



Food and Agriculture  
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**IGES**  
Institute for Global  
Environmental Strategies

Understanding countries' status and challenges for the estimation of carbon stock changes from mineral soils in national greenhouse gas inventories:

## **Preliminary survey findings**





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# ABBREVIATIONS AND ACRONYMS

<b>AFOLU</b>	Agriculture, forestry and other land use
<b>CO<sub>2</sub></b>	carbon dioxide
<b>CSCs</b>	carbon stock changes
<b>ETF</b>	Enhanced Transparency Framework
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GHG</b>	greenhouse gas
<b>GHGI</b>	greenhouse gas inventory
<b>GSP</b>	Global Soil Partnership
<b>IGES</b>	Institute for Global Environmental Strategies
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>KJWA</b>	Koronivia Joint Work on Agriculture
<b>NDC</b>	nationally determined contribution
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

# BACKGROUND

Soil constitutes the largest carbon pool in terrestrial ecosystems (FAO, 2016). Soil organic carbon is crucial to soil health and fertility, which underlies the soil's ability to provide essential ecosystem services, including food production and biodiversity. Preserving it is thus essential for sustainable development.

Soil conservation benefits efforts towards achieving biodiversity targets, land degradation neutrality objectives, and the Paris Agreement's long-term temperature goals (UNFCCC, 2016) through carbon sequestration. Soil carbon and soil fertility are recognized as major topics in the Koronivia Joint Work on Agriculture (KJWA) under the United Nations Framework Convention on Climate Change (UNFCCC) where there is a growing recognition that investing in soil health could be a 'no-regrets' option for the KJWA moving forward (UNFCCC, 2019).

The Food and Agriculture Organization of the United Nations (FAO), in close collaboration with the UNFCCC and other actors at the international and national levels, supports the development and implementation of the KJWA by providing technical support to adapt to climate change and mitigate against it. FAO also hosts the secretariat of the Global Soil Partnership (GSP) which is the recognized mechanism aiming at positioning soils in the global agenda through collective action (FAO, 2012). FAO also supports countries' efforts to address the reporting requirements of the Paris Agreement's Enhanced Transparency Framework (ETF) (UNFCCC, 2018) by strengthening their capacity to report on soils.

Despite the growing global support for capacity building to improve soil management, the estimation and reporting of greenhouse gas (GHG) emissions and removals, especially from mineral soils (FAO, 1998, 2014), in national GHG inventories is still very limited. Developing and developed countries are struggling to report on carbon stock changes (CSCs) and associated carbon dioxide (CO<sub>2</sub>) emissions from mineral soils, even when using the basic Intergovernmental Panel on Climate Change (IPCC) Tier 1 methodological level (IPCC, 2006).

An understanding of the reasons for these reporting difficulties is urgently needed to provide more targeted support towards filling reporting gaps. This would help countries fulfill their ETF reporting requirements. It would also provide insights for developing targeted policies to encourage ambitious nationally determined contributions (NDCs); and boost capacity to track the results of climate policy actions.



# THE SURVEY

In 2021, the Institute for Global Environmental Strategies (IGES) and FAO conducted a global survey to assess how countries have addressed the estimation of CSCs in mineral soils in their GHG inventories.

The main objectives of the survey were to:

- determine country status on estimating and reporting on CSCs in mineral soils due to land use and land management changes (methods applied, availability of background information on soils and land management, knowledge of the IPCC guidelines, internal collaboration, etc.);
- identify country challenges, constraints and capacity needs, and collect feedback on potential solutions for addressing them; and
- develop recommendations for targeted actions and support to fill reporting gaps in the UNFCCC process.

The survey was targeted at:

- technical experts involved in the GHG inventory preparation and processes (hereafter, GHGI experts); and
- experts in government, or research and academic institutes, working on soils (hereafter, soil scientists).

The survey was conducted online to allow wide dissemination especially through networks such as the FAO transparency in agriculture and land use network, the KJWA community, GSP members, and other FAO social media networks. The survey ran for three weeks from 21 September to 8 October 2021.

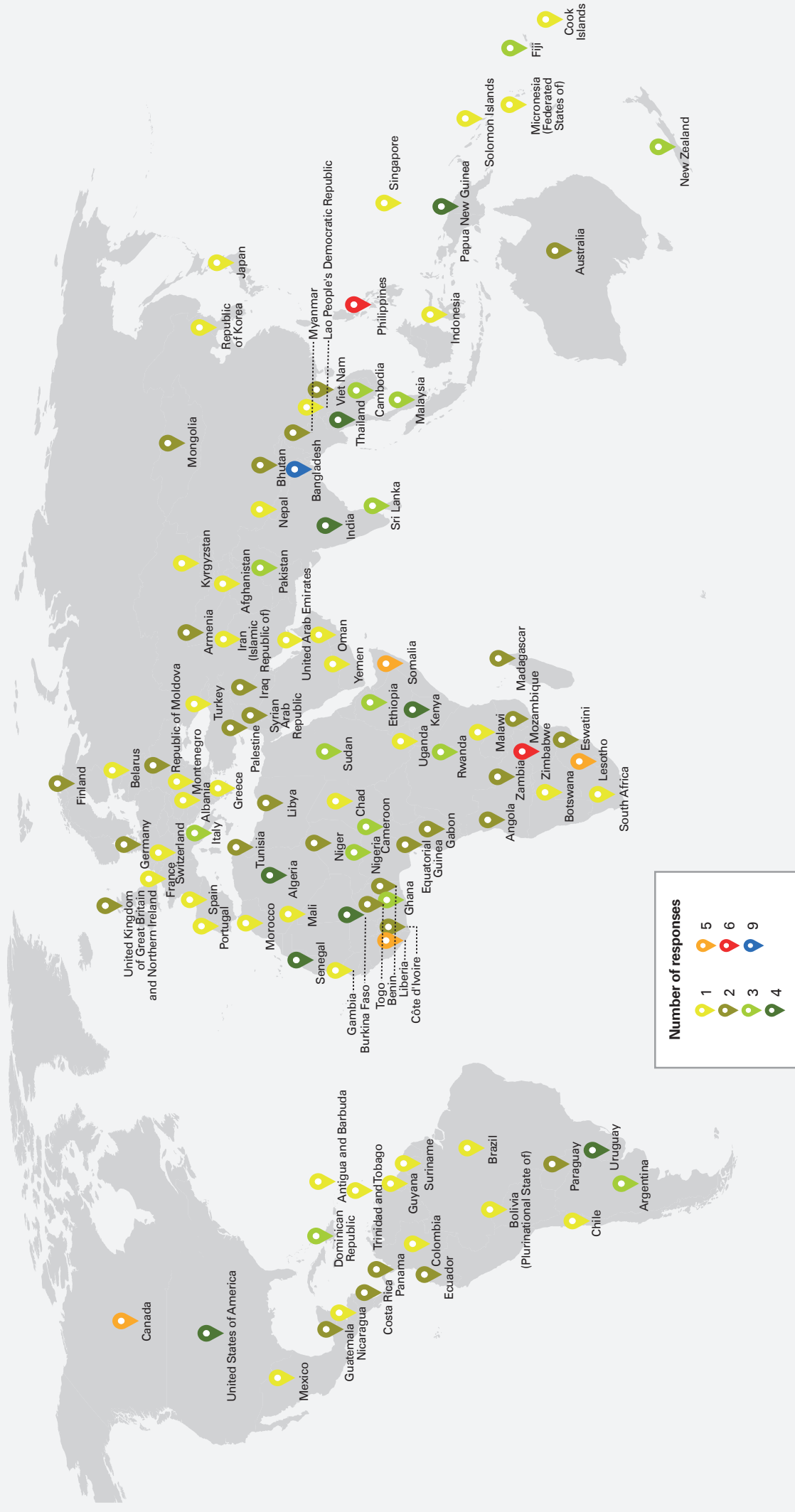
The survey had a total of 226 responses from 104 countries, of which 16 were from developed and 88 from developing countries (Figure 1).

Respondents consisted of 135 GHGI experts and 91 soil scientists. It included respondents directly involved in the GHGI process, as well as some who were not involved (Table 1).

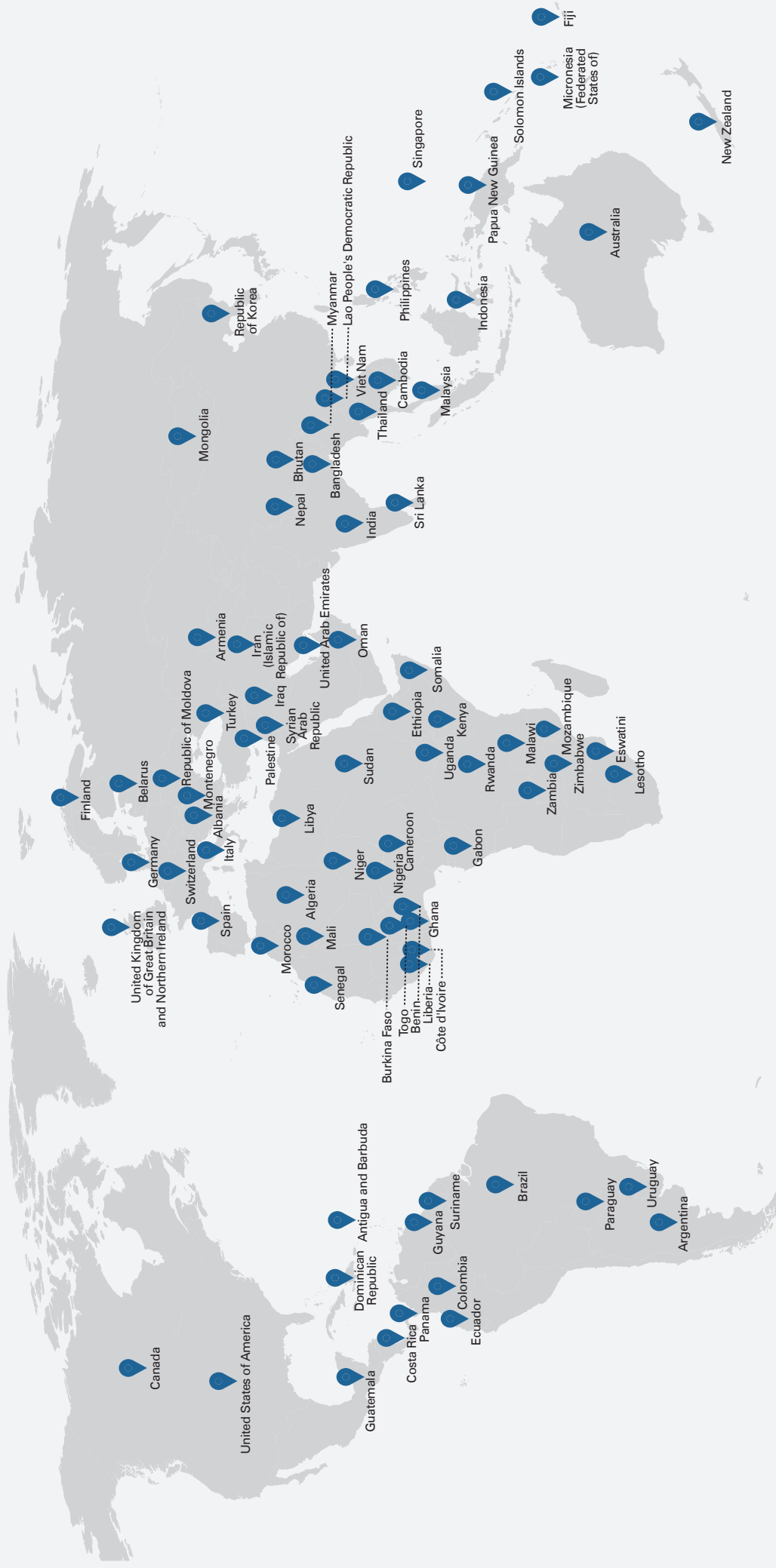
**Table 1: Profile of respondents by involvement in the GHGI process**

		GHGI EXPERTS		SOIL SCIENTISTS		TOTAL	
		No	%	No	%	No	%
ALL RESPONDENTS		135	<b>60</b>	91	<b>40</b>	226	-
INVOLVEMENT IN THE GHGI PROCESS	INVOLVED	109	<b>81</b>	30	<b>33</b>	139	<b>62</b>
	NOT INVOLVED	26	<b>19</b>	61	<b>67</b>	87	<b>38</b>

**Figure 1: Number of responses by country**



**Figure 2: Countries covered in the analysis**



# PRELIMINARY ANALYSIS

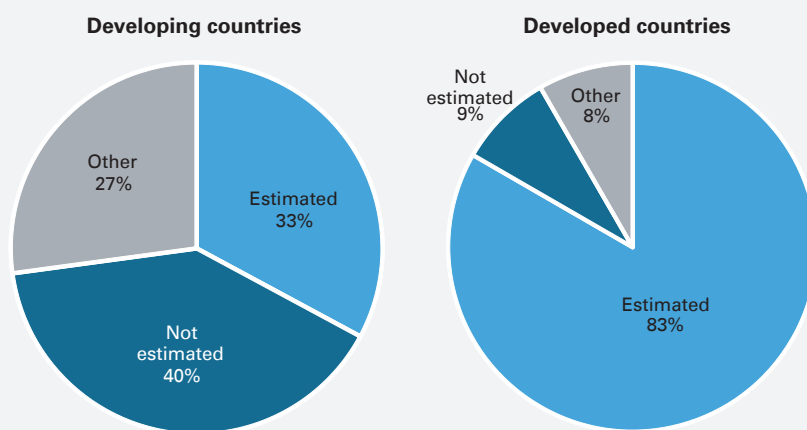
In this analysis, we describe the survey's preliminary key findings to understand country status and challenges for the estimation of CSCs in mineral soils. A more detailed analysis of the overall results will follow in the first half of 2022.

In this analysis, we focus on the responses of those directly involved in the GHGI process: 109 GHGI experts and 30 soil scientists, representing 70 developing countries and 12 developed countries (Figure 2).

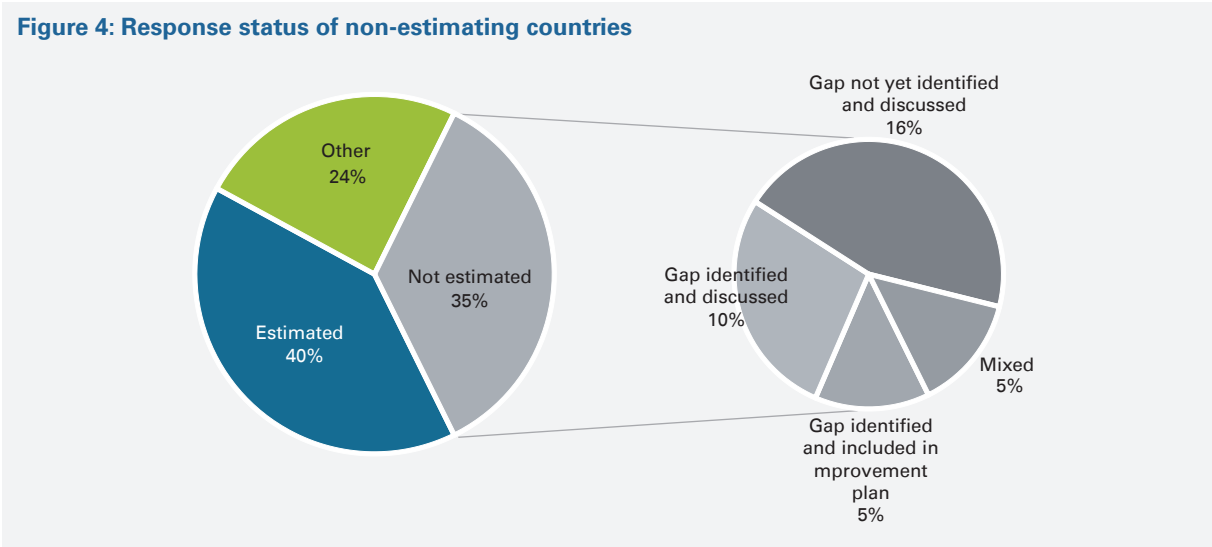
## **The majority of developed countries, but only one third of developing countries, estimated CSCs in mineral soils.**

The survey results show that the estimation of CSCs from mineral soils has been carried out in 23 out of 70 developing countries (33 percent), and ten out of 12 developed countries (83 percent) (Figure 3). On the other hand, 40 percent of developing countries did not perform this estimation versus nine percent in developed countries. Finally, some countries were labelled as "other" since: 1) respondents indicated that they were not aware of the status of CSCs estimation; or 2) respondents from the same countries indicated their status differently. In the latter case only, countries were labelled as "mixed". Therefore, the research team could not confirm the status of the country in this preliminary analysis.

**Figure 3: Country estimation status**

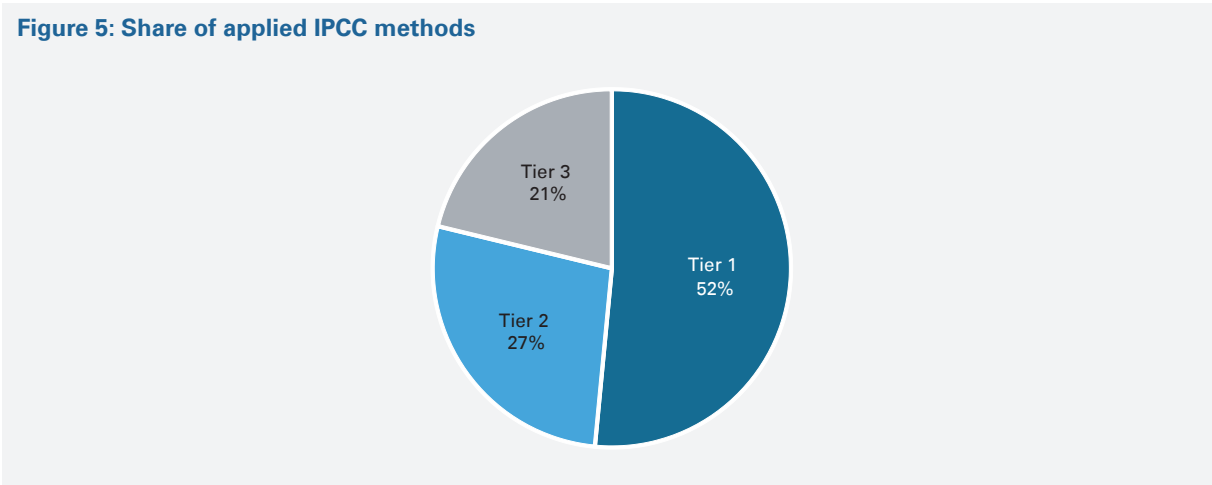


Focusing on the 28 developing countries and the one developed country that have not estimated CSCs in mineral soils, 13 countries (16 percent) have not identified or discussed the estimation of CSCs in mineral soils as a gap; eight countries (ten percent) have identified the non-estimation of CSCs as a gap; and four countries (5 percent) have included it as part of their improvement plan for national GHGIs (Figure 4). The latter will most likely estimate CSCs once they implement their plans. Finally, in 4 countries (5 percent) labelled as “mixed,” respondents from the same countries indicated their status differently.



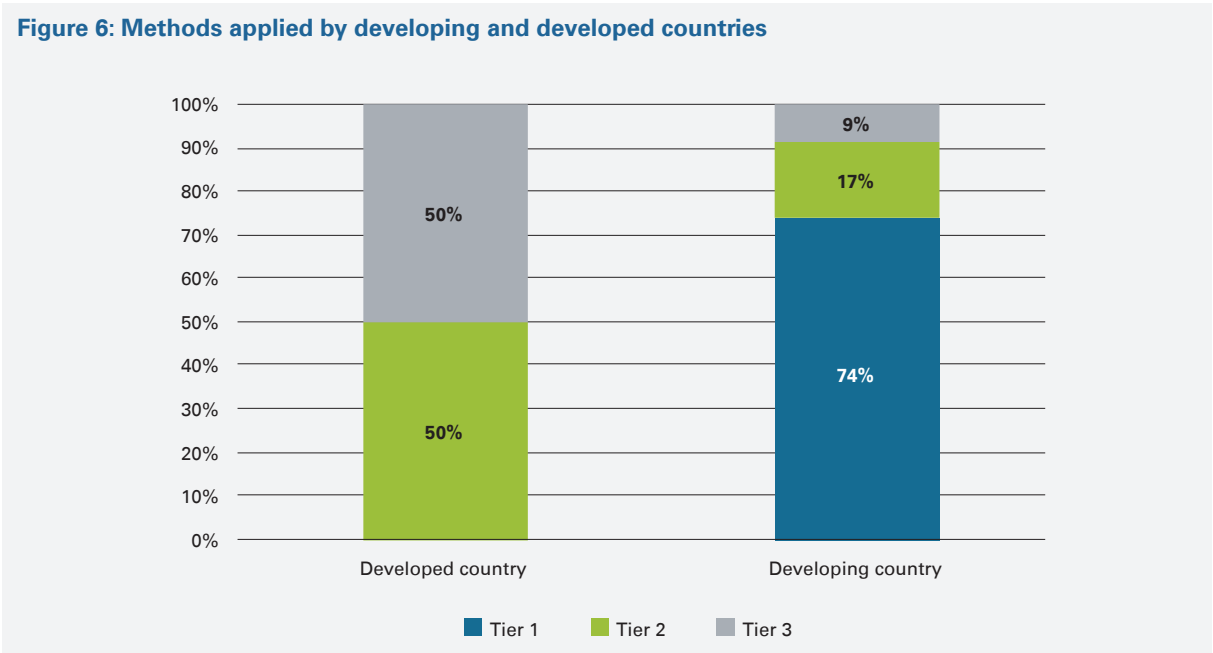
**Tier 1 is the main method applied, especially in developing countries. Advanced methods are mainly used in developed countries.**

As shown in Figure 5, responses from 17 (52 percent) out of the 33 countries that estimated CSCs indicated that the main method applied to estimate CSCs in mineral soils is Tier 1 (basic) of the 2006 IPCC guidelines. However, the method used differs according to country status.

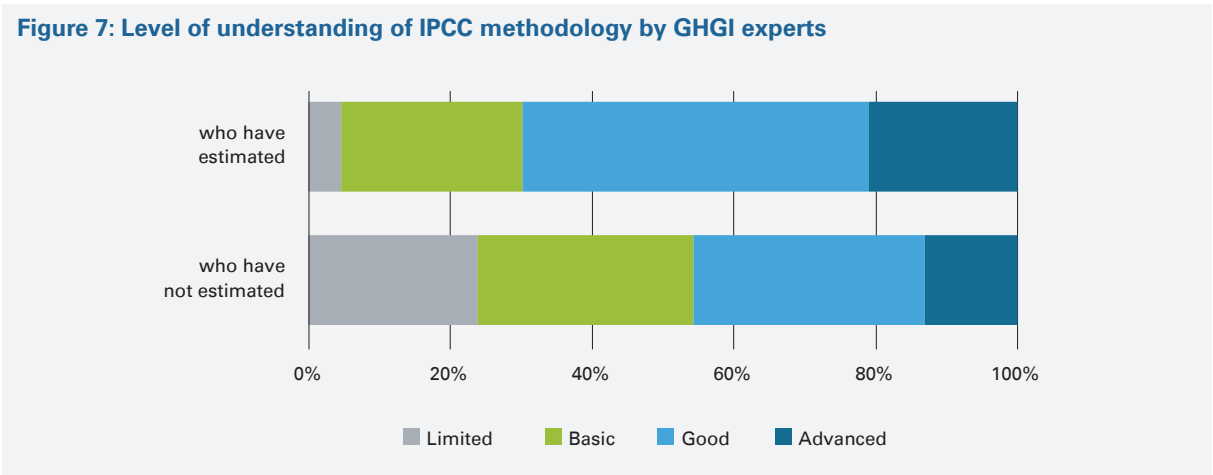




Indeed, the survey results show that 17 (74 percent) out of the 23 developing countries that estimated CSCs applied the Tier 1 method, while the remaining 6 countries (26 percent) used more advanced methods. All developed countries responding to the survey applied Tier 2 or Tier 3 methods (Figure 6).



The survey posed a question on GHGI experts’ knowledge of the IPCC CSC estimation methodology. Respondents made a self-evaluation of their own knowledge levels. Figure 7 compares the levels of understanding of GHGI experts from two groups, namely, those who have or have not estimated CSCs in mineral soils. The results showed that the experts who estimated CSCs in mineral soils had a slightly better understanding of the IPCC methodology. Seventy percent of GHGI experts who estimated CSCs in mineral soils indicated that they had a good to advanced level of understanding. On the other hand, less than 50 percent of GHGI experts who had not estimated CSCs exhibited similar levels of understanding.

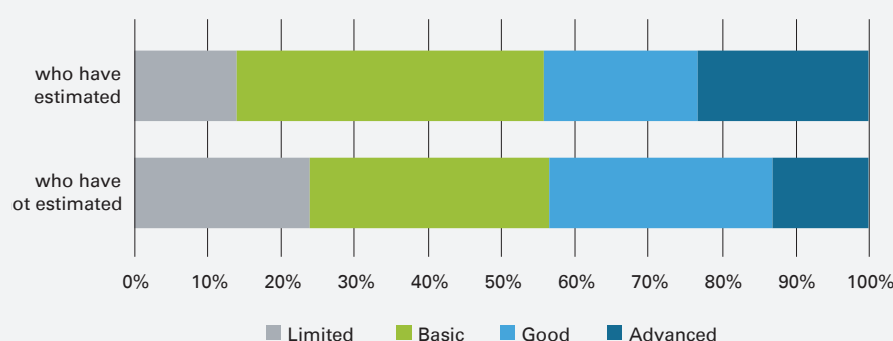


## An advanced knowledge of soil carbon dynamics by GHGI experts is not a prerequisite for countries to be able to estimate CSCs in mineral soils.

The survey explored the levels of understanding of the basics of soil carbon dynamics among GHGI experts in both groups. Overall, GHGI experts who have estimated CSCs in mineral soils have a similar understanding of the topic to those who have not estimated CSCs.

Around half of GHGI experts in both groups have a low to basic level of understanding of the basics of soil carbon dynamics (Figure 8). This suggests that advanced levels of understanding of basic soil carbon dynamics by GHGI experts is not a prerequisite for countries to prepare the estimation of CSCs in mineral soils.

**Figure 8: Level of understanding of soil carbon dynamics by GHGI experts**



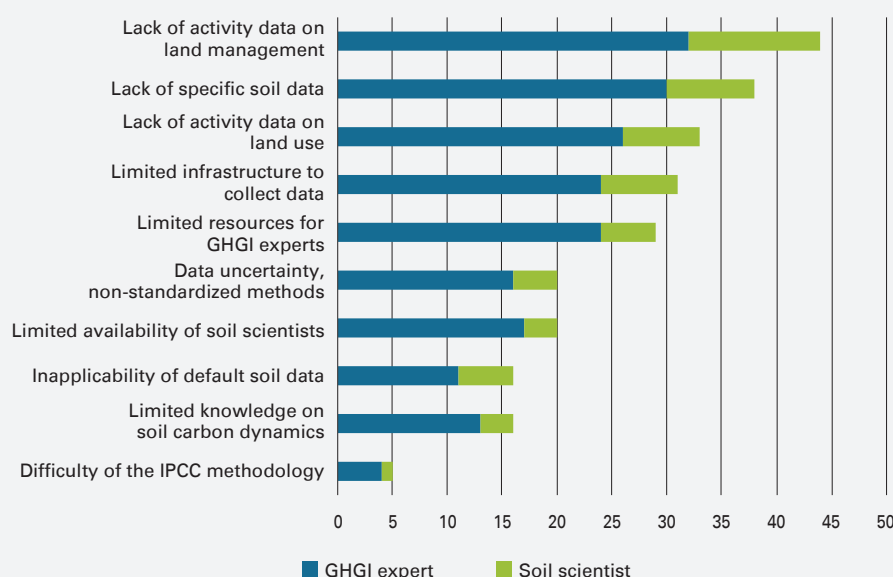
## Lack of activity data on land management and soil-specific data have been identified as the main challenges that limit countries from estimating mineral soil CSCs.

Challenges faced by GHGI experts and soil scientists in estimating CSCs in mineral soils are presented in Figure 9. Overall, GHGI experts and soil scientists agreed on the main challenges they faced. For both groups, the lack of activity data on land management and specific soil data were the most cited challenges.

The least frequently cited challenges for both groups were difficulty in understanding and applying the IPCC methodology; and a limited knowledge of soil carbon dynamics.

**Figure 9: Challenges for estimating CSCs in mineral soils**

(multiple choice answers)



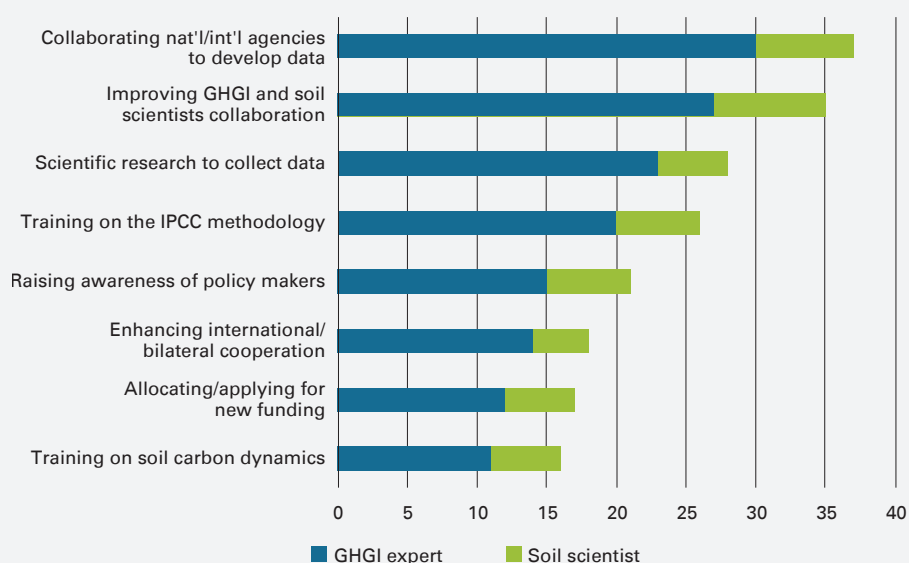
### Improved data collection and enhanced collaboration between GHGI experts and soil scientists are key to overcoming challenges for estimating CSCs in mineral soils.

Both GHG experts and soil scientists indicated 1) collaboration with other national and/or international agencies to develop data; and 2) improved collaboration between GHGI experts and soil scientists as the best approaches for overcoming challenges for estimating CSCs in mineral soils (Figure 10).

The least frequently indicated approaches for addressing challenges were 1) training on soil carbon dynamics; 2) allocating and applying for new funding; and 3) enhancing international and bilateral cooperation.

**Figure 10: Approaches to overcoming challenges in estimating CSCs in mineral soils**

(multiple choice answers)



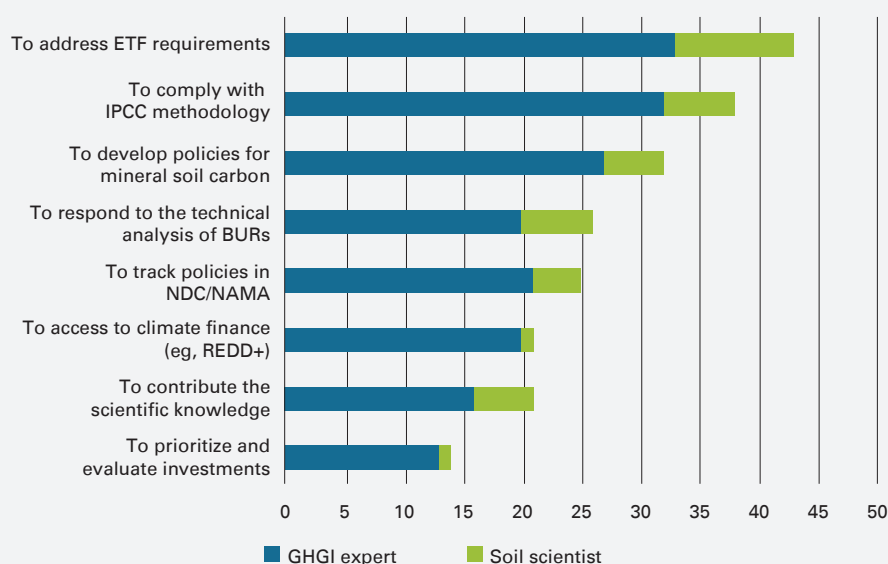
## Fulfilling international reporting requirements, complying with IPCC methodology and developing focused mitigation policies are the main advantages for the estimation of mineral soils CSCs.

The GHGI experts and soil scientists who estimated CSCs in mineral soils most frequently indicated that the advantages of doing so were to address ETF requirements; and comply with the IPCC methodology. In other words, fulfilling international reporting requirements are an important reason why GHGI experts and soil scientists engage in the estimation of CSCs.

The second most important reason centred on domestic policy formulation and implementation. This included developing policies for mineral soil carbon; and tracking policies in NDCs and/or nationally determined mitigation actions (NAMAs). Benefits such as accessing carbon finance markets (e.g. REDD+), or prioritizing investments, were less frequently chosen as advantages to be gained from estimating mineral soil CSCs. Incentives for promoting policy actions, or for accessing support, were seen as less important.

**Figure 11: Advantages of estimating CSCs in mineral soils**

(multiple choice answers)



# CONCLUSION

The preliminary findings suggest that the estimation of CSCs in mineral soils is conducted in most developed countries, while it is conducted only in one third of developing countries. A lack of activity data on land management and soil-specific data has limited countries' efforts to estimate CSCs, even with Tier 1 methodology. To overcome these challenges, additional data collection efforts, coupled with enhanced collaboration between GHGI experts and soil scientists, are necessary. Recognizing that this is a challenge for some countries, we recommend:

- supporting, both financially and technically, the collection of soil specific data in countries which are in need;
- providing clear guidance on how to collect and analyze the data;
- exploring a new IPCC methodology for the estimation of CSCs in mineral soils without relying on too many additional data;
- recognizing and identifying the role of soil scientists in the GHGI process;
- conducting joint programs where both GHGI experts and soil scientists participate;
- raising awareness on the important role that policies on mineral soil can play; and
- providing training on the advanced methodology to GHGI experts and soils scientists who have applied the Tier 1 methodology.



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