General information

Description	Maintaining site productivity requires the conservation of soil resources, particularly by reducing or preventing soil disturbance. There are various soil disturbance types ranging from rutting, compaction to roadways and landings. The Forest Soil Disturbance Monitoring Protocol describes how to monitor forest sites after management activities for physical attributes that could influence site resilience and long-term sustainability. The attributes describe surface conditions that affect site sustainability and hydrologic function. This tool aimed at strengthening a policy framework that can enhance sustainable forest management and the multifunctional role of forests in a context of increased demand for forest based goods and services.	
Geographical area	Global	
Date	December 2018	
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Tool type	Field reference guide	
Tool format	Stand-alone software	
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		

Topic

Risk	Soil degradation		
Risk component	☐ hazard	☒ impact	☐ vulnerability
Risk area	Risk planning		
Risk phase	Surveillance/monitoring/early warning		
Risk phase (alternative terms)	Response		
Level	Global		
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

Forest management activities all have the potential to create soil disturbances. Some soil disturbance may be beneficial if it is planned and conducted under suitable soil conditions by the proper equipment. The removal of forest floor material, displacement of the mineral soil, compaction, puddling, erosion, and high burn severity, however, can have potentially negative effects on site productivity and hydrologic responses. Monitoring soil disturbance enables the Forest Service to assess the success of management activities in meeting legal, regulatory, and policy objectives. By using a consistent monitoring approach, forests in every region can build soil resource programs to meet their specific requirements in accord with their soil quality standards and guidelines.

The forest soil disturbance monitoring protocol defines visual physical soil indicators that can be measured consistently, efficiently, and economically. It provides estimates of soil disturbance and confidence intervals around the monitoring results. The estimates are based on sample sizes calculated from the stand surface and a predetermined confidence level. In SEMAFOR (Sistema de Evaluación de MAquinaria FORestal), forest soil disturbance monitoring protocol, the forest stand is divided in :

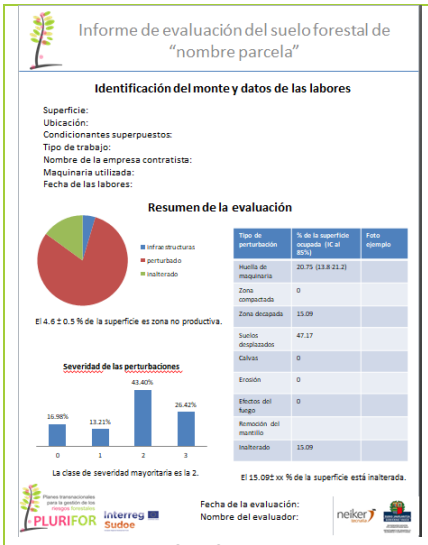
1. *Areas occupied by permanent access structures*
2. *Areas occupied by soil disturbance in the net area to be reforested*

Areas occupied by permanent access structures represent non-productive stand area. Soil disturbance in the net area to be reforested is further categorized as:

1. Ruts
2. Compacted areas
3. Soil displacement
4. Erosion evidence
5. Burning evidence
6. Scalped areas
7. Gouges
8. Undisturbed

Soil disturbance classes increase in severity of impact from class 1 (low-severity) to class 3 (high-severity).

Data collected on the field is automatically analysed and a evaluation report of the status of the soil is created.


Informe de evaluación del suelo forestal de "nombre parcela"

Identificación del monte y datos de las labores

Superficie:
Ubicación:
Condicionantes superpuestos:
Tipo de trabajo:
Nombre de la empresa contratista:
Maquinaria utilizada:
Fecha de las labores:

Resumen de la evaluación

El 4.6 ± 0.5 % de la superficie es zona no productiva.

Tipo de perturbación	% de la superficie ocupada (IC al 85%)	Foto ejemplo
Huella de maquinaria	20.75 (13.8 21.2)	
Zona compactada	0	
Zona decapada	15.09	
Suelos desplazados	47.17	
Calvas	0	
Erosión	0	
Efectos del fuego	0	
Remoción del mantillo		
Inalterado	15.09	

Severidad de las perturbaciones

La clase de severidad mayoritaria es la 2.

El 15.09± xx % de la superficie está inalterada.

Fecha de la evaluación:
Nombre del evaluador:

Figure 1: Draft of the evaluation report created by SEMAFOR.

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 an adaptation of "Soil Conservation Survey Guidebook" published by B.C. Ministry of Forestry and "Forest Soil Disturbance Monitoring Protocol" published by USDA Forest Service. The SEMAFOR tool has a data collection software application to enable an easy data collection and automatized data analysis.

Regulatory and/or socio-economic contexts

At present little regulatory context but potentially important socio-economic benefits by helping forest planners to quantify the disturbance generated by forest activities in soil and to determine if forestry in every region meet their specific requirements in accord with their soil quality standards and guidelines.

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. Definition and implementation of the method for forest soil disturbance monitoring protocol.
2. Validation of the first version of the protocol.
3. Integration of the protocol into a data collection software.
4. Validation of the data collection software on the field.
5. Tool available to download (not implemented yet)

Governance

SEMAFOR, forest soil disturbance monitoring protocol was 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 tool 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 SEMAFOR, forest soil disturbance monitoring protocol.

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 take measurements on the field, analyze the resulting data and interpret the evaluation report from SEMAFOR, personnel with technical knowledge is needed.

Financial requirements

Low level of financial requirement for installation because the tool have been created by NEIKER and NEIKER can offer training to stakeholders.

Technical requirements

SEMAFOR can be downloaded in Google Play.

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 soil disturbance evaluation in the decision making process in order to maintain sustainable production of natural resources. 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 tool can be used as stand alone software. Little experience is required in assessing soil disturbance. The main challenge is to ensure end-users understand the origins of the data colllected and their limitations.

SWOT analysis

Strengths	Weaknesses
• uniform assessment and reporting of soil disturbance • easy to use • useful to promote citizen science • completely integrated in the current management systems in Canada and USA.	• the tool is not yet integrated in the current management systems used in any region participating in PLURIFOR
Opportunities	**Threats**
• use of the tool will enable a more in-depth analysis of the soil impact averages by logging systems and propose improvements to protect soils. • use of the tool will enable the long-term evaluation of management activities. • Monitoring soil disturbance enables the Forest Service to assess the success of management activities in meeting legal, regulatory, and policy objectives.	• Difficulties in persuading people to use the tool because it adds complexity to existing decision making.

Lessons learnt

Evaluation process, if exists (internal or external) None
Assessment of results (quantitative and qualitative) and comparison with main goals The methodology of soil disturbance monitoring has been used in British Columbia (Canada) since 2001 and USA since 1990. NEIKER made the adaptation of this method in 2004 and this work was presented in 4th International Cogress of European Society for Soil Conservation (Budapest) entitled "Soil Disturbance Surveys in Pine Tree Plantations of the Basque Country". Afterwards, a more in-depth work was presented in XIII World Forestry Congress (Argentina) in 2009 as "Evaluation of the disturbance due to mechanical site preparation in forest stands".
Negative aspects identified Difficulties assessing soil disturbance categories and severity classes.
Unexpected consequences (short- / mid- / long-term) and corrective measures implemented None

Access to complete tool

Files	Soil_monitoring_manual.pdf
Web links	Not available yet

Interreg Sudoe
EUROPEAN UNION
Transnational plans for the management of forest risks
PLURIFOR
European Regional Development Fund