XV WORLD FORESTRY CONGRESS
Building a Green, Healthy and Resilient Future with Forests
2–6 May 2022 | Coex, Seoul, Republic of Korea

Lessons learned from national socioeconomic surveys in forestry

Christine Holding[a], Rebecca Tavani[b], Carlos Barahona-Zamora[c], Chado Tshering[d], Thais Linhares-Juvenal[e]

[a] *International Socioeconomic Consultant, Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy - chrisholding8@gmail.com*
[b] *Forestry Division, Food and Agriculture Organization of the United Nations (FAO)*
[c] *Statistics for Sustainable Development, Reading, England, United Kingdom*
[d] *Office for Small Island Developing States (SIDS), Least Developed Countries (LDCs) and Landlocked Developing Countries (LLDCs), Food and Agriculture Organization of the United Nations (FAO)*
[e] *Forestry Division, Food and Agriculture Organization of the United Nations (FAO)*

Abstract

Advancing conservation, restoration and sustainable management of forests is key to making progress towards the achievement of the Sustainable Development Goals (SDGs). In addition to monitoring biophysical conditions, mapping and measuring socioeconomic benefits from forests is critical to support policy-making that promotes improved targeting of SDG-oriented policies and to demonstrate contributions of forests to livelihoods. Obtaining socioeconomic information in forestry is essential to having a better understanding of the drivers of forest change and the extent to which individuals and communities rely upon forests and trees for meeting various needs ranging from livelihoods to well-being.

A review of lessons learned from FAO's involvement in forest-related socioeconomic data collection is presented, applying key steps of socioeconomic survey development and design, adapted from Neumann (2014), drawing on comparative experiences from eight countries. Key lessons are presented and recommendations made for future improvements to designing and implementing socioeconomic surveys as well as utilizing socioeconomic information in support of evidence-based policymaking. The review highlights that socioeconomic data collection as part of national forest inventory (NFI) efforts requires a clear focus on the objectives and purposes for collecting the data. Furthermore, it points to the importance of the choice of sampling frames and their effect on inferences about characteristics of forests and inferences about socioeconomic characteristics of the human population. Different institutional collaboration and data collection procedures have been piloted and developed, with varying success, to meet these challenges.

Keywords: Socioeconomic surveys; forestry data; socioeconomic monitoring, national forest inventories; sampling frames

Introduction, scope and main objectives

The value of collecting data on the contribution of forests and trees to livelihoods and food security has been increasingly recognized (Angelson and Wunder, 2003; Wunder, 2013), driven by an awareness of the continued underestimation of the global economic value of Non Wood Forest Products (NWFP) (FAO, 2015; FAO, 2020a; Sheppard *et al*, 2020) and the combined impact of both the Covid-19 pandemic (Brancalion *et al*, 2020) and the climate crisis on global food insecurity (FAO, 2018a).

Launched in 2000, FAO's National Forest Monitoring and Assessment Programme (NFMA) included mostly qualitative socioeconomic data on forest use and access in 17 countries, using focus group discussions attached to its biophysical inventory (FAO, 2012a). A subsequent household survey module attached to the biophysical

area-based NFI survey was later included in the field manual and applied in four countries. Figure 1 illustrates the nexus between socioeconomic and biophysical components in the context of NFIs.

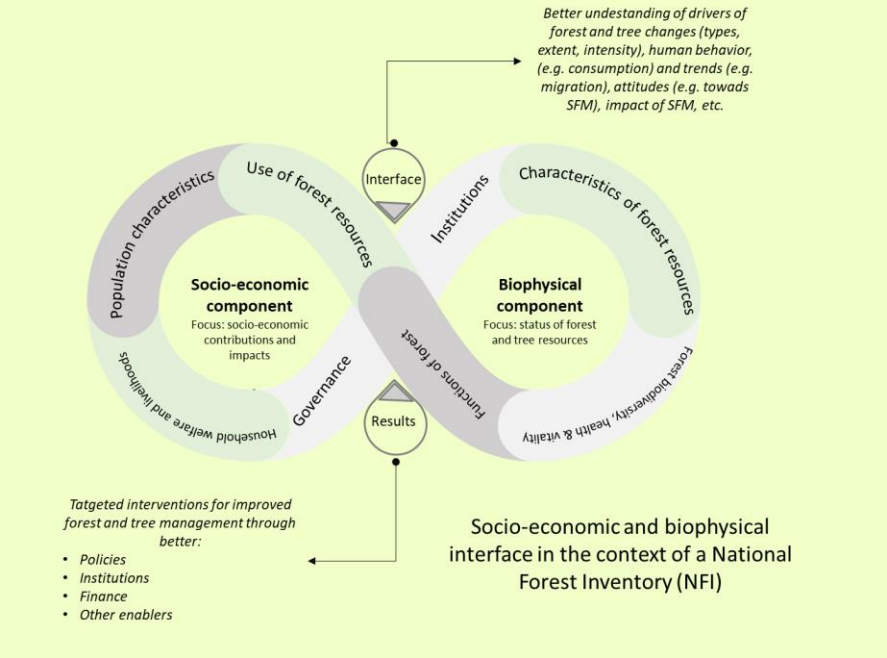

Fig. 1: socioeconomic and biophysical interface in the context of a National Forest Inventory (NFI)

This approach further evolved with the advent of the "FAO-Finland (FAO-FIN) Sustainable Management under a Changing Climate" Program in 2007-2017. Under the FAO-FIN program, national level household surveys to collect socioeconomic data were initiated in five countries (Tanzania, Peru, Ecuador, Zambia and Vietnam) as part of the National Forest Monitoring Systems (NFMS) process. Household surveys were adapted to country-specific data needs identified in the information needs assessment process and constituted a country-specific socioeconomic survey methodology. Various institutional collaboration models and survey designs were developed to better capture socioeconomic data pertaining to forests at national (and in some cases sub-national) level. These experiences led to technical and institutional learning on how to better acquire socioeconomic household data at national level in the overall framework of forest inventories. In 2016 FAO, World Bank (LSMS and PROFOR), CIFOR and IFRI published "National socioeconomic surveys in forestry" FAO Forestry Paper 179 (known as the "Forestry Modules"), targeted primarily at national statistical offices (NSOs). The Forestry Modules aimed to facilitate the production of internationally comparable data on contributions of forests to livelihoods and wellbeing (e.g Global Forest Resource Assessment (FRA) and the Global Forest Goals (GFG)). They provide a standardised survey protocol which countries can adapt to their needs (FAO *et al*, 2016). They have been implemented by the World Bank in Turkey, Armenia, Georgia, São Tomé and Príncipe and Liberia, and FAO has supported their adaptation in the Bangladesh Forest Inventory (FAO/USAID/ Government of Bangladesh).

Methodology/approach

The countries included in this review were those that had conducted or piloted national socioeconomic surveys in tandem with national forest inventories (NFIs). The following eight countries were selected in the review: Bangladesh, Brazil, Ecuador, Liberia, Peru, Tanzania, Vietnam and Zambia.

Country, year and scale	Sampling frame		Allows for unbiased national level inferences of socioeconomic characteristics?	Number of households interviewed
	Forest assessment	Socioeconomic characteristics		
Bangladesh 2016 -2019, National	Area based	Standard census enumeration areas combined with tree cover areas selected for biophysical assessment	Yes	6,135 households
Brazil 2012 -2019, National*	Area based	People living in the selected areas for biophysical assessment	No	Selected Parana State: 1,836 households. Indigenous territory: 78 households
Ecuador 2012 -2014, Provincial	Area based	Standard census enumeration areas	Yes	673 households
Liberia 2018 -2020, National	Area based	Standard census enumeration areas	Some biases remain	3,000 households
Peru 2014 -2019, Pilot	Area based	People living in the selected areas for biophysical assessment	No	14 villages selected across the four ecozones of Peru. 10 households per village, total 140 interviews
Tanzania 2010 – 2015, National	Area based	People living in the selected areas for biophysical assessment	No	3,348 households and 1,118 key informants
Vietnam 2013 -2015, Provincial	Area based	People living in the selected areas for biophysical assessment	No	276 households in Bac Giang province
Zambia 2011-2016, National	Area based	Standard census enumeration areas	Yes	5,040 households and 252 key informants

* National-level NFI carried out, but for the sake of the study, one state was included in this review.

Table 1. Sampling frames and national level inferences for Socioeconomic characteristics by country

We contrasted experiences from eight countries applying some of the core phases of socioeconomic survey development and design as our framework (adapted from Neumann 2014): 1) decision to develop a socioeconomic component 2) information needs assessment and multi-stakeholder consultation 3) sampling design 4) design of the questionnaire 5) data collection and 6) reporting and dissemination.

Results

The ***rationale of*** the different countries in developing a socioeconomic monitoring (SEM) module associated with a biophysical forest inventory was found to be driven by the following needs:

- To produce socioeconomic statistics (e.g. forest products and services and drivers of forest cover changes) that allow for contextual analysis of the forest sector;

- To fill identified national and/or international data gaps on contributions of forests and trees to livelihoods (contributions to income, food security and nutrition, energy, shelter, health and access to and governance of forest and tree resources);
- To respond to REDD + information needs on drivers of forest deforestation and safeguards.

Collaboration with other partners on socioeconomic data collection and analysis was determined by data needs, available expertise, local arrangements and budgets. In some cases (e.g. Tanzania) the Forest Department was wholly responsible for the design and implementation of the socioeconomic component of the National Forest Resources Monitoring and Assessment (NAFORMA). In other cases, Forest Departments outsourced the sampling design and data collection to other institutions specialised in collecting socioeconomic data, as in the case of Zambia's Forest Livelihoods and Economic Survey (FLES), which engaged the Central Statistics Office and used the country's census enumeration areas as the sampling frame. Bangladesh pursued a multi-stakeholder strategy in its survey implementation. An expert working group was created to capitalise on in-country competencies (from government, NGOs and universities: Bangladesh Forest Department, Bangladesh Bureau of Statistics, Arannayk Foundation, University of Dhaka and University of Chittagong, among others) and oversaw each stage of the survey. An NGO (Natural Resource Studies) provided recruitment, and training of enumerators for data collection. It was found that recourse to in-country competencies on each aspect of socioeconomic survey design and implementation yielded a more rigorous process.

The ***information needs assessment*** involved comparing supply (available data) and demand (key SEM variables identified through document analysis and stakeholder consultation). There was a tendency to identify a surfeit of data needs from consultations with leading NFI stakeholders, leading to excessively long lists of indicators and variables. To streamline the variables selection process, an additional step is needed to determine what will be reported and how, to ensure that only data that can be feasibly reported are included in the survey questionnaire. Peru and Bangladesh provide examples of good practice. In Peru (FAO, 2012b), the information needs assessment exercise produced a matrix of an initial set of variables, which was used to produce a household and key informant survey with precise subcomponents. In Bangladesh 70% of variables identified during consultations were included in the survey questionnaire, and 68% of indicators proposed were finally reported (FAO, 2020c).

Regarding the choice of sampling design, the integration of forestry biophysical assessments and socioeconomic surveys brings together two sets of objectives requiring compromises in sampling design to enable inferences at the national level. Estimation of forest status and indicators of management and supply of forestry products and services are often the priority for NFIs. These are better served by area-based sampling designs focusing on forest-covered areas, with the consequence that socioeconomic indicators are obtained from populations in or near the sampled forest areas. In contrast, studies aimed at estimating use of and demand for forest products and services nationally, require sampling designs that reach human populations, regardless of whether they are near or far from forests. While studies with either of these as the primary objective can yield indicators associated with the other type, their suitability for national level inferences is contingent on the choice of sampling frame. Estimates related to the secondary objectives usually require caveats because they are less efficient or may be biased.

Among the cases used a sampling frame focused on forested, areas and therefore prioritised estimation of forest biophysical indicators by creating an area-based sampling frames,- either based on a national grid coverage or on remote sensing derived biomass density,-that cover forests in the country, national-level inferences of socioeconomic estimates require qualification. The incomplete coverage of the national population by the sampling frame means that any socioeconomic indicators suffer from the exclusion of large proportions of the people in the country who do not live in within the sampling frame and of non-household enterprises that provide and utilize those products or services. However, the use of area-based sampling frames defined by forest areas is optimal for the estimation of forest biophysical characteristics at national level and the stewardship of the forest by the population living near the forests.

Liberia's National Household Forest Survey (NHFS) used a sampling approach based on standard census enumeration areas (EAs) but restricted the inclusion of EAs only to EAs located near forests. While this solves some of the coverage biases of countries like Tanzania, the exclusion of heavily populated EA like the capital city means that national-level socioeconomic estimates remain biased. In contrast, Zambia's FLES included all standard EAs, laying the groundwork for producing unbiased socioeconomic estimates by decoupling socioeconomic surveys from the biophysical assessment of forests. Bangladesh created a sampling frame with national coverage stratified by forest and human population criteria. This decision offers the potential to make national inferences for biophysical and socioeconomic indicators from a single sampling design. However, this sophisticated approach may reduce the efficiency in the estimation of both types of indicator.

Both sampling and ***questionnaire design*** are ultimately determined by inventory objectives and much depends on the type of data sought (e.g. contextual information on forest change and/or contributions of forests to human livelihoods and well-being).

Comparisons were made of countries in gathering data on the most common indicators in the surveys: proportion of livelihoods from forests; household food security and risk; source of energy; forests and health; forest resource base; forest clearance and tree planting; most important forest products; commercial and subsistence use; harvesting, processing and marketing; environmental services; forest governance; and perceptions of climate change. The collection of livelihoods and income data is sensitive and needs to be attuned to cultural norms of income disclosure. The collection of quantifiable and reliable data is encouraged to better provide data for evidence-based national policy making and international reporting. In some countries however, due to cultural norms this was challenging, such as Zambia and Brazil, where proxies or questions on livelihood proportions, were used in the formulation of these questions. Liberia and Bangladesh, using the Forestry Modules were able to collect quantitative data on income derived from forests. Liberia even reported income from forests as a percentage of total household income.

An element missing from earlier national surveys assessed was the conversion and standardisation of local measures and units to metric measures to enable the collection of quantifiable data on income and forest product volumes and values. Producing standard metric measurements for each NTFP, as well as fuelwood and charcoal for energy use is necessary, as local units of measurement are difficult to collate and vary in country between agro-ecological zones and ethnic groups. Ideally, a separate survey tool, as presented in the Forestry Modules, administered with key informants or in focus group discussions is used to gather this information to standardize and interpret local units. Standard metric measures will also enable greater synergies with the biophysical data results on deforestation and forest degradation.

Most of the surveys tackled different aspects of food security. Some addressed the overall context of access to food, while some, including the Forestry Modules, sought only to identify and quantify wild food sources. In the former case, Ecuador's survey also identified source of food and difficulties in accessing food (high prices, distance, lack of local markets, poor state of roads, or price speculation) (FAO & MAE, 2014). In Vietnam the section on household food security was dropped after pre-testing as it was deemed too sensitive to implement.

The role of gender in access and decision-making pertaining to forest resources is well established (Quisumbing, 2003; World Bank, FAO and IFAD, 2009; Coleman and Mwangi, 2013; Sunderland *et al*, 2014). All surveys reviewed sought to disaggregate information by gender, using a variety of methodologies. In Liberia, in particular, the survey team developed an additional module on gender-related aspects of forestry enterprises and female participation in local decision-making on forest use.

Community and focus group discussions questionnaires were used mainly for topics where there is little variability between households e.g. forest governance, enforcement and penalties, forest institutions, participation in forestry management programmes, climate change and metric standardisation of measures. Focus group discussions often serve as a means of introduction to the entry to the community, as well as enriching of the household data set contextually. Pre-tested and closed community questionnaires were easier to analyse than those with open questions, and in the case of Liberia this yielded tangible results on participation, support and gender.

There is considerable scope for error in ***data entry*** and verification when using paper questionnaires. Computer assisted personal interviewing (CAPI) using tablets offers advantages as it enables data to be saved instantly in a database, precluding the data entry step (where errors can occur), and with internet access giving the possibility of real-time data verification.

Brazil, Bangladesh, and Liberia used multi-faceted results ***dissemination*** strategies with interactive, attractive and accessible web-based tools as well as press releases, policy notes, national launch seminars, national TV coverage, workshops, videos and leaflets.

With regards to the influencing of policy, Tanzania's NAFORMA results were a crucial element in informing the drafting of the new forest policy in 2018, with particular reference to the implementation of Participatory Forest Management (F. Kafeero, personal communication, 2019). In Liberia data were translated into policy recommendations that were included in the final results report. The presence of programming expertise beyond the traditional remit of NSOs in the working group enabled this step to be taken, providing the link between evidence and policy and programming for forests and livelihoods.

Going one step further from the dissemination of aggregated results is the dissemination of the raw data between Ministries, potentially maximizing impact and use of the socioeconomic data. In Tanzania, data-sharing was built into the project agreement with an agreed-upon set of data sharing guidelines and communication strategy. These types of pre-arrangements reduce the likelihood of eventual inter-ministerial and stakeholder conflict on ownership of and access to data. Bangladesh's survey even made the aggregate data publicly available on the central Bangladesh Forest Information System (BFIS) portal.

Discussion

Experiences documented across the surveys can better facilitate the planning and implementation of future national forest socioeconomic surveys. Some key lessons learnt are as follows:

- The decision to develop a socioeconomic monitoring (SEM) component in forestry should be based on a clear set of policy-driven national objectives developed with key stakeholders (i.e. NSS, NSOs, FDs, academia, NGOs, etc) capitalizing on national competencies. Involving multiple stakeholders in the entire SEM cycle is essential for targeting prioritized data need, the rigour of the survey design, as well as for fully leveraging socioeconomic survey results and for institutional sustainability.
- Information needs assessments should be prioritized to ensure results are oriented towards strategic information needs of governments and other stakeholders, and international reporting requirements, while focusing on essential information.
- Specific involvement of national bureaus of statistics in SEM design and implementation is essential to ensure a sound methodological approach and integration with other national statistical operations/processes such as agricultural and population censuses, household surveys, and national accounts.
- Given the resources invested in national socioeconomic surveys and the need for quantitative data for national accounts, SDGs, Global Forest Goals and FRA, it is recommended to seek to obtain quantifiable data on income, livelihood alternatives, volumes and values of forest products, and woodfuel for energy use. The development of the Forestry Modules and their adaptation in Bangladesh have demonstrated this is possible at the national scale, along with contributions to international reporting requirements. Well-calibrated and executed socioeconomic surveys in NFI that produce quantitative data can lead to more meaningful contribution to national accounts, FRA, the Global Forest Goals process and the SDGs.
- Survey design evolved from those serving the forest assessment objectives and design criteria of forest departments, to population-based objectives and sampling designs better serving the estimation of

national level socioeconomic characteristics. This represents an enhancement in the perceived value of forestry socioeconomic data production and its relevance in the National Statistical System, and places this type of socioeconomic data more squarely in the national reporting and policy making domain. However, only a handful of countries have implemented NSS-compatible socioeconomic surveys on forestry to date.

- Achieving a sampling design that is optimal for the estimation of biophysical and socioeconomic indicators relating to forests at national level - that provide information about both the supply and the demand of forest products and services - is a tall order. In general, it is the study objectives and priorities that will guide the choice of sampling frame and the sampling design, which in turn will determine the scope and potential bias of the estimates generated.
- Field validation steps are essential to the eventual quality of the data. Field testing, manual preparation and enumerator training are all essential.
- Additional training in optimising methodologies for collecting, analysing and utilising data relating to gender is required by forest departments and partners. Efforts should also be made to improve parity of gender representation in all aspects of survey management and implementation.
- Reporting data on its own is not sufficient to catalyse changes to forest policy. As in the case of Liberia, the multi-stakeholder working group overseeing the implementation of the socioeconomic survey could usefully consider developing strategic programming recommendations based on the survey outcomes.
- Given the documented evidence (World Bank, 2020) of the reliance on medicinal plants by rural communities in developing countries, a separate section in the survey on forests and health should be added as these can often be buried within other product categories.
- Countries should plan and budget for a dissemination strategy and community feedback mechanisms if the results of the socioeconomic survey are to meet policy objectives.
- Countries should consider planning for open access data, data ownership and data sharing protocols with relevant Ministries and stakeholders from the outset of the survey commission.

Conclusions/wider implications of findings

When collecting socioeconomic data on forests and their use, establishing clear policy-driven objectives is essential to guiding the choice of sampling frame and the sampling design, which in turn will determine the scope and potential bias of the estimates generated. The choice of sampling frame when collecting socioeconomic data is determinative as it has a direct effect on inferences made on both forests and the socioeconomic characteristics of the human population. Designing sampling frames based on population census information in addition to obtaining more quantitative data from socioeconomic surveys are both essential to producing more robust, nationally representative data that can better contribute to FRA reporting, and measure progress towards GFGs and SDGs.

Acknowledgements

The authors would like to thank the NFI managers and lead socio-economists in each country included in the review, for their significant contribution to the contents of this paper. The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

References

Angelsen, A. & Wunder, S. 2003. Exploring the forest–poverty link: key concepts, issues and research implications. Bogor, Indonesia, Center for International Forestry Research (CIFOR).

Bangladesh Forest Department. 2020. The Bangladesh Forest Inventory Portal [online]. Bangladesh. [cited May 6, 2021]. http://bfis.bforest.gov.bd/bfi/

Brancalion, P.H.S., Broadbent, E.N., de-Miguel, S., Cardil, A., Rosa, M.R., Almeida, C.T., Almeida, D.R.A., Chakravarty, S., Zhou, M., Gamarra, J.G.P., Liang, J., Crouzeilles, R., Herault, B., Aragao, L.E.O.C., Silva, C.A., and Almeyda- Zambrano, A.M. 2020. Emerging threats linking tropical deforestation and the COVID-19 pandemic. *Perspective Ecological Conservation,* 18(4): 243-246.

Coleman, E. & Mwangi, E. 2013. Women's participation in forest management: a cross country analysis. *Global Environmental Change*, 23(1): 193-205.

FAO. 2008. Climate Change and Food Security: A Framework Document. Rome. 110 pp. (also available at http://www.fao.org/3/k2595e/k2595e00.pdf).

FAO. 2012a. National Forest Monitoring and Assessment – Manual for integrated field data collection. Version 3.0. National Forest Monitoring and Assessment Working Paper NFMA 37/E. Rome. (also available at http://www.fao.org/3/ap152e/ap152e.pdf).

FAO. 2012b. Identificación y priorización de información para el monitoreo socio-económico y gobernanza forestall. Memoria del taller para el proyecto "Inventario Nacional Forestal y Manejo Forestal Sostenible del Perú ante el Cambio Climático". FAO internal report. November 2012.

FAO. 2014a. State of the World's Forests. Enhancing the socioeconomic benefits from forests. Rome. (also available at http://www.fao.org/3/i3710e/i3710e.pdf).

FAO. 2014b. COFO/2014/4.3: Income, Employment and Livelihoods from Forests. Rome. (also available at http://www.fao.org/3/mk155e/mk155e.pdf).

FAO 2015. Global Forest Resources Assessment 2015: Desk Reference. Rome. (also available at http://www.fao.org/3/i4808e/i4808e.pdf).

FAO & Ministerio del Ambiente Ecuador. 2014. Evaluation Nacional Forestal Resultados. Informe del proyecto "Manejo Forestal Sostenible ante el Cambio Climático (MFSCC)". FAO internal report. December 2014.

FAO, CIFOR, IFRI and World Bank. 2016. *National socioeconomic surveys in forestry: guidance and survey modules for measuring the multiple roles of forests in household welfare and livelihoods*, by R.K. Bakkegaard, A. Agrawal, I. Animon, N. Hogarth, D. Miller, L. Persha, E. Rametsteiner, S. Wunder and A. Zezza. FAO Forestry Paper No. 179. Food and Agriculture Organization of the United Nations, Center for International Forestry Research, International Forestry Resources and Institutions Research Network, and World Bank. (also available at http://www.fao.org/3/i6206e/I6206E.pdf).

FAO. 2016. Forest-related indicators, monitoring and reporting progress related to the achievements of the sustainable development goals. Rome. (also available at http://www.fao.org/3/mq753e/mq753e.pdf).

FAO. 2017. Voluntary guidelines on national forest monitoring. Rome. (also available at http://www.fao.org/3/i6767e/i6767e.pdf).

FAO. 2018. The State of the World's Forests 2018 - Forest pathways to sustainable development. Rome. (also available at http://www.fao.org/3/i9535en/i9535en.pdf).

FAO. 2018. Guidelines for the incorporation of a woodfuel supplementary module into existing household surveys in developing countries. Rome. (also available at http://www.fao.org/3/ca6402en/ca6402en.pdf).

FAO. 2020a. Global Forest Resources Assessment 2020: Main report. Rome. (also available at https://doi.org/10.4060/ca9825en).

FAO and UNEP. 2020b. The State of the World's Forests 2020. Forests, biodiversity and people. Rome. (also available at https://doi.org/10.4060/ca8642en).

FAO 2020c. An assessment of the Socioeconomic Survey of Bangladesh Forest Inventory 2015-2019. FAO internal document. Rome.

Neumann, W.L. 2014. *Social Research Methods: Qualitative and Quantitative Approaches.* 7th ed. New York, Pearson Education Inc.

Quisumbing A.R. 2003. *Household Decisions, Gender and Development: A synthesis of recent research*. IFPRI.

Servico Florestal Brasileiro. 2020. IFN-Resultados [online]. Brazil. [Cited March 16, 2021]. https://www.florestal.gov.br/resultados

Sheppard, J. P., Chamberlain, J., Agúndez, D., Bhattacharya, P., Chirwa, P.W., Gontcharov, A., Sagona, W.C.J., Shen, H.L., Tadesse, W., & Mutke, S. 2020. Sustainable Forest Management Beyond the TimberTimer-Oriented Status Quo: Transitioning to Co-production of Timber and Non-wood Forest Products—a Global Perspective. *Current Forestry Reports,* 6, 26-40.

Sunderland, T., Achdiawan, R., Angelsen, A., Babigumira, R., Ickowitz, A., Paumgarten, F., Reyes-García, V. & Shively, G. 2014. Challenging perceptions about men, women, and forest product use: a global comparative study. *World Development*, 64(1): S56-S66.

World Bank, FAO & IFAD. 2009. Module 15: Gender and Forestry. In *Gender and Agriculture Sourcebook*. pp. 643-676. (also available at http://www.fao.org/3/aj288e/aj288e.pdf)

World Bank. 2020. People and Forest Interface: Contribution of Liberia's Forests to Household Incomes, Subsistence, and Resilience. World Bank, Washington, DC. http://hdl.handle.net/10986/34438

World Bank. 2020. Story map [online]. Washington DC. [cited April 13, 2021] https://geowb.maps.arcgis.com/apps/MapJournal/index.html?appid=2872d917454d4bec8c0fa74cba09a309

Wunder, S., Angelsen, A., Belcher, B. 2013. Forests, Livelihoods and Conservation: Broadening the Empirical Base. *World Development,* 64(1): S1-S11.