Objective B4 - MRV Tools

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Label	Title	Description
MRV Tools	Provide tools for Monitoring, Reporting & Verification of Soil Health (SH) and Soil Organic Carbon (SOC) to practitioners	An updated and improved, global, user-friendly MRV (Monitoring, Reporting & Verification) toolkit on SH and SOC, providing, i.a., tools for cost-benefit analysis, evaluation, monitoring, and decision support systems is available and freely accessible online.

Targets B4 - MRV Tools

Baseline 2020	Target 2030	Target 2050
Existing tools and experts on MRV have been identified and are active in the 4p1000 network.	Existing MRV tool kits have comparable and clearly defined outputs available on the electronic platform.	The MRV toolkit provides an important foundation for the development and application of a dynamic and ecosystem-based diagnosis of SH.

Context B4 - MRV Tools

Problem B4 - MRV Tools

Problem Statement	Description	Consequences
The availability, reliability, and accuracy of current MRV instruments vary from country to country.	While there are a variety of field, laboratory, and remote sensing soil assessment tools, a compilation of the many methods developed does not result in a single efficient, state-of-the-art protocol that ensures MRV reliability. There are many tools/techniques proposed by the scientific community, with varying levels of development and complexity, and varying ranges of validity. It is very difficult for a non-expert to select among these instruments. A global consensus on what constitutes good soil management practices with cost-effective and practical tools for land managers to evaluate soil regeneration outcomes remains elusive. This includes establishing third-party verification and monitoring mechanisms to make the system transparent and reliable and to attract investors. This is a prerequisite for evidence-based agriculture and land management practices as an important feedback loop in the system.	Different methodologies have not been harmonized to enable robust result comparison. Missing agreement on how to measure SH and SOC also leads to confusion and makes positive results from GAFOLUP adoption debatable. This hampers policy action and investments. Different methodologies can also add value and robustness when combined. Instead of harmonization, an alternative consequence can be an additional stage of methodology integration.

Causes B4 - MRV Tools

N°	Cause	Description
1	Oversimplification	Classic Soil laboratories over-emphasize soil's physical and chemical properties, simplifying the dynamics of plants, soil, and soil organisms. The results discourage perspectives of promoting SH from an ecosystem perspective. It also has limitations in providing an in-situ diagnosis of SH conditions.
2	Complexity	SOC dynamics are more complex and long-term based than the mere amount of total carbon at one specific time.
3	Regional calibration	MRV tools are often calibrated only at the global instead of regional level.
4	Costliness	Current SOC measurement methods are costly, resource-intensive, and time-consuming.
5	Lack of standard for SOC	The traditional indexes (carbon mineralization coefficient, microbial biomass: carbon ratio, metabolic quotient, and mean retention time of SOC) require standard quantification and detailed training in terms of calculation and standard units for each index. There are also fundamental methodological challenges in determining SOC and its dynamics. It is not easy to determine whether natural or added SOC is readily mineralized or stable and whether microbial biomass increases or decreases after soil amendments. Added biomass can also promote CO_2 emissions. Thus, the actual half-life of SOC is difficult to determine based only on current soil respiration rates.
6	Multivariate	Soil is a complex ecosystem with interacting biophysical processes leading to functions and properties. SH is an integrative concept that can be formalized in different ways.

Implementation strategy B4 - MRV Tools

Activities B4 - MRV Tools

N°	Title	Description
1	Screen MRV solutions	Conduct an inventory and assessment of existing MRV tools, considering transferability, regional adaptability, and knowledge limitations.
2	Match offer and demand for MRV tools	Identify and involve major MRV tool developers and users to analyze and match supply and demand for the toolkit.
3	Mobilize resource	Raise funds for MRV from public and private investors that fund climate action projects and encourage research in SOC dynamics.
4	Ensure interoperability	Support the establishment of a globally integrated monitoring system (see GLOSIS from FAO). This will be crucial to overcome initialization costs and facilitate large-scale comparisons between regions, countries, and even commodities. It will also help to support the provision of incentives to farmers implementing regenerative agriculture.
5	Include benefits for ecosystems	Include MRV tools for cost-benefit analysis and quantify ecosystem-function benefits resulting from good SOC management, as this will encourage financial support.
6	Develop a user-friendly online catalog	Develop a user-friendly interface for the MRV toolkit adapted to users' needs and possibilities. Explore what is the most broadly available online device among farmers in targeted regions to develop a solution that is tailored to the most popular technology.
7	Ensure inclusion of small farms	Support the development of policies that provide support to small and medium-sized farms, as well as young and beginner farmers, to continuously use MRV. Ensure that a greater portion of funding in available programs is dedicated to this group.
8	Train users	Organize training modules for MRV toolkit users. These training modules should be linked to training on soil carbon storage activities.

Critical Success Factors (CSFs) B4 - MRV Tools

N°	Critical Success Factor	Description
1	Co-design	Involve farmers in the design of the MRV toolkit to make sure that they have tangible benefits from using it.
2	Open-source	Grant open access to the MRV toolkit and generated data. This allows the community to develop tools further, builds on network effects, and contributes to a growing data stock, which makes MRV easier in the future.
3	Accuracy and reliability	The online toolkit should be validated by farm-level sampling for multiple regions to provide confidence to users and incentivize providers.
4	Monetary incentives	Incentivize land managers to evaluate and report SOC levels by strengthening the role of SOC in carbon markets.
5	Comprehensive coverage	Make sure to include all relevant models and actors engaged in long term SH and SOC studies and monitoring
6	State-of-the-art	Keep in mind that technologies will change in the next 10 to 30 years. Built the MRV kit around technological trends, which are likely to stay such as remote sensing-based models, drones, airborne direct measurements, and modeling. It is recommendable to evaluate how to integrate laboratory and remote sensing data.
7	Knowledge transfer	New research-centered approaches and technologies need to become applicable. For this, a trans-disciplinary approach is needed, which builds on initial research results but is centered around action research incl. field-testing of MRV techniques and gathering feedback in a real-life context. The gap between research and application can be filled by private companies.
8	Context specificity	Ensure that regional advocates help adapt the toolkits to local contexts, considering local resources and available materials, and demonstrate it to front-line parties. This is especially important when the front line has a limited knowledge base or difficulties in reading/comprehending written materials.
9	Synergies	Ensure cross-referencing with some established MRV toolkits such as those from FAO’s soil global partnership scheme.

Barriers B4 - MRV Tools

N°	Barrier	Description
1	Skepticism	Contextual considerations regarding the regions' cultural practices and myths can hinder people's acceptance of new tools. For example, impressions like those that soil is full of pathogens and insects, which are mostly harmful to crop yield, are deep-rooted in farming communities.
3	Infrastructure	Many farmers, from the rural USA to subsistence farmers in developing countries, lack access to (high-speed/broadband) internet.
4	Policy support	A lack of regulations and incentive programs to support the use of MRV tools.