarez from BCAM. Dae-Jin Lee is currently a Researcher at BCAM and Applied Statistics research line leader. Previously, from February 2011 to February 2014, he was Postdoctoral Fellow at CSIRO (Commonwealth Scientific and Industrial Research Organization) at the Mathematics, Informatics, and Statistics Division, now Computational Informatics, in the Risk Analytics Group in Clayton, Victoria, Australia. He obtained his Ph.D. in Statistics in June 2010, and Masters Degree in Mathematical Engineering (Area of Statistical Sciences) in 2006, Bsc. in Statistical Sciences (2004) and Bsc. in Business Administration and Management (2002) from the University Carlos III de Madrid, Spain.

Dr Maria Xose Rodriguez-Alvarez is an Ikerbasque Research Fellow at BCAM. Her methodological research in Statistics covers three different, but related, areas: (a) Statistical evaluation of the diagnostic and/or prognostic value of clinical biomarkers; (b) Development of efficient algorithms for the estimation of flexible regression models; and (c) Categorisation of continuous clinical variables to be included in prediction models. All her research has a strong multidisciplinary component with a special focus on Medical and Agricultural applications. Most of the statistical-methodological topics she has covered have been motivated by the need of analysing and understanding complex biological and health phenomena. Besides, the transference of the new advances to the biomedical field by means of user-friendly software constitutes an important fraction of her research.

Negative aspects identified

Precipitation data availability might be a problem for rainfall erosivity (R-factor) modelling.

Unexpected consequences (short- / mid- / long-term) and corrective measures implemented

None

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Access to complete tool

Files	Rainfall_erosivity_CAPV.pdf
Web links	https://plurifor.efi.int/wp-content/uploads/WP2/tools/rainfall_erosivity.pdf