2023

Protocol for Assessing Digital Tools in Climate Change Mitigation Research and Extension

Mary Ngaiwi
Martha Vanegas Cubillos
Janelle Sylvester
Alliance Bioversity - CIAT
11/24/2023

Introduction

Climate change is one of the most pressing global issues of our time, and it requires urgent action from individuals, businesses, and governments worldwide. While there are various ways to mitigate the effects of climate change, the role of digital tools in this effort cannot be overstated. With the advancement of technology, we now have access to a wide range of digital tools that can help reduce greenhouse gas emissions, increase energy efficiency, and promote renewable energy sources while also taking into consideration Sustainable Development Goals (SDGs). In this context, this assessment aims to highlight some of the most effective research-based digital tools available for climate change mitigation that can also guide the inclusion of SDGs in climate change mitigation research. Using these tools, we can take essential steps towards a more sustainable future and mitigate the impact of climate change. While it is true that many digital tools for climate change mitigation in agriculture are farmer centered, there are also several tools available for researchers and agricultural extension advisors. These groups play a crucial role in developing and implementing sustainable agricultural practices that can help mitigate the impact of climate change. For this assessment, we use the definition provided by Burns et al. (2022) that regards digital tools as "programs or applications used on devices such as cell phones, computers, or tablets that allow users to engage in defined target activities," in this case, climate change mitigation and selected SDGs.

Objective

The objective of this study is to assess available digital tools that researchers and extension advisers can use to contribute to achieving low-emission food systems and sustainable development priorities and to determine, based on the assessment, what digital tool needs persist.

Methodology

Based on the definition used for digital tools, we selected tools that have research or extensionist functions and climate change mitigation content, features, or components. The assessment of the tools included their application to SDGs[1] 1, 2, 13, 15, and 16 and gender and social inclusion.

Search Databases

Tools were identified using the following approaches:

- CGIAR Evidence Clearing House (https://bigdata.cgiar.org/evidence-clearing-house/)
- Digital Agri Hub (https://digitalagrihub.org/)
- Science Direct search query: (digital tools) AND (climate change mitigation) AND (Researcher OR Extension agent) AND (agroecosystem OR landscape OR value chain)
- Google searches
- Questionnaire to scientists working on climate change at the Alliance Bioversity and CIAT.

Selection Criteria

The inclusion criteria required that the digital tool:

- Has a robust scientific foundation backed by research.
- Is intended to be used by researchers and agricultural extension agents.
- Provides technical advice or can be used in the monitoring, reporting, or verification (MRV) of aspects of climate change mitigation projects, initiatives, practices, or strategies.
- Applies or could be applied to planning, development, implementation, or MRV of research or agricultural extension services targeting climate change mitigation.
- Applies or could be applied at the agroecosystem, landscape, value chain, or food system scale.

[1] The SDGs selected comply with the work being developed by AgriLAC Resiliente, the OneCGIAR initiative in which this work is being developed. In addition, these SDGs also represent the impact areas of the CGIAR: climate adaptation and mitigation; environmental health and biodiversity; nutrition, health, and food security; poverty reduction, livelihoods, and jobs; gender equality, youth, and social inclusion.

The exclusion criteria eliminated tools that:

- Were solely farmer centered.
- Did not provide enough information online.
- Were no longer active or in use.

Data Extraction

We have developed 66 variables to characterize and assess the digital tools. Variables include basic information (e.g., developer, year of development, date of update) and whether they are classified as ex-ante (i.e., the tool is designed to predict or anticipate the outcomes or effects of a particular decision or action or serves as a planning tool that helps researchers or extensionists to plan and organize their activities, projects, or goals) or ex-post (i.e., the tool is used for assessing a project, program, or research after completion) or both. We also consider whether the tool is/can be applied to the agroecosystem, value chain, landscape, or food system scale. Lastly, we include variables that consider the application of the tool to the SDG priorities of no poverty, zero hunger, climate action, peace, justice, and strong institution, climate action (climate change mitigation), gender and social inclusion, land neutrality and restoration.

The variables regarding the SDGs were adopted and refined from the *Global indicator framework for Sustainable Development Goals* developed by the Inter-Agency and Expert Group on SDG Indicators[2] using the methodology of Burns et al. (2022). A description of each variable is given in Annex 1. The assessment of each tool is done by accessing the tool and reviewing in-depth related materials online. A database is to be created in Microsoft Excel with the tools and the results of the assessment. Variables are marked as 'NI' when information is not available and ‘NA’ when the variable does not apply to the tool.

[2] https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202022%20refinement_Eng.pdf

Evaluation process

During the assessment, each tool is evaluated against the predefined criteria and assessed in the context of its applicability to climate change research. This systematic examination has three principle aims: 1) identify synergies between the digital tools and one or more of the SDGs identified for consideration; 2) to offer to researchers and extensionists an overview of the digital tools that can be used in climate action research and that also aim to contribute to the specific SDGs selected; and 3) determine gaps among available tools regarding synergies between climate change mitigation and selected SDGs.

A noteworthy feature of the protocol is its adaptability. The protocol can be flexibly adjusted to accommodate the researcher's or extensionist's specific preferences and priorities. This flexibility extends to the consideration of SDGs, wherein variables deemed irrelevant by the researcher can be omitted from the evaluation, streamlining the assessment process.

This protocol stands as a comprehensive framework designed to facilitate the assessment of digital tools. Its overarching objective is to ensure a thorough evaluation, meticulously aligned to promote low-emission food systems and contribute substantively to broader sustainable development objectives.

Following the execution of this protocol, the subsequent phase will involve a presentation of study results alongside the Excel spreadsheet employed to assess digital tools. This documentation will provide transparency, replicability, and a detailed insight into the evaluation process.

Acknowledge

This work was carried out in the frame of work package 3 “Developing an agrifood system that meets both mitigation and sustainable development objectives” of the One CGIAR regional initiative AgriLAC resiliente.

Reference

Burns, S., Dittmer K.M., Shelton S.W., Wollenberg E. 2022. Global digital tool review for agroecological transitions. Agroecological TRANSITIONS: Inclusive Digital Tools to Enable Climate-informed Agroecological Transitions (ATDT). Cali, Colombia: Alliance of Bioversity & CIAT.

Annex 1 Variables used to characterize and assess tools for climate change mitigation research and extensionist services. *Where applicable, measuring may also include projections of measurements associated with some type of change in land use, such as in the case of ex-ante foresight tools. **Additional SDG targeted by the variable.

Type of information collected	Variable	Explanation	Examples
Basic Informtion	**Name of tool**	Refers to the official name of the tool	Scala- PB, Terra-i
	Source of Information	Refers to source(s) from which information on this tool was gathered	ZALF website, name of the article, name of the report
	Year	Refers to the year the tool was developed	2018, 2020
	Ex-ante, ex-post	Refers to when the tool can be applied	ex-ante, ex-post, both
	Purpose of the tool	Refers to the purpose with which the tool was created	The aim of the tool is to calculate GHG emissions
	Developer	Refers to who developed this tool	FAO, World Bank
	If developed by CGIAR, specify	Specify the name of the CGIAR center or program, if applicable	IFPRI, ABC, Gender impact platform

Access	Refers to the accessibility of the tool (open access, limited access, access under payment)	Open access, only some modules/features are open access, only under payment
Date of update	Refers to the last known date of tool update	2020
Number of common users	Refers to the number of frequent users of the tool	100
Number of monthly users	Refers to the number of users of the tool in a month	500
Number of downloads	Refers to the number of times that the tool has been downloaded	1000
Adaptable to different geographical areas	Refers to the possibility to use the tool in different geographical areas	Yes/no, specify
Tool format	Refers to the format in which h the tool is accessible	phone app, computer app, spreadsheet, online platform, website
Scale	Refers to the scale in which the tool can be used	Agroecosystem, landscape, value chain scale or food system

	Target users	Refers to the target users of the tool	Researchers, extensionists, practitioners, policymakers
	Language	Refers to the languages the tool can be used	English, Spanish, French
	Type of data required	Refers to the type of data the tool uses or requires to function	emissions data, carbon stock data, economic data, social data, etc.
SDG 13 – Climate Action	**Provides carbon footprint estimations**	Does this tool facilitate estimating the carbon footprint (i.e. the overall total amount of greenhouse gases) that are generated directly or indirectly by the target activity? The carbon footprint involves assessing the overall impact of an activity on the climate, considering the total greenhouse gas emissions associated with that activity. The carbon footprint includes all relevant emissions, expressed in CO2e (carbon dioxide equivalent), to provide a comprehensive measure of the activity's contribution to climate change.	yes/no, if yes, how?
	Supports MRV of emissions	Is the tool used in measuring or calculating emissions? Contrary to a carbon footprint, calculating	yes/no, if yes, how?

	emissions could entail focusing on specific gases from specific sources, rather than trying to capture the overall total of GHG emissions directly and indirectly generated by an activity. In other words, the tool supports MRV of direct emissions from selected parts of the activity (and does not necessarily express emissions as CO2e).	
Supports MRV of carbon stocks	Is the tool used in measuring carbon stocks? This question focuses on whether the tool is designed to measure or assess the amount of carbon stored in specific terrestrial or aquatic ecosystems, such as forests, soils, seagrass beds, or other vegetation and habitats. Tools that measure carbon stocks provide insights into the capacity of an ecosystem (or an intervention, such as reforestation) to sequester and store carbon.	yes/no, if yes, how?
Supports MRV of carbon benefits	Does the tool support quantifying emissions avoided or carbon sequestered above the "business-as-usual" (i.e. baseline) scenario?	yes/no, if yes, how?
Supports MRV of co-benefits (non-carbon benefits)	Does the tool support MRV of non-carbon benefits arising from mitigation activities, such as alleviating poverty, protecting the	yes/no, if yes, how?

		environment, enhancing biodiversity, improving forest governance and protecting human rights, among others?	
	Provides information on or supports MRV of CC impacts	Does this tool provide information on or support MRV of climate change impacts such as impact of climate-related shocks and stresses?	yes/no, if yes, how?
	Support making CC mitigation recommendations?	Does this tool support making climate change mitigation recommendations?	yes/no, if yes, how?
	Collect or provide information on agricultural practices	Does this tool collect or provide information on agricultural practices that will allow to identify if the practices are sustainable or aligned with a low - emission food system?	yes/no, if yes, how?
	Monitors resilience or provides recommendations for increasing resilience of agricultural systems against extreme weather events?	Can this tool monitor resilience of agricultural systems or provide information needed to adapt to a changing climate (e.g. extreme weather events), mitigate risks, and optimize productivity in a sustainable and resilient manner? **SDG1	yes/no, if yes, how?
SDG1- No poverty	**Collect/consider/monitor sociodemographic data related to poverty**	Does this tool collect or consider sociodemographic data related to poverty?	yes/no, if yes, how?
	Can the tool be used to monitor or improve farmer or community access to and use of financial services?	Does the tool relate to improving farmers or community access to and use of financial services/resources?	yes/no, if yes, how?

	Monitor or improve farmer income generation	Can the tool be used to monitor or improve farmer income generation?	yes/no, if yes, how?
	To be used in conjunction with training or capacity building workshops	Does this tool required training or capacity building workshops to be used?	yes/no, if yes, how?
	Collect or provide information on land tenure status and security	Does this tool collect or provide information on land tenure status and security?	yes/no, if yes, how?
SDG 2 – zero hunger	**Collect or provide information on food availability**	Does this tool collect or provide information on food availability in different regions? SDG1	yes/no, if yes, how?
	Collect information on or provide a track record of the distribution of food	Does this tool collect information on or provide a track record of the distribution of food in different regions?	yes/no, if yes, how?
	Collect or provide information related to efficiency or productivity of agricultural systems	Does this tool collect or provide information related to efficiency or productivity of agricultural systems?	yes/no, if yes, how?
	Collect or provide information for tracking and reducing food waste	Does this tool collect or provide information that is useful for tracking and reducing food waste?	yes/no, if yes, how?
	Collect data on or include considerations about prevalence of undernourishment or malnutrition	Does this tool collect data on or include considerations about prevalence of undernourishment or malnutrition? This includes collecting or considering data on proxy variables related to nutrition.	yes/no, if yes, how?

Track the nutrition outcomes of food programs, interventions, or policies	Can this tool be used to track the nutrition outcomes of specific interventions or projects, such as food programs policies or agricultural/landscape interventions? This would require baseline data and monitoring of nutrition outcomes after an intervention.	yes/no, if yes, how?
Collect data on or monitor changes in food insecurity	Can this tool be used to collect data on or monitor changes in food insecurity?	yes/no, if yes, how?
Used to gain information on the proportion of agricultural land under different production systems?	Can this tool be used to gain information on the proportion of agricultural land under different production systems? This does not include tools that use proportions of land under different agricultural uses as input data. A common example is mapping and remote sensing tools.	yes/no, if yes, how?
Identify priority areas where sustainable food production can be promoted and established	Can this tool be used to identify priority areas where sustainable food production can be promoted and established?	yes/no, if yes, how?
Monitoring and assessment of the sustainability of production systems	Does this tool contribute to the monitoring and assessment of the sustainability of given production systems? This means that the tool should address all three dimensions of sustainability (social, environmental, and economic). If only one of the	yes/no, if yes, how?

		dimensions is measured, please mark NO.	
	Used to inform the implementation and/or design of food production systems?	Can this tool be used to inform the implementation and/or design of food production systems?	yes/no, if yes, how?
	Provide or collect information related to government/or other type of investment in the agriculture sector	Does this tool provide or collect information related to government investment in the agriculture sector?	yes/no, if yes, how?
	Does this tool collect or provide information on food price?	The tool collects, considers or monitors food prices or related proxies.	yes/no, if yes, how?
SDG-15 Life on land	**Identify, inform the design of, support the establishment of, or monitor biodiversity-promoting practices**	Can the tool be used to identify, inform the design of, support the establishment of, or monitor the impacts of biodiversity-promoting practices?	yes/no, if yes, how?
	Applied to biodiversity monitoring in agricultural systems	Can the tool be applied to biodiversity monitoring in agricultural systems, landscapes, value chains or food system?	yes/no, if yes, how?
	Collect or provide information useful for tracking ecosystem health	Does the tool collect or provide information useful for tracking ecosystem health? The tool would require a monitoring component (i.e. collection of real-time data, regular assessments, or periodic updates on	yes/no, if yes, how?

		key indicators) and might include information on biodiversity, soil quality, water quality, vegetation cover, and other indicators that contribute to the overall well-being of ecosystems. Ideally, the tool incorporates a comprehensive set of ecosystem indicators.	
	Applications for assessing or monitoring soil health	Does this tool have applications for assessing or monitoring soil health? Review whether the tool is designed to measure key soil indicators that contribute to soil health. These indicators may include soil organic matter content, nutrient levels, pH, texture, microbial activity, and other relevant parameters.	yes/no, if yes, how?
	Support forest management and conservation efforts	Does the tool support forest management and conservation efforts, such as by tracking deforestation rates or identifying key forest habitats?	yes/no, if yes, how?
	Monitor or assess land degradation	Can this tool be used to monitor or assess land degradation?	yes/no, if yes, how?
	Monitor or assess land restoration	Can this tool be used to monitor or assess land restoration?	yes/no, if yes, how?
	Identify priority areas for restoration	Can this tool be used to identify priority areas for restoration?	yes/no, if yes, how?
	Provide information on the assessment and	Does this tool provide information on the assessment and management of	yes/no, if yes, how?

	management of water resources, such as by tracking water usage or informing the development of irrigation systems?	water resources, such as by tracking water usage or informing the development of irrigation systems?	
SDG-16 peace, justice and strong institutions	**Can the tool be used in a participatory approach to decision-making?**	Is the tool useful for or help facilitate a participatory approach that involves stakeholders in decision-making processes?	yes/no, if yes, how?
	Provide or help facilitate opportunities for feedback, discussion, and collaboration among stakeholders	Does the tool provide or help facilitate opportunities for feedback, discussion, and collaboration among stakeholders?	yes/no, if yes, how?
	Provide a platform to monitor and evaluate its outcomes and adjust its strategies accordingly	Does the tool facilitate monitoring and evaluation of outcomes and adaptive management (i.e. adjusting strategies as needed based on observed outcomes, new information or changing conditions)?	yes/no, if yes, how?
Gender	**Collect data on gender and intersectionality**	The tool includes specific fields or questions in its data collection forms/surveys that capture gender-related information, such as gender identity, roles, and responsibilities, OR the tool allows for the collection of data on intersecting identities and characteristics, such as age, ethnicity,	yes/no, if yes, how?

		socioeconomic status, disability, etc.	
	Aid in improving gender and social inclusion in the planning, development, and implementation of interventions/projects/research for development	The tool offers guidance or resources on gender-responsive and inclusive approaches to project planning and design, supports the identification and incorporation of gender and social inclusion considerations into project goals and objectives, or provides means to involve marginalized and underrepresented groups in decision-making processes.	yes/no, if yes, how?
	Facilitate data collection or provide information on how the benefits of an intervention/project (could or did) differ among gender and intersectionality dimensions?	Does the tool help provide information on how the benefits of an intervention/project could or did differ among gender and intersectionality dimensions? For example, the tool offers options to disaggregate data by gender and intersectionality dimensions for analysis and reporting, allows for the comparison of project outcomes and impacts across gender and intersectionality dimensions, or provides visualizations or reports that highlight differences in benefits received by diverse groups.	yes/no, if yes, how?
	Facilitate monitoring and assessment of benefits related to gender and social inclusion	To facilitate monitoring, the tool could: • Include indicators and metrics related to gender and social inclusion that can be monitored throughout the project's duration.	yes/no, if yes, how?

		• Allow for the regular reporting of gender and social inclusion-related progress and results. • Support real-time tracking of outcomes to identify potential gender and social inclusion gaps.	
	Facilitate measures to consider, prioritize, assess, monitor and/or improve women empowerment	For example, • The tool includes specific indicators and metrics to measure women's empowerment. • The tool offers guidance or resources on how to assess and improve women's empowerment in projects. • The tool supports regular monitoring of women's empowerment indicators.	yes/no, if yes, how?
	Collect or consider data regarding diversity of the research team	Does the tool include questions or fields that capture demographic information of the research team members or allow for the reporting and analysis of diversity-related data for the research team.	yes/no, if yes, how?
	General comments	Please provide any additional comments relevant for the assessment	