General information

Description	Soil erosion is a transnational geological hazard which can be mitigated through better future land-use planning.
Geographical area	Euskadi
Date	December 2018
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Tool type	Map/remote sensing
Tool format	Cartography layers (SIG)
Language	Spanish
Risk management plans to which the tools can be added	Soil degradation risk management plan
Risk management plans link	https://www.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	Mapa del grado de erosión hídrica de los suelos. http://www.geo.euskadi.eus/mapa-erosion-suelos-euskadi/s69-geodir/es/

Topic

Risk	Soil degradation		
Risk component	☐ hazard	☐ impact	☒ vulnerability
Risk area	Risk planning		
Risk phase	Prevention		
Risk phase (alternative terms)	Prevention		
Level	EU		
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		

Description and analysis

Summary

Site productivity is a key indicator of forest ecosystem health. In order to maintain site productivity, attention must be paid to the interaction of the physical properties of the site (i.e., soil texture, moisture, fertility and topography) with environmental conditions (i.e., weather and season), and the types of forest operations which are applied to the site. The impact of identical treatments on different sites will be vastly different based on the particular sensitivity of the site to disturbance under the current set of environmental conditions. One of major type of damage due to forest operations that can affect long-term site productivity is soil erosion. Besides, soil erosion by water is one of the most serious environmental and public health problems facing human society today due to sediment delivery to streams. In most cases, sensitive sites can be operated without causing damage through site-specific planning and implementation of forest operations.

Assessment of soil erosion sensitivity is defined as the possibility of soil erosion occurrence and identification of areas susceptible to soil erosion that form when only considering natural factors. Based on Geographic Information System (GIS) technologies, the influences of precipitation, soil and topography on soil erosion sensitivity were evaluated at a resolution of 10m using a modified version of the Revised Universal Soil Loss Equation (RUSLE) model. The input layers for the Basque Country (Rainfall erosivity, Soil Erodibility, and Topography) have been developed by NEIKER. The erosion-sensitivity is given in classes based on a personal communication of Panos Panagos.

Erosion after severe fires is not considered in this map because USLE derived models for erosion estimation do not perform adequately when forest fires disrupt soil structure.

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.

State of technical knowledge

The tool represents a Revised Universal Soil Loss Equation (RUSLE) model with the most recently available regional datasets.

Regulatory and/or socio-economic contexts

At present little regulatory context but potentially important socio-economic benefits by helping forest planners to identify areas of the forest most at risk of soil erosion and to evaluate the overall level of risk of forests in the region.

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.

Implementation requirements and durability

Description of the implementation steps

1. Input layers from ESDAC (European Soil Data Centre)
    - Rainfall Erosivity in the Basque Country (R-factor). 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.
    - Soil Erodibility (K- Factor) for the Basque Country. A soil texture map and soil organic matter map have been developed based on 12.260 georeferenced soil analytical results using GAM-Generalized Additive Models with p-splines.
    - LS-factor (Slope Length and Steepness factor) for the Basque Country has been developed based on Digital Elevation Model (DEM) at 10 m resolution.
2. Incorportion of input layers in QGIS to calculate risk using RUSLE model.
3. Classification of erosion-sensitive areas based on potential erosion rate as (Panagos personal communication):
   < 1 Mg ha-1 year-1 = very low
   1-2 Mg ha-1 year-1 = low
   2-5 Mg ha-1 year-1= medium low
   5-10 Mg ha-1 year-1= medium
   10-20 Mg ha-1 year-1= high
   >20 Mg ha-a year-1 = very high
4. 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. The NEIKER agrees to provide the data free of charge but is not bound to justify the content and values contained in the databases.

NEIKER has been the responsible of the development of soil erosion susceptibility in the Basque Country region.

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/)

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), Basque Country 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.

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
Opportunities	**Threats**
• Possible to develop maps with higher resolution when information available • Allows to identify erosion-prone areas that can be operated without causing damage through site-specific planning and implementation of forest operations.	• 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) Participation in the Soil Erosion Modelling workshop organized by JRC in Ispra. Discussion with participants was essential for the development of this tool.

Assessment of results (quantitative and qualitative) and comparison with main goals The methodology for input layers development and classification have been proposed by Panos Panagos who has a PhD in soil erosion modelling awarded from University of Basel. During the last years he has been involved in soil data modelling relevant to soil erosion and soil organic carbon. He has published more than 80 scientific articles in Peer review international Journals including a recent correspondence in NATURE an article on rainfall erosivity in Scientific Reports. 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 Data availability might be a problem for high resolution soil erosion modelling and lower resolution output might not be useful for forest planning.
Unexpected consequences (short- / mid- / long-term) and corrective measures implemented none

Access to complete tool

Files	erosion_susceptibility_CAPV.pdf
Web links	https://plurifor.efi.int/wpcontent/uploads/WP2/tools/erosion_susceptibility_CAPV_Neiker.pdf