CLEAN DEVELOPMENT MECHANISM

CDM-MP97-A08

Information note

Development of default values for fraction of non-renewable biomass

Version 03.0

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 116th meeting, considered the information on development of accurate and reliable region-specific default values for fraction of non-renewable biomass (f_{NRB}) that can be applied in methodologies for clean cooking and requested the Methodologies Panel (MP) to develop subnational/regional values of f_{NRB}, building on scientific studies and engaging external experts. The Board highlighted that such default values should be consistent with the methods contained in "TOOL30 Calculation of the fraction of non-renewable biomass" (hereinafter referred to as TOOL30). In this regard, the Board requested the MP to prepare a concept note based on the work undertaken for consideration by the Board at a future meeting. The Board further requested the MP to propose a revision to TOOL30 and/or related methodologies/tools if there is a need to further clarify and/or revise elements of TOOL30 or related methodologies/tools, in light of the work undertaken on default values.

2. The MP launched a call for stakeholder inputs on the info note: “Default values for fraction of non-renewable biomass (f_{NRB})”, as contained in MP 92, Annex 7, from 13 October 2023 to 31 January 2024.

3. At its 122nd meeting (EB 122 meeting report, para. 23), the Board took note of the information note on “Stakeholder inputs on the review of clean cooking methodologies including estimation of f_{NRB} values”, as contained in annex 4 to the MP 94 meeting report, and requested the MP to continue to consider the issue and make a recommendation at its next meeting for the consideration of the Board.

4. The MP launched a call for stakeholder inputs on the updated revised report from the experts on the “Default values for fraction of non-renewable biomass (f_{NRB})” from 21 June to 9 August 2024.

5. At its 123rd meeting (EB 123 meeting report, para. 28), the Board took note of the information note on “Stakeholder inputs on the review of clean cooking methodologies including estimation of f_{NRB} values”, as contained in annex 4 to the MP 95 meeting report, and requested the MP to continue to consider the issues and make a recommendation for the consideration of the Board at its next meeting.

6. At its 124th meeting (EB 124 meeting report, para. 30), the Board took note of the information note “Development of default values for fraction of non-renewable biomass”, as contained in annex 3 to the MP 96 meeting report, and taking into account the feedback provided by the Board at this meeting, requested the MP to further work on the following:

   (a) Explore further the data on the calculation of urban fraction of non-renewable biomass (f_{NRB}) and the localisation of wood harvesting for charcoal production supplying the urban areas; and

   (b) Assess the optimal geographical disaggregation for the estimation of f_{NRB} values, taking into account e.g. the uncertainty level of estimates at different geographical

levels and fuelwood and charcoal flows between different sub-national jurisdictions or across national borders.

7. The Board requested the MP to revise the information note for consideration by the Board at its next meeting.

2. Purpose

8. The purpose of this information note is to address the mandate provided at EB 116 (i.e. develop subnational, national, regional and global default values of f_{NRB}) and provide a recommendation to the Board on the default values of f_{NRB} and TOOL33: Default values for common parameters" (hereinafter referred to as TOOL33). Further, this information note provides MP's response to issues raised by the Board at EB 124.

3. Key issues and proposed solutions

9. CDM programmes of activities (PoAs) have a high share of efficient cookstove projects which reduce consumption of non-renewable biomass. The f_{NRB}, as opposed to what can be sustainably harvested, is one of the key parameters for calculating emission reduction in the methodologies for efficient cookstoves such as "AMS-II.G. Energy efficiency measures in thermal applications of non-renewable biomass", along with other parameters, such as the annual consumption of woody biomass and efficiency of devices.

10. In accordance with TOOL30 for estimating f_{NRB}, project participants currently have three options when determining f_{NRB} values: (a) Using a default value of 0.30; (b) Using pre-approved default country-specific values, known as the standardized baselines, where available; or (c) Calculating project specific f_{NRB} values using TOOL30.

11. The current default value of 0.30 that can be applied globally was adopted by the Board at its 97th meeting as a conservative default, taking into account literature available at that time[1].

12. Over time, it became apparent that this universal default value of 0.30 has seldom been applied in CDM projects and PoAs. Instead, most projects used either of the other two options which yielded much higher and therefore less conservative values of the f_{NRB}. In addition, the data used to establish that default value, by now over a decade old, are likely to be outdated as well as some of the data is based on very limited study and anecdotal reporting.

13. In that context, the EB 116 requested the MP to develop subnational/regional values of f_{NRB}. External experts have been engaged to assist the work of the MP on this matter. The report of the external experts is available in Appendix 3 to this document.

14. The revisions to the information note are highlighted in two colors: yellow highlights indicate changes introduced at MP96 and submitted for consideration at EB 124; while green highlights reflect additional changes made at MP97, and submitted for consideration of the Board at EB 125.

[1] For example, Bailis, R.; Drigo, R.; Ghilardi, A. & Masera, O. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), pp. 266–272. This paper estimated that global *fNRB* value was 27 to 34 per cent, with large geographic variations.

15. It may be noted that with regard to issues raised at EB 124, these issues were not addressed by TOOL30: Calculation of the fraction of non-renewable biomass, and/or other similar calculations undertaken to develop f_{NRB} values. The MP considers the approach used in MoFuSS as an advancement in terms of accuracy and conservativeness compared to the f_{NRB} values obtained using the existing approach provided in the TOOL30. However, the MP welcomes stakeholders to submit new methodological approaches for calculation of f_{NRB} values that result in further advancements in terms of accuracy and conservativeness for consideration by the Board.

16. With regard to the clarification requests raised at EB 124, the additional clarifications are as below:

(a) f_{NRB} for urban areas and charcoal production: MoFuSS estimates the impacts of demand at the point of woodfuel harvesting, not limited to the area where consumption occurs. Further, urban demand is mainly met from commercial woodfuel, which is typically harvested over wider areas and transported by road to areas of consumption. This implies that urban fuelwood demand will impact harvesting in areas outside of administrative units with urban areas. While the calculation of f_{NRB} for an administrative unit is based on all harvest and demand within that administrative unit. As a result, urban areas show low f_{NRB} values despite their high demand of woodfuel. Whereas most rural demand is supplied through non-commercial woodfuel collected from areas typically accessible by foot. Thus to improve further the calculation of urban f_{NRB}, additional work would have to be undertaken at a minimum to map charcoal production and environmental degradation; to predict future charcoal production risk areas; to understand local actors and governance dynamics. Collecting the data and preparing maps is estimated to take at least 24 months.

(b) Optimal geographical disaggregation:

(i) The MoFuSS model offers an improvement over the previous TOOL30 and models, in that the woodfuel supply area for a demand center is defined with the distances from which fuelwood can be collected. This supply distance is defined by the following factors: commercial or domestic demand; for commercial fuelwood - the ease of collection and transport (depending on the transport infrastructure). Thus the supply distances for a demand centre are identified by the model. This depends on assumptions for the share of commercial fuelwood, for road infrastructure, for the probability of demand coming from various harvesting areas etc. Unless the project proponents have detailed information on the sources of wood for a particular demand centre, it is difficult to define a geographical area that is most appropriate (in this case the second administrative level, which in most countries are called districts, or the first administrative level). But within a country the MoFuSS model doesn't restrict the supply of fuelwood to demand centres by administrative boundaries. One of the main improvements of MoFuSS over earlier methods like WISDOM is that it does not require optimal geographical disaggregation or fixed 'woodfuel sheds', instead, it sets areas where wood is harvested around demand centers. Assessing an "optimal geographical disaggregation for the estimation of f_{NRB}" would require empirically determined f_{NRB} values for specific areas, to which the model results can be compared to and adjusting spatial boundaries to improve model accuracy; however, such empirical values do not exist for any location. MoFuSS

aggregates raster outputs from business as usual (BaU) simulations at different administrative levels to estimate regional trends. However, these results must be interpreted cautiously. Woodfuels harvested in one administrative unit may supply demand centers in another unit, especially in smaller administrative units. Unless the project developer knows the maximum sourcing distance, national-level values should be used to account for all potential woodfuel flows. On the MoFuSS webpage, users can draw or upload custom Areas of Interest (AoIs), and basic statistics will be calculated instantly, following the same recommendation.

(ii) A key limitation of any analysis or approach is the lack of detailed data on demand and supply, and specially so regarding charcoal. The MoFuSS model uses the existing data. Most of this data is available at national levels except the forest areas in a country. MoFuSS uses the existing data more efficiently. Based on the available data, the model assesses the influence area for demand centres from where the fuelwood for direct use and charcoal production could be supplied. This is then used for calculating the f_{NRB} values at different levels for national sub-regions. The model needs to be adapted to be able to capture the trade flows across national and sub-regional boundaries; in addition the availability of data is a limitation. To include detailed data of flows of fuelwood and charcoal among national sub-regions, while possible, would require significant additions to the model to capture the data. This exercise would require significant additional resources and time.

~~(c) Modeling fuelwood and charcoal flows between multiple subnational jurisdictions or across national border is not possible within the scope and timeframe of the current framework.~~

4. Impacts

17. The ~~sub-national~~ national and regional (continental) ~~and global~~ default values of f_{NRB} will ensure the reliability of calculating emission reductions, reduce transaction cost and facilitate the implementation of CDM project activities and PoAs in the household cookstove or water purification sector.

5. Subsequent work and timelines

18. Based on the mandate received from the Board, the MP will undertake further work.

6. Recommendations to the Board

19. The MP recommends that the Board approve the default ~~sub-national,~~ regional (continental) and national ~~and global~~ default values of f_{NRB} for the countries respectively shown in Table 1 and 2 of Appendix 1. ~~Table 2 and Table 3 of Appendix 2~~. The MP agreed to include these default values in the updated version of TOOL33[2]. ~~National values may be used if it can be justified that the project activity has an impact on fuelwood harvesting all over the host country.~~ Where national ~~/sub-national~~ values are not listed in the aforementioned tables, the project participant may use the ~~relevant regional value in Table~~

[2] Refer to Annex 1 of MP 97 meeting report.

~~1 of the Appendix 2~~ the regional (continental) values. ~~the global default value~~. Alternatively, stakeholders may submit new methodological approaches for the calculation of f_{NRB} values that result in further advancements in terms of accuracy and conservativeness, for consideration by the Board. Further, stakeholders may also choose to propose different default values through a request for revision to TOOL33 as per existing procedures[3].

20. The MP also recommends that f_{NRB} for project activities in urban areas and in countries where more than 20% of the woodfuel consumed in the country is imported, the weighted average of the fNRB of the host country and the f_{NRB} of countries from where woodfuel is imported shall be used to calculate a relevant value for the project activity.

~~21. Use of the sub-national values are recommended in principle, unless the applied methodology/ies specifies the level (e.g. national). In addition, where sub-national values are not listed, the national value may be used. In cases where neither the sub-national or national values are listed, the regional value may be used.~~

~~The choice between the national or sub-national level for the f_{NRB} shall be selected depending on the geographical boundary of the project activity. The final choice for the relevant f_{NRB} value may be made at the issuance stage once the area of implementation of the project activity can be observed.~~

22. The MP recommends the discontinuation of TOOL30 with effect from 1 January 2026.

23. The MP ~~will~~ has updated the relevant methodologies[4] where the f_{NRB} values are referred to and submitted these methodologies for the consideration of the Board at EB125 as annexes to the MP97 meeting report.

~~24. The MP is also of the view that the modelling fuelwood savings scenarios (MoFuSS) model could be used by the Project Participants to define the appropriate geographic area around the project site to develop a project specific f_{NRB}. The MoFuSS model is open access and accessible to public.~~

~~The MP seeks further mandate to~~

~~(a) Undertake additional work on the calculation of f_{NRB} using the marginal approach; the f_{NRB} values estimated so far determines the share of the current fuelwood harvest taking place in elemental areas (pixels) where overharvesting can be observed. The marginal f_{NRB} value reflects the fact that reduction of fuelwood harvest triggered by a project activity does not uniformly impact the harvesting activity in each elemental area uniformly and therefore results in a different f_{NRB} for the reduced amount of fuelwood due to the implementation of the project activity. MoFuSS can be used to provide some information on this issue;~~

~~(b) Explore further the data on the calculation of urban f_{NRB} and the localisation of wood harvesting for charcoal production supplying the urban areas; and~~

[3] Development, revision and clarification of baseline and monitoring methodologies and methodological tools v02.1.

[4] AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user; AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass; AMS-III.AV.: Low greenhouse gas emitting safe drinking water production systems; AMS-III.BG.: Emission reduction through sustainable charcoal production and consumption.

~~(c) Assess the optimal geographical disaggregation for the estimation of f_{NRB} values taking into account e.g. the uncertainty level of estimates at different geographical levels and fuelwood and charcoal flows between different sub-national jurisdictions or across national borders.~~

25. The MP noted that the availability of data on demand for woodfuel and on the growth rates of forests is limited, which adds to the uncertainty of the f_{NRB} values. The MP would like to request the Board to make a call to other agencies and entities to enhance their efforts to collect such data.

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1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 116th meeting, considered the information on development of accurate and reliable region-specific default values for fraction of non-renewable biomass (f_{NRB}) that can be applied in methodologies for clean cooking and requested the Methodologies Panel (MP) to develop subnational/regional values of f_{NRB}, building on scientific studies and engaging external experts. The Board highlighted that such default values should be consistent with the methods contained in "TOOL30 Calculation of the fraction of non-renewable biomass" (hereinafter referred to as TOOL30). In this regard, the Board requested the MP to prepare a concept note based on the work undertaken for consideration by the Board at a future meeting. The Board further requested the MP to propose a revision to TOOL30 and/or related methodologies/tools if there is a need to further clarify and/or revise elements of TOOL30 or related methodologies/tools, in light of the work undertaken on default values.

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7. The Board requested the MP to revise the information note for consideration by the Board at its next meeting.

2. Purpose

8. The purpose of this information note is to address the mandate provided at EB 116 (i.e. develop subnational, national, regional, global default values of f_{NRB}) and provide a recommendation to the Board on the default values of f_{NRB} and TOOL30.

3. Key issues and proposed solutions

3.1. Existing approach to calculate fNRB

9. CDM programmes of activities (PoAs) have a high share of efficient cookstove projects which reduce consumption of non-renewable biomass. The f_{NRB}, as opposed to what can be sustainably harvested, is one of the key parameters for calculating emission reduction in the methodologies for efficient cookstoves such as "AMS-II.G. Energy efficiency measures in thermal applications of non-renewable biomass", along with other parameters such as the annual consumption of woody biomass and efficiency of devices.

10. In accordance with TOOL30 for estimating f_{NRB}, project participants currently have three options when determining f_{NRB} values: (a) Using a default value of 0.30; (b) Using pre-approved default country-specific values, known as the standardized baselines, where available; or (c) Calculating project specific f_{NRB} values, using TOOL30.

11. The current default value of 0.30 that can be applied globally was adopted by the Board at its 97th meeting as a conservative default, taking into account literature available at that time[1].

12. Over time, it became apparent that this universal default value of 0.30 has seldom been applied in CDM projects and PoAs. Instead, most projects used either of the other two options which yielded much higher and therefore less conservative values of the f_{NRB}. In addition, the data used to establish that default value, by now over a decade old, are likely to be outdated as well as some of the data is based on very limited study and anecdotal reporting.

13. In that context, the EB 116 requested the MP to develop subnational/regional values of f_{NRB}. External experts have been engaged to assist the work of the MP on this matter. The ~~draft~~ report of the external experts is available in Appendix 2 ~~3~~ of this document.

14. The sections below describe the approach used by the external experts to develop new default values of f_{NRB}.

3.2. Key changes between the report submitted in October 2023 and the current report

15. After the preliminary f_{NRB} results for Sub-Saharan Africa were submitted to the Board in October 2023, several key assumptions were changed in response to stakeholders' inputs. In addition, the scope of the assessment was expanded to encompass the entire Global South. These changes required the use of different input datasets and several modifications to the model itself.

[1] For example, Bailis, R.; Drigo, R.; Ghilardi, A. & Masera, O. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), pp. 266–272. This paper estimated that global *fNRB* value was 27 to 34 per cent, with large geographic variations.

16. For clarity, the most critical modifications and new datasets recently introduced, ranked by their impact on the differences between the new results and those presented in October 2023 for Sub-Saharan Africa, are as follows:

    a) Population maps: Transitioned from HSRL to WorldPop (https://www.worldpop.org) to include countries not covered by HSRL, such as China and others in Asia and Africa;

    b) Revegetation Growth Curves: The submodule for generating revegetation growth curves was completely recoded. In the previous approach, growth functions were estimated based on the IPCC's biomass stock estimations. A few issues were identified e.g. in very arid areas, it was found that available biomass was less than the model's minimum harvestable threshold (1 tonne/ha for charcoal production and 0.1 tonne/ha for gathered fuelwood), which caused the model to output physically impossible negative harvest and f_{NRB} values in a small number of pixels[2]/elemental areas. This was corrected to avoid those outputs;

    c) Sub-region trade in Sub-Saharan Africa: The information from reviews of international fuelwood trading in Sub-Saharan Africa was used to redefine the boundaries across which trading can take place;

    d) Woodfuel consumption: All fuelwood and charcoal demand figures have been thoroughly reviewed in response to stakeholder inputs.

3.3. Approach to develop new default values of f_{NRB}

17. The assessment of f_{NRB} values was conducted using the latest available data on woody biomass supply and demand with the Geographic Information System (GIS) based model called modelling fuelwood savings scenarios (MoFuSS). The model relies on the same basic concepts used by the Woodfuels Integrated Supply/Demand Overview Mapping (WISDOM) methodology, used to derive the results on which the current default value of 0.3 is based, with several key differences. Where WISDOM uses a snapshot in time, the MoFuSS model runs simulations, which allow users to compare intervention (i.e. actions to reduce extraction on non-renewable biomass such as through efficient cook stove projects) and non-intervention scenarios that incorporate dynamic variables such as population growth, urbanization, and land cover change.

~~18. In the first phase of the assessment, the model was run for 43 countries in Sub-Saharan Africa. These countries/regions were selected as they account for the large majority of CDM projects and PoAs in the pipeline. Subject to guidance from the Board, work will continue to be conducted for the remaining countries/regions in the world; with the possibility of further updates given new global datasets and assumptions become available in the coming years.~~

19. There are similarities and differences in the approach used in the assessment and the approach defined in TOOL30. For example:

    (a) While TOOL30 defines biomass consumption on a jurisdictional basis (e.g. districts, counties, or countries), the model used in the assessment calculates

[2] Pixels are the smallest unit of a digital image or display. In relation to elemental areas, a pixel represents a discrete elemental area on a screen or sensor, where each pixel carries a single colour or intensity value.

it at pixel level (tonnes of dry biomass per hectare or km^2) and then uses this data to derive results at larger aggregation levels;

(b) Both TOOL30 and the MoFuSS use biomass growth parameters such as Mean Annual Increment (MAI) and Current Annual Increment (CAI) respectively, to define long-term average wood growth. In case of TOOL30 biomass growth parameters are applied to the entire land cover categories regardless of their standing stock. In contrast, the new model relies on growth functions, which are specific to land cover type and ecological zone and vary with current stock levels. The model applies these functions at the pixel level, so that every pixel has a unique woody biomass production function. Therefore, it is expected that the model simulates biomass harvest and regrowth after harvest more realistically;

(c) TOOL30 only considers accessibility in the sense that it removes protected areas from consideration of biomass supply. MoFuSS also accounts for protected areas but goes further by considering physical accessibility based on topographical features and the effort that woodfuel users must expend to access sources of woody biomass.

20. There are multiple ways to use the changes in biomass simulated by MoFuSS to estimate f_{NRB}. In this assessment, f_{NRB} has been estimated within a given administrative boundary by identifying pixels within the boundary that experience biomass losses during a specific timespan. This wood loss is defined as non-renewable biomass or NRB. To estimate f_{NRB}, the sum of losses occurring within the administrative boundary of interest is divided by the total biomass harvest within that same boundary. Please refer to the supplementary material of Ghilardi et al 2016[3] for a detailed description of how harvest events and natural regrowth of woody biomass interact in MoFuSS over space and time to render pixel-based results of NRB.

~~21. In this assessment, the following steps were taken to develop f_{NRB} values:~~

~~(a) Create maps of **woody biomass use** from 2010 to 2030, using population distribution maps, and woodfuel demand scenarios;~~

~~(b) Create maps depicting **where the woody biomass from the previous step is coming from** (i.e., where it is being harvested and/or collected in each year), using accessibility functions that integrate recent globally harmonized maps of land cover, biomass/carbon stocks, roads, rivers, elevation, and protected areas; this is calculated for each and every single place using biomass;~~

~~(c) Create maps of the **potential regrowth and/or replenishment of woody biomass** in natural and anthropic ecosystems respectively, after being harvested for fuelwood or charcoal;~~

~~(d) Generate **maps of woody biomass harvest, NRB, and** f_{NRB} between 2010 and 2030, at both the pixel and administrative level.~~

3.3.1. Key assumptions in MoFuSS ~~Estimation of woody biomass supply and accessibility~~

22. The MoFuSS relies on several dozen parameters to model land cover change associated with woodfuel harvesting. The main assumptions that MoFuSS uses to estimate non-

[3] https://docs.google.com/document/d/140duZZaBIUuCG7nvgHwsdw7Wkm2Nce7cenEpEHEvgqI/edit.

renewable biomass demand in a given locality are listed below. Full details of the following parameters are in the Appendix 3:

(a) Biomass stocks: This data informs how much biomass exists in a pixel in the initial year of the simulation, which contributes to the available supply for harvesting and the potential for future growth. There are several global maps of above-ground biomass (AGB) available. Further details are provided in the Appendix 3 (Para 23);

(b) Biomass growth functions: These functions rely on two important parameters: annual growth rate and maximum stock within each pixel.[4] We use the following logistic (sigmoidal) growth function to simulate woody biomass growth in each pixel and land-cover type;

$$AGB_{(t+1)i,j} = AGB_{(t)i,j} + AGB_{(t)i,j} \cdot r_{max,j} \cdot \left(1 - \frac{AGB_{(t)i,j}}{K_j}\right)$$

Where:

- *i* and *j* are indices for pixel i in land cover type j
- $ABG_{(t)i,j}$ or $ABG_{(t+1)i,j}$ aboveground wood biomass in pixel *i* and land cover *j* at time t or t+1
- $r_{max,j}$ is the slope at the inflection point of the sigmoidal growth function, which determines the maximum growth rate of woody biomass in each land-cover type *j* [5]
- K_j is the maximum woody biomass in land-cover type *j* (or "carrying capacity");

(c) Biomass consumption: Both current and future biomass consumption are contributors to f_{NRB}. Spatially modeling the impacts of biomass consumption requires estimates of the quantity consumed and the location of consumers. To estimate the quantity of wood and charcoal consumed, two simple parameters are taken into consideration: the number of users and the amount per user. The number of wood and charcoal users is based on WHO's recently updated "Global Household Energy Model", which projects the number and percentage of people using primary household cooking fuels in rural and urban areas of low- and middle-income countries.[6] By not accounting for stacking, uncertainty in woodfuel demand may be introduced. However, it is unclear whether this leads to underestimates or overestimates. For example, a fraction of the people counted as "primary charcoal users" may actually cook some of their meals with LPG or fuelwood and use less charcoal than people counted as "primary charcoal users" who do not stack with other fuels. In that case, the charcoal consumption could be overestimated. By the same token, a fraction of the people counted as "primary LPG users" may cook with some of their meals with charcoal and use less LPG than people counted as "primary LPG users" who do not stack with other fuels. This could lead to an underestimation of charcoal consumption. The same applies to other categories of

[4] Pixel size can vary, but models are generally limited by the lowest resolution input file. For our regional or global model, we use 1km x 1km pixels. However, for sub-national or project-scale models we could use higher resolutions like 100m or 30m.

[5] Note, r_{max} is not a direct estimate of the maximum growth rate. Rather, it is a parameter proportional to the maximum growth rate such that maximum growth equals the product [¼ r_{max} K].

[6] Urban woodfuel users rely primarily on commercially supplied fuelwood and charcoal, which is usually transported by road from distant rural areas. Rural users generally gather wood from nearby. These different harvesting practices result in different geographic patterns of impacts, which we model using different algorithms.

primary fuel users. There is very little reliable data on fuel consumption among fuel-stacking households;

(d) Residential, commercial and industrial woodfuel consumption.

~~23. Biomass stocks data tells us how much biomass exists in a pixel in the initial year of the simulation, which contributes to the available supply for harvesting and the potential for future growth. Among the several global maps of above-ground biomass available that could be used in the model, the dataset provided by the World Conservation Monitoring Centre (WCMC) was used. The map shows above- and below-ground carbon stocks in tonnes per hectare from 2010 and the resolution is 300m.~~

~~24. The biomass growth functions rely on two important parameters: annual growth rate and maximum stock within each pixel. The specific growth functions were used to simulate woody biomass growth in each pixel by land-cover type and ecological zone.~~

~~25. The model focuses on stocks and growth rates of above-ground biomass, the main carbon pool on which woodfuel users depend. However, other pools of terrestrial carbon like soil organic carbon (SOC) and dead organic matter (DOM) may be affected by woodfuel harvesting, particularly if harvesting leads to forest degradation or deforestation. The model does not account for changes in SOC and only addresses DOM indirectly.~~

~~3.3.2. Estimation of current and projected demand for woodfuel~~

~~26. Both current and future biomass consumption are contributors to f_{NRB}. Spatial modelling of the impacts of biomass consumption requires the estimates of the quantity consumed and the location of consumers. To estimate the quantity of fuelwood and charcoal consumed, the model relied on two simple parameters: **the number of users and the amount per user.** The number of fuelwood and charcoal users is based on WHO's recently updated "Global Household Energy Model", which projects the number and percentage of people using primary household cooking fuels in rural and urban areas of low- and middle-income countries.[7]~~

27. The model focuses primarily on residential woodfuel demand. In some countries, wood may be consumed by formal and cottage industries as well as commercial establishments. The model does not include these sources of demand for several reasons: first, because there is no reliable data for the use of wood by cottage industries and informal such as brickmaking, fish smoking, beer brewing; second, while FAO publishes data on industrial roundwood production, in most countries in sub-Saharan Africa, this accounts for less than 10% of the overall wood harvest.

28. The MoFuSS model focuses primarily on residential woodfuel demand. In some countries, there may be industrial or commercial use of wood that affects tree cover. In earlier versions of MoFuSS, that data was omitted because of a lack of reliable data that would allow mapping of demand in the same way that residential demand is mapped (described below). However, in response to public comments, non-residential woodfuel demand from commercial entities like hotels and restaurants, public institutions like schools, prisons, and military barracks, and cottage industries like brick burning, ceramics, beer brewing, and fish smoking among others were reviewed. To include these sources of demand, limited literature review was undertaken that focused on sub-Saharan Africa.

29. Accessibility to woody biomass was also accounted for by defining "friction" maps that represent the effort that wood consumers must expend to travel to a given supply area.

~~[7] World Health Organization. "Household Air Pollution Data." Air pollution data portal, 2021. https://www.who.int/data/gho/data/themes/air-pollution/household-air-pollution.~~

These maps are derived by integrating road and river networks, land cover characteristics, elevation, and protected areas.

3.3.3. Other considerations

30. Use of deforestation by-products: ~~There are very few studies that have measured the share of woody biomass cleared for agriculture that is used as firewood or charcoal. In this assessment, it is assumed that 70% of the woody by-products of land clearance is accessible in a given year, but that it is only available that year. This assumption has a small impact on the overall results but may have a significant impact on f_{NRB} estimations being conservative in locations that experience high rates of tree cover loss in densely populated areas. When running the model for this study, this function was not activated because the algorithms used were not effective across very large regions~~.

Most countries included in this analysis experience some annual loss of tree cover, which may contribute to long-term deforestation. These losses are identified by tracking annual changes in canopy cover using remotely sensed data. Tree removals identified by remotely-sensed changes in canopy cover are typically caused by land clearance for large-and small-scale agricultural expansion rather than woodfuel harvesting. However, in some situations, the by-products of land clearance are used for firewood or charcoal production. When this occurs, the harvested biomass is non-renewable because land-clearance for agriculture makes it difficult for trees to regenerate; however, the biomass does not contribute to f_{NRB} because the trees would have been removed regardless of woodfuel demand. Thus some fraction of demand might be satisfied with non-renewable biomass that does not contribute to f_{NRB}. The MoFuSS model includes an optional module that simulates these processes and adjusts f_{NRB} results accordingly. However, for this assessment, this feature was not used due to a variety of reasons, which are explained in the experts' report[8].

31. Treatment of Protected Areas: Protected areas add some uncertainty because they often contain large stocks of biomass, but the extent to which the biomass is accessible for use as woodfuel is unclear. Some protected areas are completely inaccessible, others may be used for low-level extractive activities like collecting wood for household use, and still others might be legally inaccessible, but easily exploited due to poor enforcement. In this assessment, it was considered that all protected areas are equally difficult (but not impossible) to access for both self-collection and commercial extraction. This was accomplished by increasing the "friction" or effort required to travel within the boundaries of protected areas relative to unprotected areas with similar terrain. For this assessment, friction was set at 90%, which means that the likelihood of wood harvesting within protected areas was only 10% that of unprotected areas with similar terrain.

32. National boundaries and trade: The sustainability of woodfuel consumption within national boundaries can be affected by transboundary trade. ~~For example, if woodfuel is imported to Country A from neighbouring Country B, it relieves pressure on domestic sources of woody biomass in Country A, but increases pressure on domestic sources of woody biomass in Country B. The MoFuSS model can accommodate transnational trade; however, it is difficult to model because there is no reliable data to verify the results. In addition, for this analysis, Africa was divided into four sub-regions (East, Central, Southern and West) to reduce the computing time necessary for each modelling run. Thus, while transborder trade could occur between countries within each region, it could not occur between countries in separate regions, even if they share a common border such as Chad and Niger or Cameroon and Nigeria, because they were modelled separately. Modelling~~

[8] https://cdm.unfccc.int/public_inputs/2024/202406/index.html.

~~the entire SSA region in one simulation will be carried out in the near future~~. For example, if Country-A has a major source of demand like a large urban center close to its border with Country-B, then it is possible that Country-A imports charcoal from Country-B. If that occurs, then Country-A's woodfuel supply-demand balance could be affected favorably because those imports would reduce pressure on A's own resources. By the same token, Country-B's balance would be affected negatively by the additional removals.

33. In theory, MoFuSS can accommodate transnational trade; however, this is difficult in practice because there is no reliable data quantifying the magnitude of the trade. FAO's forest statistics database includes woodfuel imports and exports, but the accuracy of this data is unclear and there is no information about trading partners.

34. In this analysis, separate regional models with semi-permeable national borders have been run, resulting in some international flow of woodfuels within each region, but no flows between regions. Within regions, crossing borders adds "friction" or travel time for wood suppliers, making it more costly, but not impossible, for people to access wood in neighboring countries. The final model includes a mix of individual countries and countries clustered together to accommodate trade, where it is suspected to be a significant fraction of overall woodfuel consumption.

3.4. Results of f_{NRB} values

35. f_{NRB} is defined at the pixel level for a given time period as:

$$fNRB_{(t=n),j} = \frac{NRB_{(t=n),j}}{H_j} \qquad \text{Equation (1)}$$

Where:

$fNRB_{(t=n),j}$	=	Fraction of non-renewable biomass (fraction or %) in pixel *j* during the simulation period of "n" years
NRB_j	=	Quantity of non-renewable biomass harvested in pixel *j* during the simulation period of "n" years
H_j	=	Total consumption of woody biomass in pixel *j* during the simulation period of "n" years

And

$$NRB_{t=n,j} = \begin{cases} 0 \; if \; AGB_{t=n,j} \geq AGB_{t=0,j} \\ AGB_{t=n,j} - AGB_{t=0,j} \; if \; AGB_{t=n,j} < AGB_{t=0,j} \end{cases} \qquad \text{Equation (2)}$$

Where:

$AGB_{t=0,j}$	=	Above ground woody biomass in pixel *j* in the initial year of interest
$AGB_{t=n,j}$	=	Above ground woody biomass in pixel *j* in the final year of interest

36. The model simulates the supply and demand for the period 2010 – 2050. This is used to estimate the f_{NRB} values, which can be defined for the entire simulation, or divided into smaller time periods. This experts' report (in Appendix 2) presents the f_{NRB} results for the period 2020 – 2030 only.

37. To be applied in projects or programmes of activity, f_{NRB} must be aggregated from pixel-based values to a geographic area that is appropriate for the scale of the intervention, which may be national or sub-national. To do this, the model aggregates NRB in each

pixel during the simulation period and divides that by total consumption during the same time period within the same boundary.

$$fNRB_{(t=n),project\ area} = \sum_j NRB_{(t=n),j} \Big/ \sum_j H_j \qquad \text{Equation (3)}$$

38. Figures 1, 2 and 3 below illustrate spatial averages of f_{NRB} by national and sub-national administrative boundaries. These results are mathematically derived from spatial raster maps of woody biomass harvesting that leads to loss of tree cover. ~~(the first administrative level and the second administrative level) boundaries for 43 countries in Sub-Saharan Africa.~~ Appendix 1 2 shows a summary of results at the national level.

39. The global average f_{NRB} of the 90 ~~75~~ countries included in the assessment is 32% ±0.2% ~~± 18%~~ (spatial mean). ~~± standard deviation).~~

~~40.~~ Regionally, Sub-Saharan Africa (SSA) has the highest f_{NRB}, at 40% +/- 0.3%~~39% ± 17%~~, followed by Latin America and Asia, with 3~~2~~3% +/- 0.8% ~~± 14%~~ and 18% +/- 0.3%~~17% ± 21%~~ respectively. To estimate this variation, 30 scenarios were run by varying the value of Rmax. These Rmax values were derived from IPCC 2019 information. It needs to be noted that the information used in IPCC has high uncertainty ~~which is reflected in the standard deviations in the f_{NRB} values~~.

Table 1. Regional (Continental) f_{NRB} values

Region	f_{NRB} (%)
Asia	18 ~~7~~
Latin America	3~~2~~3
Sub-Saharan Africa	40 ~~39~~

41. At the national level, most of the f_{NRB} values range between 1% and 70%, with the interquartile range (25%-75%) falling between 21% and 40%. The highest national f_{NRB} estimates occur in semi-arid countries in the Sahel, followed by several countries in East and Southern Africa and East Asia.

Table 2 National fNRB values

Country	~~fNRB~~ Mean (%)	~~fNRB_2020_2030_se_absolute~~ Standard error (%)
Afghanistan	10	0.1
Angola	27	0.8
Armenia	1	0.1
Azerbaijan	1	0.02
Bangladesh	39	1.6
Benin	34	0.7
Bhutan	30	1.2
Plurinational State of Bolivia	14	1.1
Botswana	35	1.7
Brazil	13	0.5
Burkina Faso	36	1.8
Burundi	35	1.4
Cambodia	20	1

Country	~~fNRB~~ Mean (%)	~~fNRB_2020_2030_se_absolute~~ Standard error (%)
Cameroon	38	1.1
Central African Republic	42	0.8
Chad	37	1.5
China	10	0.4
Colombia	7	0.7
Costa Rica	10	0.9
Côte d'Ivoire	19	2.1
Democratic Republic of the Congo	42	1.3
Djibouti	1	0.04
Dominican Republic	43	2.6
Ecuador	28	0.8
Equatorial Guinea	31	2.5
Eritrea	30	1.2
Eswatini	16	1.1
Ethiopia	33	0.9
Gabon	18	2.5
Gambia	55	1.6
Georgia	1	0.2
Ghana	35	1.0
Guatemala	41	0.8
Guinea	37	1.5
Guinea-Bissau	34	1.4
Guyana	0	0
Haiti	59	4.1
Honduras	33	0.9
India	7	0.5
Indonesia	9	1.8
Islamic Republic of Iran	5	0.2
Iraq	1	0.08
Jamaica	38	1.1
Jordan	1	0.05
Kazakhstan	7	0.07
Kenya	29	1.2
Kyrgyzstan	25	0.5
Lao People's Democratic Republic	47	0.9
Liberia	40	2.4
Madagascar	36	1.1
Malawi	48	0.5
Malaysia	39	1.9
Mali	45	1.3
Mauritania	65	2.6

Country	~~fNRB~~ Mean (%)	~~fNRB_2020_2030_se_absolute~~ Standard error (%)
Mexico	30	0.6
Mongolia	12	0.5
Mozambique	38	0.8
Myanmar	36	1.4
Namibia	28	1.1
Nepal	45	0.9
Nicaragua	26	1.04
Niger	61	0.6
Nigeria	38	0.8
Pakistan	8	0.2
Panama	21	1.05
Papua New Guinea	8	0.22
Peru	4	0.6
Philippines	55	1.1
Republic of the Congo	16	1.6
Rwanda	33	1.3
Senegal	61	1.2
Sierra Leone	41	1.2
Somalia	64	1.9
South Africa	18	0.9
South Sudan	35	0.7
Sri Lanka	45	1.3
Sudan	50	2
Syrian Arab Republic	3	0.2
Tajikistan	19	0.4
United Republic of Tanzania	51	0.5
Thailand	20	1.2
Timor-Leste	39	1.2
Togo	46	1.4
Türkiye	13	0.3
Turkmenistan	0	0
Uganda	39	1.2
Uzbekistan	15	0.3
Viet Nam	36	1.1
Zambia	40	1.2
Zimbabwe	21	1.5

~~42. The full list of sub-national f_{NRB} values is included in Appendix 1. A few examples of sub-national values are listed below to showcase the range.~~

Table 3 Sub-national values[9]

Country	Sub-national	f_{NRB} %
Burundi	Bujumbura Mairie	14
Burundi	Bujumbura Rural	38
Burundi	Bururi	38
Burundi	Cankuzo	35
Burundi	Cibitoke	35
Burundi	Gitega	31
Burundi	Karuzi	35
Burundi	Kayanza	31
Burundi	Kirundo	29
Burundi	Makamba	39
Burundi	Muramvya	31
Burundi	Muyinga	36
Burundi	Mwaro	31
Burundi	Ngozi	37
Burundi	Rutana	38
Burundi	Ruyigi	42
Cambodia	Bântéay Méanchey	11
Cambodia	Batdâmbâng	15
Cambodia	Kâmpóng Cham	14
Cambodia	Kâmpóng Chhnang	13
Cambodia	Kâmpóng Spœ	16
Cambodia	Kâmpóng Thum	20
Cambodia	Kâmpôt	17
Cambodia	Kândal	10
Cambodia	Kaôh Kong	41
Cambodia	Kep	10
Cambodia	Krâchéh	27
Cambodia	Krong Pailin	23
Cambodia	Krong Preah Sihanouk	33
Cambodia	Môndól Kiri	40
Cambodia	Otdar Mean Chey	17
Cambodia	Phnom Penh	6

[9] These are few examples of sub-national values. The full list of sub-national values is in the Appendix 1. Where sub-national values are not available for a particular country, project participants may refer to the relevant regional values in Appendix 2.

~~Country~~	~~Sub-national~~	~~f_{NRB} %~~
~~Cambodia~~	~~Pouthisat~~	~~19~~
~~Cambodia~~	~~Preah Vihéar~~	~~29~~
~~Cambodia~~	~~Prey Vêng~~	~~14~~
~~Cambodia~~	~~Rôtânôkiri~~	~~38~~
~~Cambodia~~	~~Siemréab~~	~~17~~
~~Cambodia~~	~~Stœng Trêng~~	~~31~~
~~Cambodia~~	~~Svay Rieng~~	~~34~~
~~Cambodia~~	~~Takêv~~	~~11~~
~~Cambodia~~	~~Tbong Khmum~~	~~24~~

43. To estimate urban f_{NRB}, it has been assumed that woodfuels consumed in towns and cities are harvested and transported from the rural areas. As they are exploited commercially, urban fuelwood and charcoal tend to have higher impact than wood harvested for subsistence use by rural households. To account for this, the experts carried out a simple statistical analysis that considered a weighted average of the rural administrative units with higher f_{NRB}. This resulted in urban f_{NRB} values that are several percentage points higher than the national average. For example, it was estimated that Sierra Leone's national f_{NRB} is 41~~0~~% ~~± 15%.~~ f_{NRB} in its four main administrative units ranges from 36% to 50%, and the f_{NRB} in Freetown and other urban centers was calculated to be 42% ~~± 15%~~. The MP, while acknowledging the work undertaken by the experts, considers further analysis needs to be undertaken to assess the urban f_{NRB} values before it recommends the urban f_{NRB} values to the Board.

~~44.~~ The experts' determine also uncertainty levels for the f_{NRB} estimates. 30 scenarios were run for that purpose by varying the values of Rmax defining the shape of the growth curves in the different ecological zones. These Rmax values were derived from IPCC 2019 information. It needs to be noted that the information provided by IPCC has high uncertainty (standard deviation similar to the average value) which results in high uncertainty for f_{NRB} estimates. ~~The panel is of the view that these uncertainty levels, due to the lack of detailed information about basic parameters like the growth rate of various forest types would be difficult to apply to conservatively adjust the f_{NRB} central values calculated with the model.~~

45. With regard to uncertainty estimates in MoFuSS, the model uses Monte Carlo simulations (30 iterations per scenario) to assess uncertainty in its predictions, particularly for values like the fraction of non-renewable biomass (f_{NRB}). Instead of reporting standard deviation (SD), which measures variability among individual simulation outputs, MoFuSS reports the standard error (SE)—a measure of the uncertainty in the mean estimate. This choice aligns with statistical best practices, especially for applications like carbon accounting, where confidence in the average prediction is more important than the variability of individual runs. By reporting SE, MoFuSS provides a clearer indication of the precision and reliability of its mean outputs, which are used for policy and baseline setting.

46. MoFuSS Uses Standard Error (SE) as it:

(a) Focuses on Precision: SE shows how precisely the mean is estimated—critical for policy and baseline decisions.

(b) Suited for Monte Carlo Methods: SE appropriately reflects uncertainty in the mean outcome, which is the goal of Monte Carlo simulations.

(c) Statistical Best Practice: Reporting SE aligns with expert guidelines when the mean is the primary result of interest.

(d) Avoids Misinterpretation: SD could misleadingly suggest problematic variability, while SE rightly emphasizes the reliability of the average prediction.

Figure 1. National f_{NRB} values ~~at the country level~~ averaged for the period 2020-2030
(new figure below replacing the previous figure)

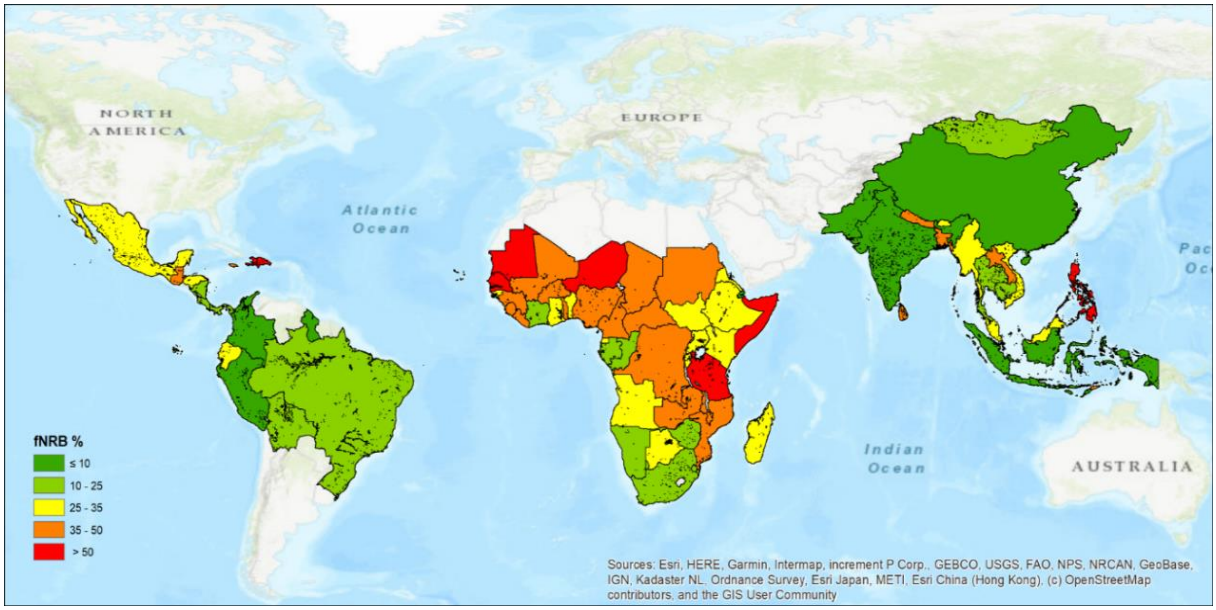


Figure 2. f_{NRB} values at the first administrative level for the period 2020-2030
(new figure below replacing the previous figure)

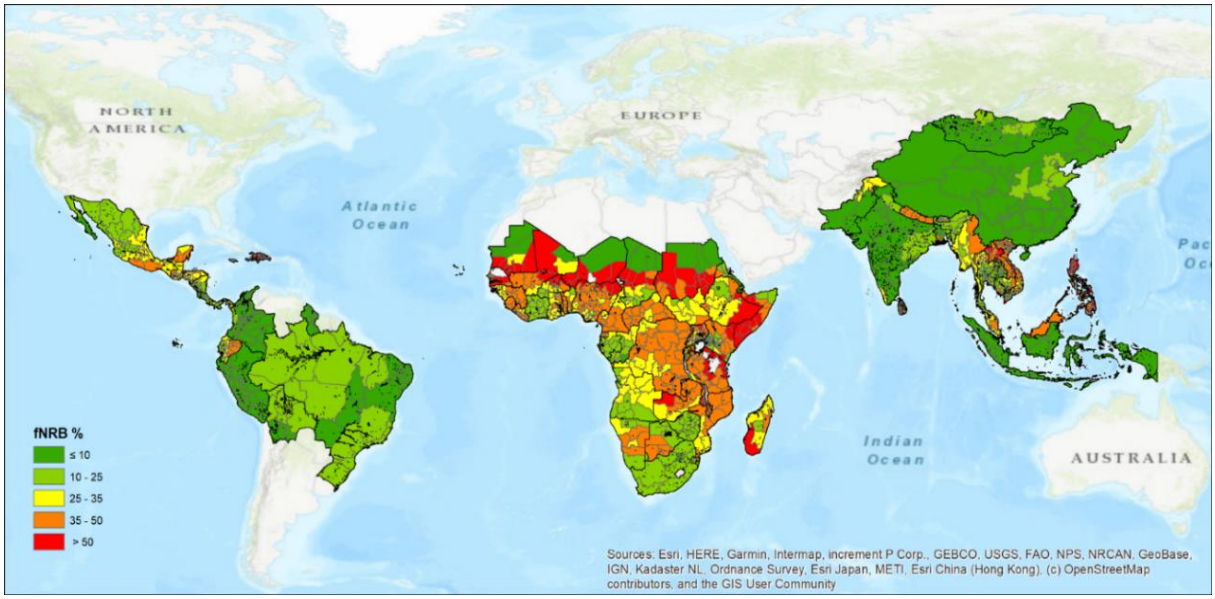
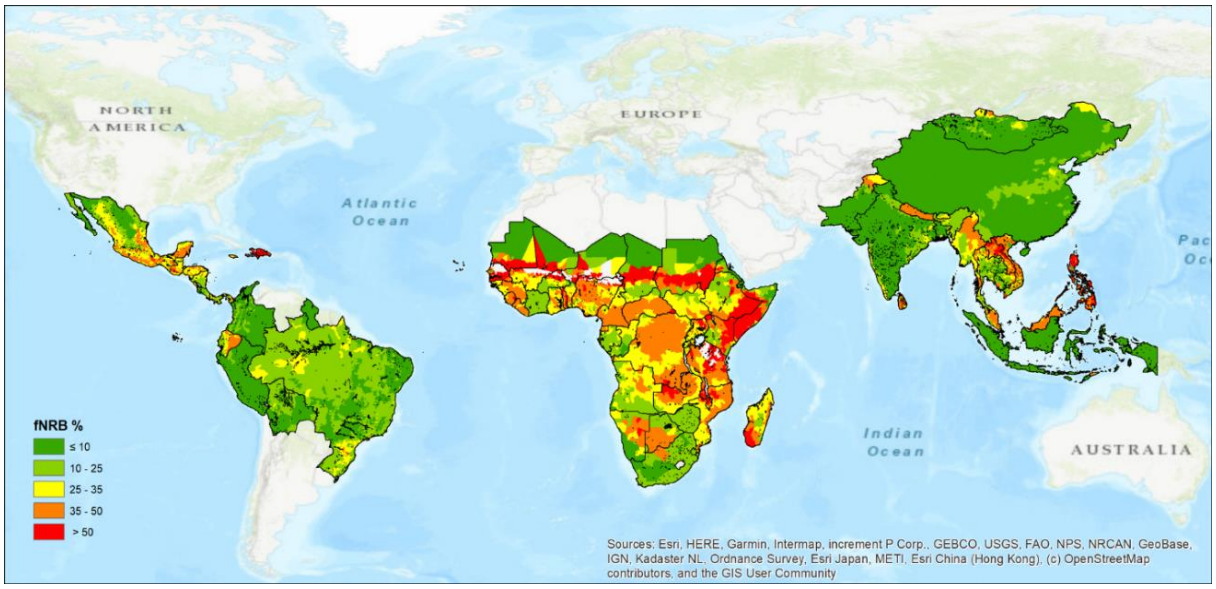


Figure 3. fNRB values at the second administrative level for the period 2020-2030
(*new figure below replacing the previous figure)*



47. By examining the maps above, it is clear that there is spatial variation across all world regions mostly in Africa. For example, Southern Africa has lower f_{NRB} than the other sub-regions. There is also variation across countries within sub-regions, and within countries at sub-national levels. There are many factors that could drive this variation, including infrastructure and accessibility, population density, tree cover at the start of the simulation, and woodfuel demand trajectories predicted by WHO's database. All of the causes of spatial variation are not covered in this report. However, some differences are likely driven by a few key variables. For example, the lower f_{NRB} outcomes in Southern African countries are very likely due to lower demand relative to supply than in other sub-regions. In the case of South Africa and Kenya, both countries have populations of over 50 million people, and both have substantial areas of arid or semi-arid land with little or no tree cover. The WHO estimates that in 2020, roughly 5 million people in South Africa used woodfuels as their primary cooking fuel. In contrast, in Kenya (less than half the size of South Africa), over 40 million people used woodfuels as their primary cooking fuel.

4. Impacts

48. National ~~/sub-national~~ and regional (continental) values of f_{NRB} will ensure the reliability of calculating emission reductions, reduce transaction cost and facilitate the implementation of CDM project activities and PoAs in the household cookstove or water purification sector.

5. Recommendations to the Board

49. The MP recommends that the Board approve the default ~~sub-national, -~~regional (continental) ~~-~~and national ~~global~~ values of f_{NRB} for the countries respectively shown in Table 1 and 2 of Appendix 1, ~~Table 2 and Table 3 of Appendix 2~~ and also included in the updated version of TOOL33- Default values for common parameters[10].

50. The MP recommends the national values ~~may~~ to be used. ~~if it can be justified that the project activity has an impact on fuelwood harvesting all over the host country~~. Where national~~/sub-national~~ values are not listed in the aforementioned table~~s~~, regional

[10] ~~Refer to Annex 4 of MP 96 meeting report. (~~Refer to Annex 1 of MP 97 report).

(continental) values may be used. Further, stakeholders may submit new methodological approaches for the calculation of f_{NRB} values that results in further advancements in terms of accuracy and conservativeness as per existing procedures for consideration by the Board. ~~may use the relevant regional value in Table 1 of the Appendix 2~~.

51. The MP also recommends that for urban project activities where more than 20% of the fuelwood is imported, the relevant f_{NRB} should be calculated as the weighted average of the f_{NRB} values from the source areas.

52. The MP recommends the discontinuation of TOOL30 with effect from 1 Jan 2026.

53. The MP ~~will~~ has updated the relevant methodologies where the TOOL30 and/or f_{NRB} values are referred to.

~~54. The MP is also of the view that the MoFuSS model could be used by the Project Participants to define the appropriate geographic area around the project site to develop a project specific f_{NRB}. The MoFuSS model is open access and accessible to public.~~

~~55. The MP seeks further mandate to~~

~~(a) Undertake additional work on the calculation of f_{NRB} using the marginal approach; the f_{NRB} values estimated so far determines the share of the current fuelwood harvest taking place in elemental areas (pixels) where overharvesting can be observed. The marginal f_{NRB} value reflects the fact that reduction of fuelwood harvest triggered by a project activity does not uniformly impact the harvesting activity in each elemental area uniformly and therefore results in a different f_{NRB} for the reduced amount of fuelwood due to the implementation of the project activity. MoFuSS can be used to provide some information on this issue;~~

~~(b) Explore further the data on the calculation of urban f_{NRB} and the localisation of wood harvesting for charcoal production supplying the urban areas; and~~

~~(c) Assess the optimal geographical disaggregation for the estimation of f_{NRB} values taking into account e.g. the uncertainty level of estimates at different geographical levels and fuelwood and charcoal flows between different sub-national jurisdictions or across national borders.~~

56. The MP noted that the availability of data on demand for woodfuel and on the growth rates of forests is limited, which adds to the uncertainty of the f_{NRB} values. The MP would like to request the Board to make a call to other agencies and entities to enhance their efforts to collect such data.

Appendix 1 Sub-national f_{NRB} values

Table 1 Default sub-national f_{NRB} values[1]

Country	Sub-national	f_{NRB} (%)
Afghanistan	Badakhshan	33
Afghanistan	Badghis	26
Afghanistan	Baghlan	12
Afghanistan	Balkh	1
Afghanistan	Bamyan	46
Afghanistan	Daykundi	44
Afghanistan	Farah	3
Afghanistan	Faryab	5
Afghanistan	Ghazni	11
Afghanistan	Ghor	51
Afghanistan	Hilmand	3
Afghanistan	Hirat	4
Afghanistan	Jawzjan	1
Afghanistan	Kabul	1
Afghanistan	Kandahar	1
Afghanistan	Kapisa	3
Afghanistan	Khost	8
Afghanistan	Kunar	34
Afghanistan	Kunduz	0
Afghanistan	Laghman	11
Afghanistan	Logar	0
Afghanistan	Nangarhar	3
Afghanistan	Nimroz	0
Afghanistan	Nuristan	36
Afghanistan	Paktika	3
Afghanistan	Paktya	6
Afghanistan	Panjshir	21
Afghanistan	Parwan	7
Afghanistan	Samangan	20
Afghanistan	Sari Pul	24
Afghanistan	Takhar	2
Afghanistan	Uruzgan	26
Afghanistan	Wardak	13
Afghanistan	Zabul	11
Angola	Bengo	26
Angola	Benguela	28
Angola	Bié	28
Angola	Cabinda	30

[1] Source: MoFuSS global simulations 1km 2010-2050 Values for 2020-2030 summary_adm0_fr.csv.

Country	Sub-national	f_{NRB} (%)
Angola	Cuando Cubango	25
Angola	Cuanza Norte	28
Angola	Cuanza Sul	30
Angola	Cunene	20
Angola	Huambo	25
Angola	Huíla	22
Angola	Luanda	23
Angola	Lunda Norte	30
Angola	Lunda Sul	34
Angola	Malanje	31
Angola	Moxico	36
Angola	Namibe	26
Angola	Uíge	28
Angola	Zaire	22
Armenia	Aragatsotn	0
Armenia	Ararat	0
Armenia	Armavir	0
Armenia	Erevan	0
Armenia	Gegharkunik	0
Armenia	Kotayk	0
Armenia	Lori	1
Armenia	Shirak	0
Armenia	Syunik	1
Armenia	Tavush	4
Armenia	Vayots Dzor	0
Azerbaijan	Absheron	0
Azerbaijan	Aran	0
Azerbaijan	Daglig Shirvan	1
Azerbaijan	Ganja-Qazakh	1
Azerbaijan	Kalbajar-Lachin	7
Azerbaijan	Lankaran	3
Azerbaijan	Nakhchivan	0
Azerbaijan	Quba-Khachmaz	2
Azerbaijan	Shaki-Zaqatala	4
Azerbaijan	Yukhari-Karabakh	2
Bangladesh	Barisal	46
Bangladesh	Chittagong	72
Bangladesh	Dhaka	0
Bangladesh	Khulna	40
Bangladesh	Mymensingh	2
Bangladesh	Rajshahi	0
Bangladesh	Rangpur	1
Bangladesh	Sylhet	21
Benin	Alibori	25

Country	Sub-national	f_{NRB} (%)
Benin	Atakora	32
Benin	Atlantique	30
Benin	Borgou	31
Benin	Collines	43
Benin	Donga	37
Benin	Kouffo	28
Benin	Littoral	0
Benin	Mono	28
Benin	Ouémé	30
Benin	Plateau	39
Benin	Zou	34
Bhutan	Bumthang	33
Bhutan	Chhukha	33
Bhutan	Dagana	32
Bhutan	Gasa	16
Bhutan	Haa	24
Bhutan	Lhuentse	30
Bhutan	Monggar	34
Bhutan	Paro	26
Bhutan	Pema Gatshel	37
Bhutan	Punakha	28
Bhutan	Samdrup Jongkhar	37
Bhutan	Samtse	31
Bhutan	Sarpang	34
Bhutan	Thimphu	25
Bhutan	Trashi Yangtse	28
Bhutan	Trashigang	30
Bhutan	Trongsa	32
Bhutan	Tsirang	36
Bhutan	Wangdue Phodrang	28
Bhutan	Zhemgang	39
Botswana	Central	27
Botswana	Chobe	19
Botswana	Francistown	10
Botswana	Gaborone	18
Botswana	Ghanzi	50
Botswana	Jwaneng	25
Botswana	Kgalagadi	49
Botswana	Kgatleng	43
Botswana	Kweneng	44
Botswana	Lobatse	7
Botswana	North-East	18
Botswana	North-West	24
Botswana	Selibe Phikwe	10

Country	Sub-national	f_{NRB} (%)
Botswana	South-East	41
Botswana	Southern	45
Botswana	Sowa	9
Burkina Faso	Boucle du Mouhoun	28
Burkina Faso	Cascades	26
Burkina Faso	Centre	30
Burkina Faso	Centre-Est	29
Burkina Faso	Centre-Nord	55
Burkina Faso	Centre-Ouest	28
Burkina Faso	Centre-Sud	29
Burkina Faso	Est	35
Burkina Faso	Haut-Bassins	25
Burkina Faso	Nord	47
Burkina Faso	Plateau-Central	33
Burkina Faso	Sahel	63
Burkina Faso	Sud-Ouest	26
Burundi	Bubanza	37
Burundi	Bujumbura Mairie	14
Burundi	Bujumbura Rural	38
Burundi	Bururi	38
Burundi	Cankuzo	35
Burundi	Cibitoke	35
Burundi	Gitega	31
Burundi	Karuzi	35
Burundi	Kayanza	31
Burundi	Kirundo	29
Burundi	Makamba	39
Burundi	Muramvya	31
Burundi	Muyinga	36
Burundi	Mwaro	31
Burundi	Ngozi	37
Burundi	Rutana	38
Burundi	Ruyigi	42
Brazil	Acre	14
Brazil	Alagoas	9
Brazil	Amapá	15
Brazil	Amazonas	17
Brazil	Bahia	12
Brazil	Ceará	11
Brazil	Distrito Federal	3
Brazil	Espírito Santo	12
Brazil	Goiás	8
Brazil	Maranhão	15
Brazil	Mato Grosso	12

Country	Sub-national	f_{NRB} (%)
Brazil	Mato Grosso do Sul	10
Brazil	Minas Gerais	13
Brazil	Pará	16
Brazil	Paraíba	11
Brazil	Paraná	17
Brazil	Pernambuco	11
Brazil	Piauí	13
Brazil	Rio de Janeiro	13
Brazil	Rio Grande do Norte	11
Brazil	Rio Grande do Sul	17
Brazil	Rondônia	12
Brazil	Roraima	18
Brazil	Santa Catarina	21
Brazil	São Paulo	11
Brazil	Sergipe	9
Brazil	Tocantins	10
Cambodia	Bântéay Méanchey	11
Cambodia	Batdâmbâng	15
Cambodia	Kâmpóng Cham	14
Cambodia	Kâmpóng Chhnang	13
Cambodia	Kâmpóng Spœ	16
Cambodia	Kâmpóng Thum	20
Cambodia	Kâmpôt	17
Cambodia	Kândal	10
Cambodia	Kaôh Kong	41
Cambodia	Kep	10
Cambodia	Krâchéh	27
Cambodia	Krong Pailin	23
Cambodia	Krong Preah Sihanouk	33
Cambodia	Môndól Kiri	40
Cambodia	Otdar Mean Chey	17
Cambodia	Phnom Penh	6
Cambodia	Pouthisat	19
Cambodia	Preah Vihéar	29
Cambodia	Prey Vêng	14
Cambodia	Rôtânôkiri	38
Cambodia	Siemréab	17
Cambodia	Stœng Trêng	31
Cambodia	Svay Rieng	34
Cambodia	Takêv	11
Cambodia	Tbong Khmum	24
Cameroon	Adamaoua	40
Cameroon	Centre	43
Cameroon	Est	43

Country	Sub-national	f_{NRB} (%)
Cameroon	Extrême-Nord	33
Cameroon	Littoral	44
Cameroon	Nord	32
Cameroon	Nord-Ouest	26
Cameroon	Ouest	26
Cameroon	Sud	45
Cameroon	Sud-Ouest	45
Central African Republic	Bamingui-Bangoran	40
Central African Republic	Bangui	25
Central African Republic	Basse-Kotto	26
Central African Republic	Haut-Mbomou	51
Central African Republic	Haute-Kotto	52
Central African Republic	Kémo	45
Central African Republic	Lobaye	39
Central African Republic	Mambéré-Kadéï	43
Central African Republic	Mbomou	41
Central African Republic	Nana-Grébizi	48
Central African Republic	Nana-Mambéré	47
Central African Republic	Ombella-M'Poko	39
Central African Republic	Ouaka	35
Central African Republic	Ouham	47
Central African Republic	Ouham-Pendé	45
Central African Republic	Sangha-Mbaéré	42
Central African Republic	Vakaga	25
Chad	Barh el Ghazel	59
Chad	Batha	62
Chad	Borkou	0
Chad	Chari-Baguirmi	33
Chad	Ennedi Est	0
Chad	Ennedi Ouest	1
Chad	Guéra	28
Chad	Hadjer-Lamis	62
Chad	Kanem	56
Chad	Lac	65
Chad	Logone Occidental	27
Chad	Logone Oriental	28
Chad	Mandoul	26
Chad	Mayo-Kebbi Est	21
Chad	Mayo-Kebbi Ouest	22
Chad	Moyen-Chari	21
Chad	Ouaddaï	65
Chad	Salamat	17
Chad	Sila	39
Chad	Tandjilé	21

Country	Sub-national	f_{NRB} (%)
Chad	Tibesti	0
Chad	Ville de N'Djamena	30
Chad	Wadi Fira	51
China	Anhui	12
China	Beijing	13
China	Chongqing	6
China	Fujian	12
China	Gansu	5
China	Guangdong	9
China	Guangxi	6
China	Guizhou	7
China	Hainan	12
China	Hebei	12
China	Heilongjiang	6
China	Henan	15
China	Hong Kong	11
China	Hubei	11
China	Hunan	9
China	Jiangsu	10
China	Jiangxi	11
China	Jilin	6
China	Liaoning	10
China	Macau	6
China	Nei Mongol	5
China	Ningxia Hui	5
China	Qinghai	1
China	Shaanxi	15
China	Shandong	15
China	Shanghai	7
China	Shanxi	13
China	Sichuan	7
China	Tianjin	6
China	Xinjiang Uygur	0
China	Xinjiang Uygur	0
China	Xinjiang Uygur	0
China	Xizang	1
China	Xizang	0
China	Xizang	0
China	Yunnan	10
China	Zhejiang	12
Costa Rica	Alajuela	9
Costa Rica	Cartago	15
Costa Rica	Guanacaste	8
Costa Rica	Heredia	13

Country	Sub-national	f_{NRB} (%)
Costa Rica	Limón	12
Costa Rica	Puntarenas	12
Costa Rica	San José	10
Colombia	Amazonas	7
Colombia	Antioquia	10
Colombia	Arauca	7
Colombia	AtlÃ¡ntico	3
Colombia	Bogota	3
Colombia	BolÃ-var	5
Colombia	BoyacÃ¡	7
Colombia	Caldas	10
Colombia	CaquetÃ¡	9
Colombia	CaquetÃ¡	3
Colombia	Casanare	9
Colombia	Cauca	4
Colombia	Cesar	14
Colombia	Choca	2
Colombia	Cardoba	7
Colombia	Cundinamarca	7
Colombia	Guaina	9
Colombia	Guaviare	8
Colombia	Huila	4
Colombia	La Guajira	2
Colombia	Magdalena	2
Colombia	Meta	5
Colombia	Nariato	9
Colombia	Norte de Santader	10
Colombia	Putumayo	12
Colombia	Quinda	8
Colombia	Risaralda	12
Colombia	San Adra	8
Colombia	Santander	9
Colombia	Sucre	1
Colombia	Tolima	6
Colombia	Valle del Cauca	7
Colombia	Vaupa	7
Colombia	Vichada	3
Congo	Bouenza	13
Congo	Brazzaville	4
Congo	Cuvette	16
Congo	Cuvette-Ouest	18
Congo	Kouilou	22
Congo	Lékoumou	21
Congo	Likouala	24

Country	Sub-national	f_{NRB} (%)
Congo	Niari	16
Congo	Plateaux	11
Congo	Pointe-Noire	0
Congo	Pool	9
Congo	Sangha	24
Côte d'Ivoire	Abidjan	14
Côte d'Ivoire	Bas-Sassandra	18
Côte d'Ivoire	Comoé	17
Côte d'Ivoire	Denguélé	19
Côte d'Ivoire	Gôh-Djiboua	19
Côte d'Ivoire	Lacs	18
Côte d'Ivoire	Lagunes	19
Côte d'Ivoire	Montagnes	23
Côte d'Ivoire	Sassandra-Marahoué	20
Côte d'Ivoire	Savanes	19
Côte d'Ivoire	Vallée du Bandama	19
Côte d'Ivoire	Woroba	19
Côte d'Ivoire	Yamoussoukro	19
Côte d'Ivoire	Zanzan	17
Democratic Republic of the Congo	Bas-Uele	49
Democratic Republic of the Congo	Équateur	50
Democratic Republic of the Congo	Haut-Katanga	49
Democratic Republic of the Congo	Haut-Lomami	37
Democratic Republic of the Congo	Haut-Uele	43
Democratic Republic of the Congo	Ituri	41
Democratic Republic of the Congo	Kasaï	39
Democratic Republic of the Congo	Kasaï-Central	36
Democratic Republic of the Congo	Kasaï-Oriental	34
Democratic Republic of the Congo	Kinshasa	26
Democratic Republic of the Congo	Kongo-Central	27
Democratic Republic of the Congo	Kwango	34
Democratic Republic of the Congo	Kwilu	32
Democratic Republic of the Congo	Lomami	28
Democratic Republic of the Congo	Lualaba	44
Democratic Republic of the Congo	Mai-Ndombe	43
Democratic Republic of the Congo	Maniema	44
Democratic Republic of the Congo	Mongala	47
Democratic Republic of the Congo	Nord-Kivu	42
Democratic Republic of the Congo	Nord-Ubangi	37
Democratic Republic of the Congo	Sankuru	46
Democratic Republic of the Congo	Sud-Kivu	42
Democratic Republic of the Congo	Sud-Ubangi	39
Democratic Republic of the Congo	Tanganyika	39
Democratic Republic of the Congo	Tshopo	50

Country	Sub-national	f_{NRB} (%)
Democratic Republic of the Congo	Tshuapa	51
Djibouti	Ali Sabieh	0
Djibouti	Arta	0
Djibouti	Dikhil	1
Djibouti	Djiboutii	0
Djibouti	Obock	0
Djibouti	Tadjoura	3
Dominican Republic	Azua	46
Dominican Republic	Bahoruco	46
Dominican Republic	Barahona	46
Dominican Republic	Dajabón	62
Dominican Republic	Distrito Nacional	11
Dominican Republic	Duarte	31
Dominican Republic	El Seybo	13
Dominican Republic	Espaillat	34
Dominican Republic	Hato Mayor	23
Dominican Republic	Independencia	59
Dominican Republic	La Altagracia	11
Dominican Republic	La Estrelleta	56
Dominican Republic	La Romana	17
Dominican Republic	La Vega	52
Dominican Republic	María Trinidad Sánchez	26
Dominican Republic	Monseñor Nouel	41
Dominican Republic	Monte Cristi	50
Dominican Republic	Monte Plata	34
Dominican Republic	Pedernales	47
Dominican Republic	Peravia	37
Dominican Republic	Puerto Plata	45
Dominican Republic	Salcedo	33
Dominican Republic	Samaná	4
Dominican Republic	San Cristóbal	38
Dominican Republic	San José de Ocoa	39
Dominican Republic	San Juan	48
Dominican Republic	San Pedro de Macorís	28
Dominican Republic	Sánchez Ramírez	35
Dominican Republic	Santiago	46
Dominican Republic	Santiago Rodríguez	47
Dominican Republic	Santo Domingo	39
Dominican Republic	Valverde	50
Ecuador	Azuay	29
Ecuador	Bolivar	33
Ecuador	Cañar	30
Ecuador	Carchi	34
Ecuador	Chimborazo	29

Country	Sub-national	f_{NRB} (%)
Ecuador	Cotopaxi	32
Ecuador	El Oro	21
Ecuador	Esmeraldas	29
Ecuador	Galápagos	18
Ecuador	Guayas	21
Ecuador	Imbabura	34
Ecuador	Loja	18
Ecuador	Los Rios	25
Ecuador	Manabi	23
Ecuador	Morona Santiago	45
Ecuador	Napo	39
Ecuador	Orellana	36
Ecuador	Pastaza	43
Ecuador	Pichincha	31
Ecuador	Santa Elena	21
Ecuador	Santo Domingo de los Tsachilas	33
Ecuador	Sucumbios	38
Ecuador	Tungurahua	31
Ecuador	Zamora Chinchipe	34
Equatorial Guinea	Annobón	0
Equatorial Guinea	Bioko Norte	26
Equatorial Guinea	Bioko Sur	31
Equatorial Guinea	Centro Sur	32
Equatorial Guinea	Kié-Ntem	29
Equatorial Guinea	Litoral	32
Equatorial Guinea	Wele-Nzas	31
Eritrea	Anseba	24
Eritrea	Debub	18
Eritrea	Debubawi Keyih Bahri	3
Eritrea	Gash Barka	53
Eritrea	Maekel	15
Eritrea	Semenawi Keyih Bahri	18
Eswatini	Hhohho	17
Eswatini	Lubombo	14
Eswatini	Manzini	17
Eswatini	Shiselweni	16
Ethiopia	Afar	50
Ethiopia	Amhara	23
Ethiopia	Benshangul-Gumaz	29
Ethiopia	Dire Dawa	19
Ethiopia	Gambela Peoples	40
Ethiopia	Harari People	18
Ethiopia	Oromia	30
Ethiopia	Somali	56

Country	Sub-national	f_{NRB} (%)
Ethiopia	Southern Nations Nationalities	29
Ethiopia	Tigray	29
Gabon	Addis Ababa	9
Gabon	Haut-Ogooué	17
Gabon	Moyen-Ogooué	14
Gabon	Ngounié	16
Gabon	Nyanga	15
Gabon	Ogooué-Ivindo	18
Gabon	Ogooué-Lolo	18
Gabon	Ogooué-Maritime	13
Gabon	Wouleu-Ntem	24
Georgia	Abkhazia	2
Georgia	Ajaria	1
Georgia	Guria	1
Georgia	Imereti	1
Georgia	Kakheti	0
Georgia	Kvemo Kartli	1
Georgia	Mtskheta-Mtianeti	1
Georgia	Racha-Lechkhumi-Kvemo Svaneti	0
Georgia	Samegrelo-Zemo Svaneti	0
Georgia	Samtskhe-Javakheti	0
Georgia	Shida Kartli	0
Georgia	Tbilisi	4
Ghana	Ahafo	34
Ghana	Ashanti	37
Ghana	Bono	30
Ghana	Bono East	39
Ghana	Central	33
Ghana	Eastern	36
Ghana	Greater Accra	28
Ghana	North East	36
Ghana	Northern	41
Ghana	Oti	32
Ghana	Savannah	33
Ghana	Upper East	30
Ghana	Upper West	27
Ghana	Volta	33
Ghana	Western	32
Ghana	Western North	31
Gambia	Banjul	39
Gambia	Lower River	60
Gambia	Maccarthy Island	50
Gambia	North Bank	64
Gambia	Upper River	48

Country	Sub-national	f_{NRB} (%)
Gambia	Western	59
Guatemala	Alta Verapaz	30
Guatemala	Baja Verapaz	31
Guatemala	Chimaltenango	52
Guatemala	Chiquimula	33
Guatemala	El Progreso	39
Guatemala	Escuintla	30
Guatemala	Guatemala	36
Guatemala	Huehuetenango	42
Guatemala	Izabal	31
Guatemala	Jalapa	35
Guatemala	Jutiapa	35
Guatemala	Petén	28
Guatemala	Quezaltenango	47
Guatemala	Quiché	45
Guatemala	Retalhuleu	36
Guatemala	Sacatepéquez	56
Guatemala	San Marcos	47
Guatemala	Santa Rosa	32
Guatemala	Sololá	54
Guatemala	Suchitepéquez	33
Guatemala	Totonicapán	62
Guatemala	Zacapa	36
Guinea	Boké	32
Guinea	Conakry	42
Guinea	Faranah	41
Guinea	Kankan	39
Guinea	Kindia	28
Guinea	Labé	42
Guinea	Mamou	38
Guinea	Nzérékoré	37
Guinea-Bissau	Bafatá	33
Guinea-Bissau	Biombo	35
Guinea-Bissau	Bissau	18
Guinea-Bissau	Bolama	23
Guinea-Bissau	Cacheu	34
Guinea-Bissau	Gabú	38
Guinea-Bissau	Oio	36
Guinea-Bissau	Quinara	23
Guinea-Bissau	Tombali	28
Guyana	Barima-Waini	0
Guyana	Cuyuni-Mazaruni	0
Guyana	Demerara-Mahaica	0
Guyana	East Berbice-Corentyne	0

Country	Sub-national	f_{NRB} (%)
Guyana	Essequibo Islands-West Demerara	0
Guyana	Mahaica-Berbice	0
Guyana	Pomeroon-Supenaam	0
Guyana	Potaro-Siparuni	0
Guyana	Upper Demerara-Berbice	0
Guyana	Upper Takutu-Upper Essequibo	0
Haiti	Centre	61
Haiti	Grand'Anse	65
Haiti	L'Artibonite	43
Haiti	Nippes	69
Haiti	Nord	71
Haiti	Nord-Est	64
Haiti	Nord-Ouest	63
Haiti	Ouest	25
Haiti	Sud	61
Haiti	Sud-Est	66
Honduras	Atlántida	34
Honduras	Choluteca	31
Honduras	Colón	30
Honduras	Article I. Comayagua	34
Honduras	Article II. Copán	31
Honduras	Article III. Cortés	32
Honduras	Article IV. El Paraíso	31
Honduras	Article V. Francisco Morazán	34
Honduras	Article VI. Gracias a Dios	26
Honduras	Article VII. Intibucá	36
Honduras	Article VIII. Islas de la Bahía	33
Honduras	Article IX. La Paz	35
Honduras	Article X. Lempira	33
Honduras	Article XI. Ocotepeque	34
Honduras	Article XII. Olancho	32
Honduras	Santa Bárbara	34
Honduras	Article XIII. Valle	31
Honduras	Article XIV. Yoro	35
India	Article XV. Andaman and Nicobar	28
India	Article XVI. Andhra Pradesh	6
India	Arunachal Pradesh	27
India	Arunachal Pradesh	28
India	Assam	24
India	Bihar	5
India	Chandigarh	2
India	Chhattisgarh	12
India	Dadra and Nagar Haveli	19
India	Daman and Diu	4

Country	Sub-national	f_{NRB} (%)
India	Goa	33
India	Gujarat	1
India	Haryana	0
India	Himachal Pradesh	17
India	Himachal Pradesh	0
India	Himachal Pradesh	0
India	Jammu and Kashmir	10
India	Jharkhand	16
India	Karnataka	5
India	Kerala	34
India	Lakshadweep	0
India	Madhya Pradesh	4
India	Maharashtra	4
India	Manipur	25
India	Meghalaya	28
India	Mizoram	31
India	Nagaland	27
India	NCT of Delhi	0
India	Odisha	19
India	Puducherry	13
India	Punjab	1
India	Rajasthan	0
India	Sikkim	23
India	Tamil Nadu	6
India	Telangana	2
India	Tripura	22
India	Uttar Pradesh	2
India	Uttarakhand	23
India	Uttarakhand	0
India	Uttarakhand	0
India	West Bengal	15
Indonesia	Aceh	10
Indonesia	Bali	6
Indonesia	Bangka Belitung	11
Indonesia	Banten	9
Indonesia	Bengkulu	11
Indonesia	Gorontalo	8
Indonesia	Jakarta Raya	0
Indonesia	Jambi	12
Indonesia	Jawa Barat	9
Indonesia	Jawa Tengah	8
Indonesia	Jawa Timur	8
Indonesia	Kalimantan Barat	11
Indonesia	Kalimantan Selatan	9

Country	Sub-national	f_{NRB} (%)
Indonesia	Kalimantan Tengah	12
Indonesia	Kalimantan Timur	11
Indonesia	Kalimantan Utara	12
Indonesia	Kepulauan Riau	8
Indonesia	Lampung	7
Indonesia	Maluku	12
Indonesia	Maluku Utara	12
Indonesia	Nusa Tenggara Barat	6
Indonesia	Nusa Tenggara Timur	3
Indonesia	Papua	10
Indonesia	Papua Barat	12
Indonesia	Riau	12
Indonesia	Sulawesi Barat	11
Indonesia	Sulawesi Selatan	7
Indonesia	Sulawesi Tengah	11
Indonesia	Sulawesi Tenggara	10
Indonesia	Sulawesi Utara	11
Indonesia	Sumatera Barat	11
Indonesia	Sumatera Selatan	10
Indonesia	Sumatera Utara	10
Indonesia	Yogyakarta	7
Islamic Republic of Iran	Alborz	8
Islamic Republic of Iran	Ardebil	9
Islamic Republic of Iran	Bushehr	0
Islamic Republic of Iran	Chahar Mahall and Bakhtiari	8
Islamic Republic of Iran	East Azarbaijan	9
Islamic Republic of Iran	Esfahan	2
Islamic Republic of Iran	Fars	1
Islamic Republic of Iran	Gilan	18
Islamic Republic of Iran	Golestan	7
Islamic Republic of Iran	Hamadan	10
Islamic Republic of Iran	Hormozgan	0
Islamic Republic of Iran	Ilam	3
Islamic Republic of Iran	Kerman	1
Islamic Republic of Iran	Kermanshah	7
Islamic Republic of Iran	Khuzestan	1
Islamic Republic of Iran	Kohgiluyeh and Buyer Ahmad	2
Islamic Republic of Iran	Kordestan	10
Islamic Republic of Iran	Lorestan	8
Islamic Republic of Iran	Markazi	9
Islamic Republic of Iran	Mazandaran	18
Islamic Republic of Iran	North Khorasan	6
Islamic Republic of Iran	Qazvin	10
Islamic Republic of Iran	Qom	2

Country	Sub-national	f_{NRB} (%)
Islamic Republic of Iran	Razavi Khorasan	4
Islamic Republic of Iran	Semnan	2
Islamic Republic of Iran	Sistan and Baluchestan	0
Islamic Republic of Iran	South Khorasan	0
Islamic Republic of Iran	Tehran	5
Islamic Republic of Iran	West Azarbaijan	9
Islamic Republic of Iran	Yazd	0
Islamic Republic of Iran	Zanjan	11
Iraq	Al-Anbar	0
Iraq	Al-Basrah	0
Iraq	Al-Muthannia	0
Iraq	Al-Qadisiyah	0
Iraq	An-Najaf	0
Iraq	Arbil	2
Iraq	As-Sulaymaniyah	2
Iraq	At-Ta'mim	1
Iraq	Babil	0
Iraq	Baghdad	0
Iraq	Dhi Qar	0
Iraq	Dihok	6
Iraq	Diyala	1
Iraq	Karbala'	0
Iraq	Maysan	0
Iraq	Ninawa	1
Iraq	Sala ad-Din	0
Iraq	Wasit	0
Jamaica	Clarendon	34
Jamaica	Hanover	39
Jamaica	Kingston	41
Jamaica	Manchester	35
Jamaica	Portland	47
Jamaica	Saint Andrew	44
Jamaica	Saint Ann	38
Jamaica	Saint Catherine	39
Jamaica	Saint Elizabeth	34
Jamaica	Saint James	38
Jamaica	Saint Mary	43
Jamaica	Saint Thomas	44
Jamaica	Trelawny	39
Jamaica	Westmoreland	34
Jordan	Ajlun	8
Jordan	Amman	1
Jordan	Aqaba	0
Jordan	Balqa	1

Country	Sub-national	f_{NRB} (%)
Jordan	Irbid	1
Jordan	Jarash	8
Jordan	Karak	0
Jordan	Ma`an	0
Jordan	Madaba	2
Jordan	Mafraq	0
Jordan	Tafilah	0
Jordan	Zarqa	0
Kazakhstan	Almaty	17
Kazakhstan	Aqmola	0
Kazakhstan	Aqtöbe	0
Kazakhstan	Atyrau	0
Kazakhstan	East Kazakhstan	7
Kazakhstan	Mangghystau	0
Kazakhstan	North Kazakhstan	11
Kazakhstan	Pavlodar	0
Kazakhstan	Qaraghandy	0
Kazakhstan	Qostanay	1
Kazakhstan	Qyzylorda	0
Kazakhstan	South Kazakhstan	8
Kazakhstan	West Kazakhstan	0
Kazakhstan	Zhambyl	8
Kenya	Baringo	21
Kenya	Bomet	26
Kenya	Bungoma	22
Kenya	Busia	18
Kenya	Elgeyo-Marakwet	22
Kenya	Embu	34
Kenya	Garissa	47
Kenya	Homa Bay	19
Kenya	Isiolo	46
Kenya	Kajiado	30
Kenya	Kakamega	21
Kenya	Kericho	23
Kenya	Kiambu	23
Kenya	Kilifi	22
Kenya	Kirinyaga	26
Kenya	Kisii	20
Kenya	Kisumu	26
Kenya	Kitui	45
Kenya	Kwale	20
Kenya	Laikipia	17
Kenya	Lamu	20
Kenya	Machakos	25

Country	Sub-national	f_{NRB} (%)
Kenya	Makueni	34
Kenya	Mandera	50
Kenya	Marsabit	46
Kenya	Meru	27
Kenya	Migori	22
Kenya	Mombasa	13
Kenya	Murang'a	25
Kenya	Nairobi	11
Kenya	Nakuru	21
Kenya	Nandi	24
Kenya	Narok	22
Kenya	Nyamira	21
Kenya	Nyandarua	21
Kenya	Nyeri	25
Kenya	Samburu	24
Kenya	Siaya	22
Kenya	Taita Taveta	49
Kenya	Tana River	42
Kenya	Tharaka Nithi	49
Kenya	Trans Nzoia	20
Kenya	Turkana	42
Kenya	Uasin Gishu	21
Kenya	Vihiga	20
Kenya	Wajir	50
Kenya	West Pokot	22
Kyrgyzstan	Batken	34
Kyrgyzstan	Biškek	2
Kyrgyzstan	Chüy	15
Kyrgyzstan	Jalal-Abad	30
Kyrgyzstan	Naryn	19
Kyrgyzstan	Osh	30
Kyrgyzstan	Osh city	4
Kyrgyzstan	Talas	22
Kyrgyzstan	Ysyk-Köl	16
Lao People's Democratic Republic	Attapu	54
Lao People's Democratic Republic	Bokeo	48
Lao People's Democratic Republic	Bolikhamxai	50
Lao People's Democratic Republic	Champasak	46
Lao People's Democratic Republic	Houaphan	56
Lao People's Democratic Republic	Khammouan	49
Lao People's Democratic Republic	Louang Namtha	55
Lao People's Democratic Republic	Louangphrabang	47
Lao People's Democratic Republic	Oudômxai	53
Lao People's Democratic Republic	Phôngsali	53

Country	Sub-national	f_{NRB} (%)
Lao People's Democratic Republic	Saravan	40
Lao People's Democratic Republic	Savannakhét	37
Lao People's Democratic Republic	Vientiane	45
Lao People's Democratic Republic	Vientiane [prefecture]	45
Lao People's Democratic Republic	Xaignabouri	46
Lao People's Democratic Republic	Xaisômboun	55
Lao People's Democratic Republic	Xékong	54
Lao People's Democratic Republic	Xiangkhoang	54
Liberia	Bomi	41
Liberia	Bong	40
Liberia	Gbapolu	41
Liberia	Grand Bassa	40
Liberia	Grand Cape Mount	40
Liberia	Grand Gedeh	40
Liberia	Grand Kru	37
Liberia	Lofa	42
Liberia	Margibi	37
Liberia	Maryland	34
Liberia	Montserrado	39
Liberia	Nimba	39
Liberia	River Gee	39
Liberia	Rivercess	41
Liberia	Sinoe	40
Madagascar	Antananarivo	26
Madagascar	Antsiranana	32
Madagascar	Fianarantsoa	32
Madagascar	Mahajanga	33
Madagascar	Toamasina	36
Madagascar	Toliary	54
Malawi	Balaka	62
Malawi	Blantyre	55
Malawi	Chikwawa	38
Malawi	Chiradzulu	49
Malawi	Chitipa	35
Malawi	Dedza	49
Malawi	Dowa	61
Malawi	Karonga	43
Malawi	Kasungu	55
Malawi	Likoma	0
Malawi	Lilongwe	55
Malawi	Machinga	46
Malawi	Mangochi	45
Malawi	Mchinji	60
Malawi	Mulanje	36

Country	Sub-national	f_{NRB} (%)
Malawi	Mwanza	52
Malawi	Mzimba	45
Malawi	Neno	53
Malawi	Nkhata Bay	56
Malawi	Nkhotakota	54
Malawi	Nsanje	33
Malawi	Ntcheu	54
Malawi	Ntchisi	52
Malawi	Phalombe	39
Malawi	Rumphi	41
Malawi	Salima	56
Malawi	Thyolo	40
Malawi	Zomba	49
Malaysia	Johor	38
Malaysia	Kedah	32
Malaysia	Kelantan	35
Malaysia	Kuala Lumpur	0
Malaysia	Labuan	19
Malaysia	Melaka	29
Malaysia	Negeri Sembilan	39
Malaysia	Pahang	47
Malaysia	Perak	40
Malaysia	Perlis	18
Malaysia	Pulau Pinang	12
Malaysia	Putrajaya	3
Malaysia	Sabah	47
Malaysia	Sarawak	46
Malaysia	Selangor	29
Malaysia	Trengganu	44
Mali	Bamako	4
Mali	Gao	28
Mali	Kayes	39
Mali	Kidal	1
Mali	Koulikoro	45
Mali	Mopti	70
Mali	Ségou	46
Mali	Sikasso	35
Mali	Timbuktu	54
Mauritania	Adrar	0
Mauritania	Assaba	67
Mauritania	Brakna	54
Mauritania	Dakhlet Nouadhibou	0
Mauritania	Gorgol	66
Mauritania	Guidimaka	71

Country	Sub-national	f_{NRB} (%)
Mauritania	Hodh ech Chargui	67
Mauritania	Hodh el Gharbi	69
Mauritania	Inchiri	0
Mauritania	Nouakchott	0
Mauritania	Tagant	29
Mauritania	Tiris Zemmour	0
Mauritania	Trarza	64
Mexico	Aguascalientes	19
Mexico	Baja California	15
Mexico	Baja California Sur	5
Mexico	Campeche	40
Mexico	Chiapas	34
Mexico	Chihuahua	21
Mexico	Coahuila	13
Mexico	Colima	32
Mexico	Distrito Federal	27
Mexico	Durango	27
Mexico	Guanajuato	17
Mexico	Guerrero	39
Mexico	Hidalgo	32
Mexico	Jalisco	27
Mexico	México	36
Mexico	Michoacán	34
Mexico	Morelos	31
Mexico	Nayarit	35
Mexico	Nuevo León	22
Mexico	Oaxaca	38
Mexico	Puebla	33
Mexico	Querétaro	25
Mexico	Quintana Roo	45
Mexico	San Luis Potosí	31
Mexico	Sinaloa	22
Mexico	Sonora	14
Mexico	Tabasco	29
Mexico	Tamaulipas	29
Mexico	Tlaxcala	35
Mexico	Veracruz	36
Mexico	Yucatán	30
Mexico	Zacatecas	19
Mongolia	Arhangay	9
Mongolia	Bayan-Ölgiy	10
Mongolia	Bayanhongor	9
Mongolia	Bulgan	10
Mongolia	Darhan-Uul	0

Country	Sub-national	f_{NRB} (%)
Mongolia	Dornod	1
Mongolia	Dornogovi	0
Mongolia	Dundgovi	0
Mongolia	Dzavhan	12
Mongolia	Govi-Altay	5
Mongolia	Govisümber	0
Mongolia	Hentiy	15
Mongolia	Hovd	5
Mongolia	Hövsgöl	15
Mongolia	Ömnögovi	0
Mongolia	Orhon	13
Mongolia	Övörhangay	8
Mongolia	Selenge	7
Mongolia	Sühbaatar	0
Mongolia	Töv	17
Mongolia	Ulaanbaatar	28
Mongolia	Uvs	6
Myanmar	Ayeyarwady	33
Myanmar	Bago	33
Myanmar	Chin	36
Myanmar	Kachin	49
Myanmar	Kayah	32
Myanmar	Kayin	36
Myanmar	Magway	26
Myanmar	Mandalay	33
Myanmar	Mon	34
Myanmar	Naypyitaw	37
Myanmar	Rakhine	32
Myanmar	Sagaing	35
Myanmar	Shan	41
Myanmar	Tanintharyi	40
Myanmar	Yangon	25
Mozambique	Cabo Delgado	43
Mozambique	Gaza	29
Mozambique	Inhambane	33
Mozambique	Manica	33
Mozambique	Maputo	36
Mozambique	Maputo City	34
Mozambique	Nampula	39
Mozambique	Nassa	46
Mozambique	Sofala	36
Mozambique	Tete	38
Mozambique	Zambezia	38
Namibia	!Karas	15

Country	Sub-national	f_{NRB} (%)
Namibia	Erongo	41
Namibia	Hardap	43
Namibia	Kavango	23
Namibia	Khomas	33
Namibia	Kunene	31
Namibia	Ohangwena	16
Namibia	Omaheke	53
Namibia	Omusati	18
Namibia	Oshana	18
Namibia	Oshikoto	20
Namibia	Otjozondjupa	46
Namibia	Zambezi	17
Nepal	Central	45
Nepal	East	43
Nepal	Far-Western	45
Nepal	Mid-Western	47
Nepal	West	47
Nicaragua	Atlántico Norte	27
Nicaragua	Atlántico Sur	19
Nicaragua	Boaco	24
Nicaragua	Carazo	32
Nicaragua	Chinandega	23
Nicaragua	Chontales	20
Nicaragua	Estelí	25
Nicaragua	Granada	31
Nicaragua	Jinotega	26
Nicaragua	Lago Nicaragua	17
Nicaragua	León	26
Nicaragua	Madriz	29
Nicaragua	Managua	27
Nicaragua	Masaya	37
Nicaragua	Matagalpa	25
Nicaragua	Nueva Segovia	28
Nicaragua	Río San Juan	20
Nicaragua	Rivas	28
Niger	Agadez	10
Niger	Diffa	65
Niger	Dosso	64
Niger	Maradi	76
Niger	Niamey	6
Niger	Tahoua	70
Niger	Tillabéry	53
Niger	Zinder	66
Nigeria	Abia	23

Country	Sub-national	f_{NRB} (%)
Nigeria	Adamawa	32
Nigeria	Akwa Ibom	28
Nigeria	Anambra	20
Nigeria	Bauchi	38
Nigeria	Bayelsa	40
Nigeria	Benue	35
Nigeria	Borno	54
Nigeria	Cross River	33
Nigeria	Delta	29
Nigeria	Ebonyi	19
Nigeria	Edo	30
Nigeria	Ekiti	34
Nigeria	Enugu	29
Nigeria	Federal Capital Territory	41
Nigeria	Gombe	36
Nigeria	Imo	23
Nigeria	Jigawa	53
Nigeria	Kaduna	44
Nigeria	Kano	34
Nigeria	Katsina	46
Nigeria	Kebbi	48
Nigeria	Kogi	38
Nigeria	Kwara	42
Nigeria	Lagos	25
Nigeria	Nasarawa	47
Nigeria	Niger	48
Nigeria	Ogun	28
Nigeria	Ondo	34
Nigeria	Osun	33
Nigeria	Oyo	25
Nigeria	Plateau	33
Nigeria	Rivers	30
Nigeria	Sokoto	59
Nigeria	Taraba	38
Nigeria	Yobe	67
Nigeria	Zamfara	47
Pakistan	Azad Kashmir	44
Pakistan	Balochistan	1
Pakistan	Federally Administered Tribal Ar	13
Pakistan	Gilgit-Baltistan	39
Pakistan	Islamabad	6
Pakistan	Khyber-Pakhtunkhwa	22
Pakistan	Punjab	1
Pakistan	Sindh	0

Country	Sub-national	f_{NRB} (%)
Panama	Bocas del Toro	32
Panama	Chiriquí	21
Panama	Coclé	21
Panama	Colón	25
Panama	Darién	28
Panama	Emberá	38
Panama	Herrera	21
Panama	Kuna Yala	37
Panama	Los Santos	21
Panama	Ngöbe Buglé	27
Panama	Panamá	19
Panama	Panamá Oeste	20
Panama	Veraguas	20
Papua New Guinea	Bougainville	1
Papua New Guinea	Central	2
Papua New Guinea	Chimbu	0
Papua New Guinea	East New Britain	1
Papua New Guinea	East Sepik	18
Papua New Guinea	Eastern Highlands	0
Papua New Guinea	Enga	0
Papua New Guinea	Gulf	59
Papua New Guinea	Hela	0
Papua New Guinea	Jiwaka	0
Papua New Guinea	Madang	9
Papua New Guinea	Manus	3
Papua New Guinea	Milne Bay	1
Papua New Guinea	Morobe	4
Papua New Guinea	National Capital District	12
Papua New Guinea	New Ireland	3
Papua New Guinea	Oro	0
Papua New Guinea	Sandaun	4
Papua New Guinea	Southern Highlands	4
Papua New Guinea	West New Britain	1
Papua New Guinea	Western	2
Papua New Guinea	Western Highlands	0
Peru	Amazonas	10
Peru	Ancash	2
Peru	Apurímac	1
Peru	Arequipa	1
Peru	Ayacucho	1
Peru	Cajamarca	5
Peru	Callao	0
Peru	Cusco	5
Peru	Huancavelica	1

Country	Sub-national	f_{NRB} (%)
Peru	Huánuco	2
Peru	Ica	0
Peru	Junín	5
Peru	La Libertad	2
Peru	Lambayeque	4
Peru	Lima	3
Peru	Lima Province	0
Peru	Loreto	9
Peru	Madre de Dios	4
Peru	Moquegua	1
Peru	Pasco	2
Peru	Piura	6
Peru	Puno	8
Peru	San Martín	7
Peru	Tacna	0
Peru	Tumbes	5
Peru	Ucayali	4
Philippines	Abra	63
Philippines	Agusan del Norte	49
Philippines	Agusan del Sur	49
Philippines	Aklan	53
Philippines	Albay	53
Philippines	Antique	48
Philippines	Apayao	55
Philippines	Aurora	57
Philippines	Basilan	49
Philippines	Bataan	70
Philippines	Batanes	48
Philippines	Batangas	70
Philippines	Benguet	64
Philippines	Biliran	49
Philippines	Bohol	47
Philippines	Bukidnon	46
Philippines	Bulacan	50
Philippines	Cagayan	56
Philippines	Camarines Norte	55
Philippines	Camarines Sur	52
Philippines	Camiguin	49
Philippines	Capiz	52
Philippines	Catanduanes	49
Philippines	Cavite	41
Philippines	Cebu	49
Philippines	Compostela Valley	54
Philippines	Davao del Norte	51

Country	Sub-national	f_{NRB} (%)
Philippines	Davao del Sur	53
Philippines	Davao Oriental	52
Philippines	Dinagat Islands	49
Philippines	Eastern Samar	49
Philippines	Guimaras	46
Philippines	Ifugao	62
Philippines	Ilocos Norte	60
Philippines	Ilocos Sur	64
Philippines	Iloilo	53
Philippines	Isabela	55
Philippines	Kalinga	63
Philippines	La Union	71
Philippines	Laguna	57
Philippines	Lanao del Norte	49
Philippines	Lanao del Sur	54
Philippines	Leyte	49
Philippines	Maguindanao	47
Philippines	Marinduque	49
Philippines	Masbate	40
Philippines	Metropolitan Manila	0
Philippines	Misamis Occidental	52
Philippines	Misamis Oriental	46
Philippines	Mountain Province	63
Philippines	Negros Occidental	50
Philippines	Negros Oriental	46
Philippines	North Cotabato	50
Philippines	Northern Samar	49
Philippines	Nueva Ecija	58
Philippines	Nueva Vizcaya	61
Philippines	Occidental Mindoro	49
Philippines	Oriental Mindoro	49
Philippines	Palawan	50
Philippines	Pampanga	28
Philippines	Pangasinan	60
Philippines	Quezon	62
Philippines	Quirino	59
Philippines	Rizal	59
Philippines	Romblon	49
Philippines	Samar	49
Philippines	Sarangani	42
Philippines	Siquijor	43
Philippines	Sorsogon	51
Philippines	South Cotabato	47
Philippines	Southern Leyte	50

Country	Sub-national	f_{NRB} (%)
Philippines	Sultan Kudarat	48
Philippines	Sulu	50
Philippines	Surigao del Norte	49
Philippines	Surigao del Sur	49
Philippines	Tarlac	65
Philippines	Tawi-Tawi	50
Philippines	Zambales	66
Philippines	Zamboanga del Norte	47
Philippines	Zamboanga del Sur	45
Philippines	Zamboanga Sibugay	51
Plurinational State of Bolivia	Beni	15
Plurinational State of Bolivia	Chuquisaca	9
Plurinational State of Bolivia	Cochabamba	21
Plurinational State of Bolivia	La Paz	18
Plurinational State of Bolivia	Oruro	10
Plurinational State of Bolivia	Pando	26
Plurinational State of Bolivia	Potosí	10
Plurinational State of Bolivia	Santa Cruz	11
Plurinational State of Bolivia	Tarija	11
Rwanda	Amajyaruguru	36
Rwanda	Amajyepfo	31
Rwanda	Iburasirazuba	35
Rwanda	Iburengerazuba	35
Rwanda	Umujyi wa Kigali	21
Senegal	Dakar	5
Senegal	Diourbel	12
Senegal	Fatick	59
Senegal	Kaffrine	66
Senegal	Kaolack	65
Senegal	Kédougou	46
Senegal	Kolda	53
Senegal	Louga	87
Senegal	Matam	84
Senegal	Saint-Louis	87
Senegal	Sédhiou	55
Senegal	Tambacounda	52
Senegal	Thiès	45
Senegal	Ziguinchor	55
Sierra Leone	Eastern	52
Sierra Leone	Northern	37
Sierra Leone	Southern	39
Sierra Leone	Western	35
Somalia	Awdal	39
Somalia	Bakool	66

Country	Sub-national	f_{NRB} (%)
Somalia	Bari	14
Somalia	Bay	68
Somalia	Galguduud	62
Somalia	Gedo	66
Somalia	Hiiraan	64
Somalia	Jubbada Dhexe	68
Somalia	Jubbada Hoose	65
Somalia	Mudug	37
Somalia	Nugaal	44
Somalia	Sanaag	23
Somalia	Shabeellaha Dhexe	52
Somalia	Shabeellaha Hoose	71
Somalia	Sool	41
Somalia	Togdheer	53
Somalia	Banaadir	0
South Africa	Eastern Cape	21
South Africa	Free State	14
South Africa	Gauteng	10
South Africa	KwaZulu-Natal	19
South Africa	Limpopo	14
South Africa	Mpumalanga	15
South Africa	North West	23
South Africa	Northern Cape	28
South Africa	Western Cape	16
South Sudan	Central Equatoria	37
South Sudan	Eastern Equatoria	40
South Sudan	Jungoli	28
South Sudan	Lakes	34
South Sudan	North Bahr-al-Ghazal	25
South Sudan	Unity	23
South Sudan	Upper Nile	33
South Sudan	Warap	27
South Sudan	West Bahr-al-Ghazal	32
South Sudan	West Equatoria	37
Sri Lanka	Ampara	40
Sri Lanka	Anuradhapura	44
Sri Lanka	Badulla	43
Sri Lanka	Batticaloa	48
Sri Lanka	Colombo	36
Sri Lanka	Galle	46
Sri Lanka	Gampaha	49
Sri Lanka	Hambantota	28
Sri Lanka	Jaffna	25
Sri Lanka	Kalutara	45

Country	Sub-national	f_{NRB} (%)
Sri Lanka	Kandy	47
Sri Lanka	Kegalle	47
Sri Lanka	Kilinochchi	23
Sri Lanka	Kurunegala	48
Sri Lanka	Mannar	28
Sri Lanka	Matale	49
Sri Lanka	Matara	49
Sri Lanka	Moneragala	38
Sri Lanka	Mullaitivu	35
Sri Lanka	Nuwara Eliya	51
Sri Lanka	Polonnaruwa	45
Sri Lanka	Puttalam	41
Sri Lanka	Ratnapura	47
Sri Lanka	Trincomalee	48
Sri Lanka	Vavuniya	44
Sudan	Al Jazirah	65
Sudan	Al Qadarif	63
Sudan	Blue Nile	59
Sudan	Central Darfur	49
Sudan	East Darfur	53
Sudan	Kassala	46
Sudan	Khartoum	2
Sudan	North Darfur	53
Sudan	North Kurdufan	54
Sudan	Northern	0
Sudan	Red Sea	2
Sudan	River Nile	7
Sudan	Sennar	67
Sudan	South Darfur	43
Sudan	South Kurdufan	54
Sudan	West Darfur	53
Sudan	West Kurdufan	53
Sudan	White Nile	65
Syrian Arab Republic	Al Ḥasakah	0
Syrian Arab Republic	Aleppo	2
Syrian Arab Republic	Ar Raqqah	0
Syrian Arab Republic	As Suwayda'	7
Syrian Arab Republic	Damascus	1
Syrian Arab Republic	Dar`a	2
Syrian Arab Republic	Dayr Az Zawr	1
Syrian Arab Republic	Hamah	3
Syrian Arab Republic	Hims	4
Syrian Arab Republic	Idlib	6
Syrian Arab Republic	Lattakia	13

Country	Sub-national	f_{NRB} (%)
Syrian Arab Republic	Quneitra	6
Syrian Arab Republic	Rif Dimashq	4
Syrian Arab Republic	Tartus	14
Tajikistan	Districts of Republican Subordin	26
Tajikistan	Dushanbe	7
Tajikistan	Gorno-Badakhshan	13
Tajikistan	Khatlon	12
Tajikistan	Sughd	28
Thailand	Amnat Charoen	13
Thailand	Ang Thong	17
Thailand	Bangkok Metropolis	15
Thailand	Bueng Kan	28
Thailand	Buri Ram	11
Thailand	Chachoengsao	17
Thailand	Chai Nat	10
Thailand	Chaiyaphum	16
Thailand	Chanthaburi	25
Thailand	Chiang Mai	36
Thailand	Chiang Rai	29
Thailand	Chon Buri	13
Thailand	Chumphon	33
Thailand	Kalasin	15
Thailand	Kamphaeng Phet	15
Thailand	Kanchanaburi	21
Thailand	Khon Kaen	13
Thailand	Krabi	30
Thailand	Lampang	33
Thailand	Lamphun	33
Thailand	Loei	30
Thailand	Lop Buri	12
Thailand	Mae Hong Son	39
Thailand	Maha Sarakham	11
Thailand	Mukdahan	21
Thailand	Nakhon Nayok	25
Thailand	Nakhon Pathom	23
Thailand	Nakhon Phanom	36
Thailand	Nakhon Ratchasima	15
Thailand	Nakhon Sawan	11
Thailand	Nakhon Si Thammarat	27
Thailand	Nan	41
Thailand	Narathiwat	31
Thailand	Nong Bua Lam Phu	29
Thailand	Nong Khai	36
Thailand	Nonthaburi	24

Country	Sub-national	f_{NRB} (%)
Thailand	Pathum Thani	23
Thailand	Pattani	22
Thailand	Phangnga	36
Thailand	Phatthalung	23
Thailand	Phayao	31
Thailand	Phetchabun	20
Thailand	Phetchaburi	26
Thailand	Phichit	11
Thailand	Phitsanulok	21
Thailand	Phra Nakhon Si Ayutthaya	17
Thailand	Phrae	29
Thailand	Phuket	35
Thailand	Prachin Buri	23
Thailand	Prachuap Khiri Khan	32
Thailand	Ranong	37
Thailand	Ratchaburi	16
Thailand	Rayong	17
Thailand	Roi Et	11
Thailand	Sa Kaeo	17
Thailand	Sakon Nakhon	27
Thailand	Samut Prakan	23
Thailand	Samut Sakhon	19
Thailand	Samut Songkhram	18
Thailand	Saraburi	16
Thailand	Satun	31
Thailand	Si Sa Ket	12
Thailand	Sing Buri	13
Thailand	Songkhla	26
Thailand	Sukhothai	16
Thailand	Suphan Buri	15
Thailand	Surat Thani	30
Thailand	Surin	10
Thailand	Tak	35
Thailand	Trang	30
Thailand	Trat	27
Thailand	Ubon Ratchathani	16
Thailand	Udon Thani	28
Thailand	Uthai Thani	17
Thailand	Uttaradit	28
Thailand	Yala	33
Thailand	Yasothon	12
Timor-Leste	Aileu	40
Timor-Leste	Ainaro	43
Timor-Leste	Ambeno	28

Country	Sub-national	f_{NRB} (%)
Timor-Leste	Baucau	34
Timor-Leste	Bobonaro	39
Timor-Leste	Covalima	43
Timor-Leste	Dili	24
Timor-Leste	Ermera	42
Timor-Leste	Lautém	40
Timor-Leste	Liquiçá	33
Timor-Leste	Manatuto	39
Timor-Leste	Manufahi	43
Timor-Leste	Viqueque	42
Togo	Centre	48
Togo	Kara	48
Togo	Maritime	39
Togo	Plateaux	45
Togo	Savanes	51
Türkiye	Adana	9
Türkiye	Adiyaman	9
Türkiye	Afyon	10
Türkiye	Agri	11
Türkiye	Aksaray	6
Türkiye	Amasya	13
Türkiye	Ankara	13
Türkiye	Antalya	12
Türkiye	Ardahan	8
Türkiye	Artvin	18
Türkiye	Aydin	10
Türkiye	Balikesir	14
Türkiye	Bartın	28
Türkiye	Batman	4
Türkiye	Bayburt	11
Türkiye	Bilecik	20
Türkiye	Bingöl	12
Türkiye	Bitlis	9
Türkiye	Bolu	25
Türkiye	Burdur	15
Türkiye	Bursa	20
Türkiye	Çanakkale	15
Türkiye	Çankiri	13
Türkiye	Çorum	12
Türkiye	Denizli	15
Türkiye	Diyarbakir	4
Türkiye	Düzce	28
Türkiye	Edirne	7
Türkiye	Elazığ	11

Country	Sub-national	f_{NRB} (%)
Türkiye	Erzincan	11
Türkiye	Erzurum	11
Türkiye	Eskisehir	11
Türkiye	Gaziantep	6
Türkiye	Giresun	25
Türkiye	Gümüshane	13
Türkiye	Hakkari	12
Türkiye	Hatay	10
Türkiye	Iğdır	6
Türkiye	Isparta	12
Türkiye	Istanbul	23
Türkiye	Izmir	13
Türkiye	K Maras	11
Türkiye	Karabük	28
Türkiye	Karaman	9
Türkiye	Kars	8
Türkiye	Kastamonu	24
Türkiye	Kayseri	12
Türkiye	Kilis	7
Türkiye	Kinkkale	9
Türkiye	Kirklareli	13
Türkiye	Kirsehir	9
Türkiye	Kocaeli	22
Türkiye	Konya	8
Türkiye	Kütahya	15
Türkiye	Malatya	11
Türkiye	Manisa	11
Türkiye	Mardin	4
Türkiye	Mersin	10
Türkiye	Mugla	11
Türkiye	Mus	10
Türkiye	Nevsehir	10
Türkiye	Nigde	11
Türkiye	Ordu	26
Türkiye	Osmaniye	13
Türkiye	Rize	32
Türkiye	Sakarya	23
Türkiye	Samsun	15
Türkiye	Sanliurfa	2
Türkiye	Siirt	8
Türkiye	Sinop	22
Türkiye	Sirnak	9
Türkiye	Sivas	12
Türkiye	Tekirdag	9

Country	Sub-national	f_{NRB} (%)
Türkiye	Tokat	15
Türkiye	Trabzon	25
Türkiye	Tunceli	11
Türkiye	Usak	10
Türkiye	Van	10
Türkiye	Yalova	27
Türkiye	Yozgat	9
Türkiye	Zinguldak	28
Turkmenistan	Ahal	0
Turkmenistan	Aşgabat	0
Turkmenistan	Balkan	1
Turkmenistan	Daşoguz	0
Turkmenistan	Lebap	1
Turkmenistan	Mary	0
Uganda	Adjumani	48
Uganda	Apac	36
Uganda	Arua	42
Uganda	Bugiri	35
Uganda	Bundibugyo	46
Uganda	Bushenyi	37
Uganda	Busia	36
Uganda	Gulu	42
Uganda	Hoima	29
Uganda	Iganga	36
Uganda	Jinja	36
Uganda	Kabale	35
Uganda	Kabarole	40
Uganda	Kaberamaido	40
Uganda	Kalangala	11
Uganda	Kampala	0
Uganda	Kamuli	35
Uganda	Kamwenge	32
Uganda	Kanungu	35
Uganda	Kapchorwa	41
Uganda	Kasese	36
Uganda	Katakwi	65
Uganda	Kayunga	34
Uganda	Kibale	46
Uganda	Kiboga	34
Uganda	Kisoro	33
Uganda	Kitgum	57
Uganda	Kotido	40
Uganda	Kumi	52
Uganda	Kyenjojo	40

Country	Sub-national	f_{NRB} (%)
Uganda	Lake Albert	0
Uganda	Lake Victoria	41
Uganda	Lira	52
Uganda	Luwero	40
Uganda	Masaka	29
Uganda	Masindi	35
Uganda	Mayuge	34
Uganda	Mbale	31
Uganda	Mbarara	34
Uganda	Moroto	46
Uganda	Moyo	52
Uganda	Mpigi	35
Uganda	Mubende	34
Uganda	Mukono	42
Uganda	Nakapiripirit	45
Uganda	Nakasongola	37
Uganda	Nebbi	44
Uganda	Ntungamo	34
Uganda	Pader	59
Uganda	Pallisa	36
Uganda	Rakai	33
Uganda	Rukungiri	37
Uganda	Sembabule	36
Uganda	Sironko	37
Uganda	Soroti	45
Uganda	Tororo	32
Uganda	Wakiso	35
Uganda	Yumbe	49
United Republic of Tanzania	Arusha	63
United Republic of Tanzania	Dar es Salaam	31
United Republic of Tanzania	Dodoma	71
United Republic of Tanzania	Geita	43
United Republic of Tanzania	Iringa	51
United Republic of Tanzania	Kagera	34
United Republic of Tanzania	Kaskazini Pemba	26
United Republic of Tanzania	Kaskazini Unguja	26
United Republic of Tanzania	Katavi	45
United Republic of Tanzania	Kigoma	49
United Republic of Tanzania	Kilimanjaro	67
United Republic of Tanzania	Kusini Pemba	25
United Republic of Tanzania	Kusini Unguja	34
United Republic of Tanzania	Lindi	43
United Republic of Tanzania	Manyara	70
United Republic of Tanzania	Mara	56

Country	Sub-national	f_{NRB} (%)
United Republic of Tanzania	Mbeya	41
United Republic of Tanzania	Mjini Magharibi	23
United Republic of Tanzania	Morogoro	42
United Republic of Tanzania	Mtwara	38
United Republic of Tanzania	Mwanza	41
United Republic of Tanzania	Njombe	34
United Republic of Tanzania	Pwani	53
United Republic of Tanzania	Rukwa	30
United Republic of Tanzania	Ruvuma	38
United Republic of Tanzania	Shinyanga	44
United Republic of Tanzania	Simiyu	71
United Republic of Tanzania	Singida	68
United Republic of Tanzania	Songwe	40
United Republic of Tanzania	Tabora	40
United Republic of Tanzania	Tanga	58
Uzbekistan	Andijon	27
Uzbekistan	Buxoro	0
Uzbekistan	Farg'ona	20
Uzbekistan	Jizzax	24
Uzbekistan	Namangan	25
Uzbekistan	Navoiy	15
Uzbekistan	Qaraqalpaqstan	0
Uzbekistan	Qashqadaryo	8
Uzbekistan	Samarqand'	22
Uzbekistan	Sirdaryo	5
Uzbekistan	Surxondaryo	7
Uzbekistan	Toshkent	19
Uzbekistan	Toshkent Shahri	0
Uzbekistan	Xorazm	0
Viet Nam	An Giang	15
Viet Nam	Bà Rịa - Vũng Tàu	34
Viet Nam	Bắc Giang	45
Viet Nam	Bắc Kạn	45
Viet Nam	Bạc Liêu	39
Viet Nam	Bắc Ninh	1
Viet Nam	Bến Tre	18
Viet Nam	Bình Định	43
Viet Nam	Bình Dương	35
Viet Nam	Bình Phước	39
Viet Nam	Bình Thuận	34
Viet Nam	Cà Mau	52
Viet Nam	Cần Thơ	20
Viet Nam	Cao Bằng	30
Viet Nam	Đà Nẵng	36

Country	Sub-national	f_{NRB} (%)
Viet Nam	Đắk Lắk	31
Viet Nam	Đắk Nông	35
Viet Nam	Điện Biên	41
Viet Nam	Đồng Nai	40
Viet Nam	Đồng Tháp	26
Viet Nam	Gia Lai	40
Viet Nam	Hà Giang	44
Viet Nam	Hà Nam	33
Viet Nam	Hà Nội	22
Viet Nam	Hà Tĩnh	40
Viet Nam	Hải Dương	25
Viet Nam	Hải Phòng	11
Viet Nam	Hậu Giang	24
Viet Nam	Hồ Chí Minh	27
Viet Nam	Hoà Bình	43
Viet Nam	Hưng Yên	2
Viet Nam	Khánh Hòa	34
Viet Nam	Kiên Giang	27
Viet Nam	Kon Tum	46
Viet Nam	Lai Châu	44
Viet Nam	Lâm Đồng	39
Viet Nam	Lạng Sơn	43
Viet Nam	Lào Cai	44
Viet Nam	Long An	41
Viet Nam	Nam Định	10
Viet Nam	Nghệ An	43
Viet Nam	Ninh Bình	41
Viet Nam	Ninh Thuận	32
Viet Nam	Phú Thọ	44
Viet Nam	Phú Yên	33
Viet Nam	Quảng Bình	47
Viet Nam	Quảng Nam	43
Viet Nam	Quảng Ngãi	41
Viet Nam	Quảng Ninh	42
Viet Nam	Quảng Trị	39
Viet Nam	Sóc Trăng	18
Viet Nam	Sơn La	42
Viet Nam	Tây Ninh	32
Viet Nam	Thái Bình	6
Viet Nam	Thái Nguyên	46
Viet Nam	Thanh Hóa	42
Viet Nam	Thừa Thiên Huế	41
Viet Nam	Tiền Giang	22
Viet Nam	Trà Vinh	20

Country	Sub-national	f_{NRB} (%)
Viet Nam	Tuyên Quang	45
Viet Nam	Vĩnh Long	19
Viet Nam	Vĩnh Phúc	45
Viet Nam	Yên Bái	43
Zambia	Central	42
Zambia	Copperbelt	52
Zambia	Eastern	34
Zambia	Luapula	44
Zambia	Lusaka	37
Zambia	Muchinga	38
Zambia	North-Western	55
Zambia	Northern	38
Zambia	Southern	30
Zambia	Western	38
Zimbabwe	Bulawayo	11
Zimbabwe	Harare	6
Zimbabwe	Manicaland	21
Zimbabwe	Mashonaland Central	22
Zimbabwe	Mashonaland East	21
Zimbabwe	Mashonaland West	21
Zimbabwe	Masvingo	21
Zimbabwe	Matabeleland North	21
Zimbabwe	Matabeleland South	20
Zimbabwe	Midlands	21

1. Country-level

57. s 1 below provides preliminary results of the f_{NRB} values at the country level for 43 countries in Sub-Saharan Africa.

Table 2. f_{NRB} values at the country level for the period 2020-2030

ID	County	Subregion	NRB (2020 - 2030)	Harvest (2020 - 2030)	f_{NRB} (2020 - 2030)
1	Sao Tome and Principe	Middle Africa	0	26	1
2	Mauritius	Eastern Africa	1	20	6
3	South Africa	Southern Africa	1,939	24,662	8
4	Botswana	Southern Africa	198	2,316	9
5	Namibia	Southern Africa	287	2,799	10
6	Swaziland	Southern Africa	227	1,617	14
7	Comoros	Eastern Africa	30	183	16

ID	County	Subregion	NRB (2020 - 2030)	Harvest (2020 - 2030)	f_{NRB} (2020 - 2030)
8	Zimbabwe	Eastern Africa	10,261	55,465	18
9	Cote d'Ivoire	Western Africa	25,029	130,474	19
10	Chad	Middle Africa	14,101	74,540	19
11	Ghana	Western Africa	32,966	161,532	20
12	Madagascar	Eastern Africa	38,213	174,794	22
13	Liberia	Western Africa	9,612	42,372	23
14	Togo	Western Africa	9,559	40,834	23
15	Angola	Middle Africa	33,702	131,867	26
16	Burkina Faso	Western Africa	31,502	116,872	27
17	Republic of the Congo	Middle Africa	12,392	46,613	27
18	Eritrea	Eastern Africa	5,280	17,711	30
19	Sierra Leone	Western Africa	19,628	65,899	30
20	Gambia	Western Africa	2,523	7,811	32
21	Democratic Republic of the Congo	Middle Africa	223,304	694,673	32
22	Zambia	Eastern Africa	37,083	113,828	33
23	Mozambique	Eastern Africa	54,973	163,634	34
24	Benin	Western Africa	26,208	75,389	35
25	Cameroon	Middle Africa	36,066	100,829	36
26	Ethiopia	Eastern Africa	193,578	537,661	36
27	Mali	Western Africa	65,630	184,740	36
28	Central African Republic	Middle Africa	11,278	29,685	38
29	Uganda	Eastern Africa	108,732	288,867	38
30	Nigeria	Western Africa	267,522	678,337	39
31	Mauritania	Western Africa	8,778	21,918	40

ID	County	Subregion	NRB (2020 - 2030)	Harvest (2020 - 2030)	f_{NRB} (2020 - 2030)
32	Guinea-Bissau	Western Africa	5,942	14,138	42
33	Guinea	Western Africa	67,842	161,787	42
34	Gabon	Middle Africa	1,047	2,418	43
35	Kenya	Eastern Africa	151,363	333,772	45
36	Senegal	Western Africa	35,611	79,600	45
37	Malawi	Eastern Africa	36,703	77,770	47
38	Tanzania	Eastern Africa	140,579	299,239	47
39	Equatorial Guinea	Middle Africa	1,309	2,404	54
40	Rwanda	Eastern Africa	33,856	57,078	59
41	Burundi	Eastern Africa	36,862	61,111	60
42	Djibouti	Eastern Africa	871	1,420	61
43	Niger	Western Africa	52,821	85,663	62

2. Subnational level (the first administrative level)

Tables 2 and 3 below provide preliminary results of the f_{NRB} values at the subnational level for the Republic of Congo and Mauritania respectively, both of which show high variability.

Table 3. f_{NRB} values at the subnational level in the Republic of the Congo

First administrative level	NRB (kt) (2020 - 2030)	Harvest (kt) (2020 - 2030)	f_{NRB} (2020 - 2030)
Bouenza	458	4447	7
Brazzaville	1	40	2
Cuvette-Ouest	270	1027	21
Cuvette	1176	3742	26
Kouilou	1647	3671	38
Lekoumou	2621	5275	42
Likouala	1064	2013	45
Niari	1854	5737	27
Plateaux	1199	7779	12
Pointe Noire	0	9	0

First administrative level	NRB (kt) (2020 - 2030)	Harvest (kt) (2020 - 2030)	f_{NRB} (2020 - 2030)
Pool	1814	12288	11
Sangha	287	583	41
National Total	12392	46613	27

Table 4. f_{NRB} values at the subnational level in Mauritania

First administrative level	NRB (kt) (2020 - 2030)	Harvest (kt) (2020 - 2030)	f_{NRB} (2020 - 2030)
Adrar	0	115	0
Assaba	245	2498	12
Brakna	1542	2969	41
Dakhlet Nouadhibou	0	8	0
Gorgol	1617	2822	50
Guidimaka	979	2215	43
Hodh ech Chargui	748	3269	20
Hodh el Gharbi	451	2743	14
Inchiri	0	42	0
Nouakchott	0	33	0
Tagant	4	193	2
Tiris Zemmour	0	44	0
Trarza	3192	4968	54
National Total	8778	21918	40

Appendix 2. Values for fraction of non-renewable biomass-Regional (continental) and National values

Table 1. Regional (continental) f_{NRB} values

Region	f_{NRB} (%)
1. Asia	17
2. Latin America	33
3. Sub-Saharan Africa	39

Table 2. National[1] f_{NRB} values[2]

Country	f_{NRB} (%)
Afghanistan	10
Angola	27
Armenia	1
Azerbaijan	1
Bangladesh	39
Benin	34
Bhutan	30
Plurinational State of Bolivia	14
Botswana	35
Brazil	13
Burkina Faso	36
Burundi	35
Côte d'Ivoire	19
Cambodia	20
Cameroon	38
Central African Republic	42
Chad	37
China	10
Colombia	7
Costa Rica	10
Democratic Republic of the Congo	42
Djibouti	1
Dominican Republic	43
Ecuador	28
Equatorial Guinea	31
Eritrea	30
Eswatini	16
Ethiopia	33

[1] Where national values are not available for a particular country, project participants may refer to the relevant regional values in Table 2.

[2] Source: MoFuSS global simulations 1km 2010-2050 File: 2020-2030 values summary_adm0_fr.csv.

Country	f_{NRB} (%)
Gabon	18
Gambia	55
Georgia	1
Ghana	35
Guatemala	41
Guinea	37
Guinea-Bissau	34
Guyana	0
Haiti	59
Honduras	33
India	7
Indonesia	9
Islamic Republic of Iran	5
Iraq	1
Jamaica	38
Jordan	1
Kazakhstan	7
Kenya	29
Kyrgyzstan	25
Lao People's Democratic Republic	47
Liberia	40
Mexico	30
Madagascar	36
Malawi	48
Malaysia	39
Mali	45
Mauritania	65
Mongolia	12
Mozambique	38
Myanmar	36
Namibia	28
Nepal	45
Nicaragua	26
Niger	61
Nigeria	38
Pakistan	8
Panama	21
Papua New Guinea	8
Peru	4
Philippines	55
Republic of the Congo	16
Rwanda	33
Senegal	61
Sierra Leone	41

Country	f_{NRB} (%)
Somalia	64
South Africa	18
South Sudan	35
Sri Lanka	45
Sudan	50
Syrian Arab Republic	3
Tajikistan	19
United Republic of Tanzania	51
Thailand	20
Timor-Leste	39
Togo	46
Türkiye	13
Turkmenistan	0
Uganda	39
Uzbekistan	15
Viet Nam	36
Zambia	40
Zimbabwe	21

Appendix 1.~~3.~~ Report from external experts, June 2024

1. The external experts' report "Default values for fraction of non-renewable biomass (f_{NRB})" is available at https://cdm.unfccc.int/public_inputs/2024/202406/index.html.

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Document information

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