



IT tool for calculating the impact of forest management on ecosystem services

C8

FOREST OWNERSHIP CENTRE



LIFE16 CCM/ES/000065

CLIMARK

Forest management promotion for climate change mitigation through the design of a local market of climatic credits

DELIVERABLE

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IT tool for calculating the impact of forest management on ecosystem services.

An IT tool has been created using the programming language VBA, structured using Microsoft Excel, to calculate the impact of forest management on ecosystem services: carbon, water and biodiversity. The aim is to assess the impact of forest management on these services simply and using easy-to-measure variables that are well known throughout the forestry sector. This document details the main reasons for developing this application, its structure and how it works. Future updates to the application are also listed, with images of the programme.

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1. Objectives of the action

Multifunctional sustainable management to mitigate and adapt to climate change is intended to have a positive impact on ecosystem services: carbon, water and biodiversity. To assess this impact, a methodology has been developed specifically for this project, adapted to the climate and landscape of Catalonia as part of action C6 of the LIFE CLIMARK project. The measurements used are the quantity of carbon sequestered, the quantity of water generated and the land's capacity to support biodiversity (Cervera et al. 2022).

To help assess the impact of the work of forestry managers and ensure that the methodology is correctly applied, an IT tool has been developed to directly calculate the impact on various ecosystem services. The calculator has been developed as part of action C8.

2. The "FES Impact Calculator" application

The application brings together the entire methodology for calculating the impact on forestry ecosystem services (Cervera *et al.* 2022) and is programmed in Visual Basic for Applications (VBA) in a Microsoft Excel environment. According to the methodology, the impact of forest management is classified under different headings according to different groups of equations. For this reason, the application comprises various modules: a main module, and modules for measuring the impact of management on the carbon balance, the impact of forestry work and the products obtained, carbon emissions avoided, the impact on water resources and on biodiversity.

The main module displays the overall results of the impact of forest management on ecosystem services, which is calculated independently. This module contains various functions, some for accessing the other modules and others for editing, validating and saving data. General information on the stand can also be added. Each module requests different information and data to be input in order to calculate the corresponding impact: the management model and the pre- and post-felling dasometric data of the forest biomass to measure the impact of the work on the carbon balance; the yields of extractive and transport activities, and the products obtained, in order to measure the impact of the forestry work; the probability of fire and the area protected by the work in order to measure carbon emissions avoided. Environmental and pre- and post-felling dasometric data are then entered to measure the impact of the work on water resources. Finally, to measure the impact of the work on biodiversity, the initial and expected values for each factor in the Biodiversity Potential Index are entered, in accordance with the intended improvements.

The application contains two further sections. The first section displays all the data and information entered to calculate the impact, and the results thereof, in summary form, so the user does not have to consult each module individually. The second section is a database containing all the indices, constants and values used by the calculator in its operations. This section cannot be edited.

3. Future implementation

To maintain and encourage multifunctional sustainable management through forestry projects for mitigation and adaptation to climate change, updates to the application may be implemented in the future to:

- Keep the methodology for calculating the impact up to date.
- Extend the number of forestry species the modules can handle, and the number of management models.
- Implement an option to modify the equations, indices, constants and values that each
 module uses in order to test new methodologies. Under no circumstances can the
 section in the database that defines the indices, constants and values used by the
 modules be modified.
- Improve the appearance and usability of the application via the project website, to make it more widely known and used.

4. Bibliography

Cervera, T. et al. (2022). Metodologia de càlcul de l'impacte de la gestió forestal en els serveis ecosistèmics: carboni, aigua i biodiversitat. Centre de la Propietat Forestal, Santa Perpètua de Mogoda. 61 pp.

Annex 1 – Images of the calculator

ES GENERALS	RESULTATS DEL CÀLCUL DE L'IMPACTE DE LA GESTIÓ FORESTAL EN E	LS SERVEIS E	COSISTÈMI	cs
Nom de la	Impacte de la gestió forestal en el balanç de carboni			
Codi de		t/ha/any	t/h	t
Superficie rodal	Fixació de carboni per creixement de la massa			
Període de càlcul 15	Emissions de carboni per matèria orgànica			
DULS DE CÀLCUL	Balanç de			
	Balanç de CO2			
ncions generals	Emissions CO2 produïdes pels treballs silvícoles			
Recalcular per superfície i/o període	Emissions CO2 produïdes pel transport			
	Emissions CO2 produïdes per combustió dels productes			
Validar i guardar dades	Emissions CO2 dels treballs i els productes			
	Emissions CO2 evitades en la prevenció d'incendis (rodal)			
Reiniciar i eliminar dades	Emissions CO2 evitades en la prevenció d'incendis (punt			
	Emissions CO2 evitades per l'efecte			
Balanç de carboni	Emissions de CO2			
Segrest de CO2 per gestió forestal	Impacte de la gestió forestal en el balanç de diòxid de			
Emissions CO2 treballs forestals i productes obting	Impacte de la gestió forestal en els recursos hídrics			
	Impacte de la gestió forestal sobre H2O m3/ha/any m:	3/h m	3	
Emissions CO2 evitades per prevenció i substitució				
Recursos hídrics	Impacte de la gestió forestal en la biodiversitat			
Impacte de la gestió forestal en l'aigua	IBP rodal no gestionat			
	IBP rodal gestionat			
Biodiversitat	Impacte de la gestió forestal en la biodiversitat (%)			
Impacte de la gestió forestal sobre la biodiversita				

 ${\it Figure~1.~Main~module~of~the~calculator.}$

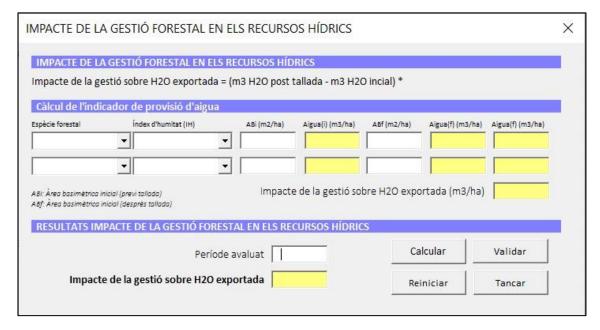


Figure 2. Impact on water resources module.

IMPACTE DE LA GEST	IÓ FORESTAL EN EL BAI	ANÇ DE CARB	ONI - CÀPS	ULA 1. SEG	GREST DE CA	ARBONI					
CÀPSULA 1. SEGREST DE	CARBONI										
Balanç de carboni segres	tat (tCO2) = tCO2 segrestad	es gestió - tCO2 s	egrestades no	•							
Dades de la situació ini	cial de la massa forestal										
F2-1-	Densitat (p/i	na) AB (m2/ha)	AB (%)	Dg (cm)	BAT (t/ha)	BBF (t/ha)	BST (t/ha)	CAT (t/ha)	CBF (t/ha)	CST (t/ha)	C (t/ha)
Espècie											
Espècie											
Model ORGEST de refer	ència i itinerari silvícola (es	pècie principal)									
Qualitat d'estació	▼ Model ORGEST (mass	a	•	Itinerar	i silvícola (sp.	principal)			•		
Situació de la massa fores	stal desprès de la tallada silv	ícola (Model ORG	EST)								
		Anys Densitat (p/ha)	AB (m2/ha)	Dg (cm)	BAT (t/ha)	BBF (t/ha)	BST (t/ha)	CAT (t/ha)	CBF (t/ha)	CST (t/ha)	C (t/ha)
volució prevista de la mo	assa forestal desprès de la to										
	Espècie	Anys Densitat (p/ha)	AB (m2/ha)	Dg (cm)	BAT (t/ha)	BBF (t/ha)	BST (t/ha)	CAT (t/ha)	CBF (t/ha)	CST (t/ha)	C (t/ha)
te.					1		1	1	1	1	1
Masses mixtes (espècie											
Qualitat d'estació	→ Model de gestió		Estadi de de	senvolupame	ent						
Dades de la tallada silvi	cola realitzada										
	Densitat (p/l	na) AB (m2/ha)	AB (%)	Dg (cm)	BAT (t/ha)	BBF (t/ha)	BST (t/ha)	CAT (t/ha)	CBF (t/ha)	CST (t/ha)	C (t/ha)
Espècie											
Espècie	<u> </u>							Į.			
RESULTATS CÀPSULA 1:	SEGREST DE CARBONI										
			<u>b gestió</u> <u>Se</u>	nse gestió	Balanç G-nG	Calı	cular	Validar	Reini	ciar	Tancar
	reixement de la massa foresta					Cui		vulluul	Kenn	Clui	Turicur
Emissions de carbo	oni per matèria orgànica morta Balanç de carbon						uadrátic mig	BAT: CB	T: Carboni aeria R: Carboni en bran		
Balanç d	e diòxid de carboni segrestat	(t/ha/any)				Biomassa e Biomassa e Riomassa e	n branques i fulles	BST: Ca	T: Carboni en arrel. rboni total 17+002	t C: 1tC=	

Figure 3. Impact on carbon balance module.

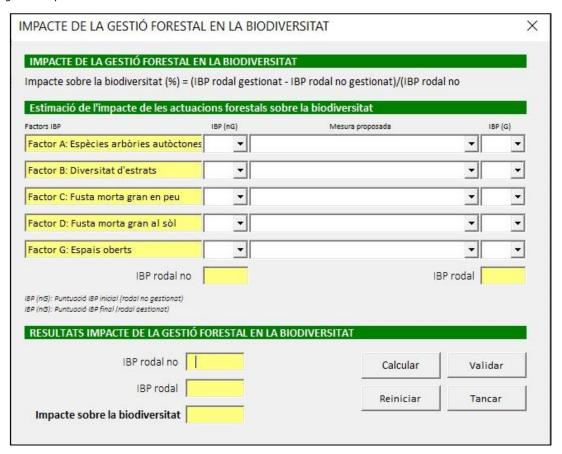


Figure 4. Impact on biodiversity module.