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Indicators to assess the contributions of forests, trees, and agroforestry to food security and nutrition at national level

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Abstract

Forest, trees and agroforestry provide multiple contributions to Food Security and Nutrition (FSN), as shown by the GFEP report (2015) and the High-Level Panel of Experts on food security and nutrition report (HLPE 2017). However, there is currently no quantitative indicator to assess these contributions at national level. Here we propose options to fill this gap using four main themes to describe the contributions of forests, trees and agroforestry to food security and nutrition:

- direct provision of food and feed;
- provision of wood energy used for cooking food and boiling of water in developing countries which is critical for assimilation of nutrients and reduction of risks of diarrhea;
- formal and informal employment, sources of income through sales of wood and non-wood forest products (NWFP) from forests, trees and agroforestry;
- provision of ecosystem services that sustain food production through water and climate regulation; soil formation and protection, nutrient cycling, pest control and pollination.

Some of these contributions, while well-known and described at local levels, like the contribution to livelihoods and to diets, are not included in national statistics. For others, particularly the contribution of ecosystem services to agricultural production, there are multiple dimensions which are difficult to measure even at a local scale. We will propose a set of indicators to track all of these contributions, using existing data that are available for all countries, such as fruit and nut consumption, woodfuel consumption, employment in forestry, and broader contribution of forests and trees to farming households through products, income and other benefits (e.g. ecosystem services, cultural value). We also suggest some ideas for how better more targeted data could be collected in the future. These proposals were discussed during the Expert Workshop in October 2019 in support of the CPF Joint Initiative on streamlining forest related reporting.

Keywords: Food systems, Knowledge Management, Monitoring and data collection

Introduction, scope and main objectives

The Collaborative Partnership on Forests¹ (CPF) initiated in 2016 a joint work to develop a concise Global Core Set (GCS) of 21 forest-related indicators (CPF 2019a) to measure the contribution of sustainable forest management to the 2030 Agenda for Sustainable Development (UN 2015), the United Nations Strategic Plan for Forests 2030 (UNDESA 2019) and other international agreements (UNFFF 2018). One of these indicators, indicator 14, will assess the “contributions of forests and trees to food security and nutrition (FSN)”. It is still classified tiers 3, meaning that there is no method nor data to calculate it. The purpose of this paper is to propose an approach to fill this gap and design a method to calculate indicator 14.

“Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO 1996; CFS 2009).² This definition considerably enlarges the perspectives, from a focus on agricultural production to much broader economic, social and environmental topics (Gitz and Meybeck 2011). The World Summit on Food Security (WSFS 2009) stated that the “four pillars of food security are availability, access, utilization, and stability”. Availability refers to the supply of food through production, distribution and exchange. Access covers physical and economical accessibility, referring thus to the affordability, means to buy it and consequent allocation of food. Utilization refers to the metabolism of food by individuals and what contributes to it (including for instance wood to cook it). Stability refers to the constancy and resilience of the three previous pillars over time.

The CPF convened a Global Forest Expert Panel (GFEP) in November 2013 and produced a report on the role of forests for FSN (Vira *et al.* 2015), which was released at the United Nations Forum on Forests (UNFF) in May 2015. In October 2014, the Committee on World Food Security (CFS) requested the High-Level Panel of Experts on food security and nutrition to prepare a study on “Sustainable forestry for FSN” (HLPE 2017) to inform its debates at the 44th CFS Plenary Session of October 2017. These two major reports have played a considerable role in clarifying the multiple contributions of forests, trees and agroforestry to FSN and in raising awareness on their importance in both the forestry and food security communities.

The HLPE (2017) suggested to group these multiple contributions under four main categories:

- direct provision of food - such as nuts, oils, vegetables (leaves, flowers, roots), fruits, bushmeat, herbs, saps, mushrooms, tubers, and insects -, and of feed for livestock;
- provision of wood energy, particularly for cooking food and boiling water in developing countries which is critical for preparing many nutrient-rich foods (such as legumes and meats), enhancing nutrient assimilation and reducing the risks of diarrhoea;
- formal and informal employment and sources of income in the forestry sector and through sales of wood and Non-Wood Forest Products (NWFPs), with significant differences by gender and social groups;

¹ The Collaborative Partnership on Forests (CPF) is an informal, voluntary arrangement among 15 international organizations and secretariats with substantial programmes on forests.

² The definition of food security, first adopted during the World Food Summit (FAO 1996), was updated with the addition of the word “social” in the FAO State of Food Insecurity in the World (FAO 2001); this modification was integrated by the CFS in 2009.

- non-provisioning ecosystem services³ that sustain all food production and agriculture activities now and in the future.

This paper proposes options to assess these contributions at national level. It builds upon the discussion paper (CPF 2019b) prepared by the same authors for the Expert Workshop organized in October 2019 in support of the CPF Joint Initiative on streamlining forest related reporting, and the conclusions of the workshop (CPF 2019a) and discusses a way forward.

Methodology/approach

GCS indicator 14 shall cover all the multiple contributions provided by forests and trees to the four dimensions of food security (availability, access, utilization and stability). However, many of these contributions, while being well known and described at local level, such as the collection of NWFPs and their contribution to livelihoods and balanced diets (Vira *et al.* 2015; HLPE 2017; Sorrenti 2017; FAO 2020a), are not appropriately covered by national statistics. For others, particularly those regarding the contribution of ecosystem services provided by forests and trees to agricultural production, there are multiple dimensions, each of which involves complex interactions and is very research-intensive to measure, even at a local scale.

There are studies using household surveys to assess some of these contributions, particularly foods and livelihoods, like the Poverty and Environment Network (PEN)⁴. They are however local in scope, generally focusing on populations living in or close to forests. Such studies would be very expensive to generalize at national level to substantiate an indicator for all countries. There is already a considerable pressure on statistical agencies to provide data to assess progress on all indicators of the SDGs and there is a broad political consensus on the need to use as much as possible data already collected at national level rather than to invent additional data collection processes, unlikely to be implemented because of their cost. We thus looked at existing data at national level in reliable databases and how it could be used.

As these contributions, whether direct or indirect, are very different in nature and benefit different groups of forest-dependent people at different spatial and temporal scales (from local to global, from short- to long-term), it seems impossible to reflect them all in one single indicator and it may be needed to adopt a sub-indicators approach (Madrid-Arroyo 2019). The objective was to identify a set of sub-indicators, that could be calculated at national level for all countries using existing data in reliable global databases. The main data series of interest for this indicator are: (i) the FAO Global

³ The Millennium Ecosystem Assessment (MA 2005), distinguishes provisioning ecosystem services (e.g. food and feed, fibre and biomass, medicines, freshwater) from non-provisioning ecosystem services. This last category is further divided in three sub-categories: regulating services (e.g., climate and water regulation, water, air quality, erosion control, pollination), supporting services (soil formation, photosynthesis, nutrient and water cycling), and cultural services (e.g., recreation, ecotourism, cultural heritage, spiritual and ethical values, existence values).

⁴ The PEN is a collaborative effort launched in 2004 and led by the Center for International Forestry Research (CIFOR). This project generated the largest and most comprehensive pantropical database on forests and poverty, including comparable socio-economic and environmental information collected from 8,301 households, in 333 villages in 24 developing countries. See: <https://www2.cifor.org/pen/about/> [accessed 24.08.20].

Forest Resources Assessment; (ii) FAO Food Balance Sheets (FBS); (iii) ILOSTAT data on employment. Additional relevant information could be found in national agricultural censuses.

Results

In order to cover the main contributions of forests and trees to FSN have been identified the following set of sub-indicators that can be calculated using existing data:

- 14.1) Employment provided by forests and trees;
- 14.2) Consumption of woodfuel per capita;
- 14.3) Consumption of fruits (or only fruits from trees) per capita;
- 14.4) Consumption of nuts per capita.

This set of quite readily available sub-indicators could be complemented by an additional indicator to better assess the importance of ecosystem services provided by forests and trees to farming systems and livelihoods. This could be informed either by an additional question in national agricultural censuses to assess the percentage of farming households having part of their livelihood coming from forests and trees or by a “proximity indicator”.

14.1) Employment provided by forests and trees

This sub-indicator would measure the total employment provided by forests and trees, both in absolute terms (number of persons employed) and as a share of total employment (in percent) to show the relative importance of forests and trees as a source of employment and livelihoods in each country.

Initially, employment in the forest sector, based on ILOSTAT data from national labour force surveys, household surveys or censuses, could serve as a proxy for this sub-indicator. Based on the International Standard Industry Classification of All Economic Activities (ISIC: see UNDESA 2008), this sub-indicator could cover people working in: “forestry and logging” (ISIC division 02); “manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials” (ISIC division 16); and, “manufacture of paper and paper products” (ISIC division 17). At a later stage, further work could help identify other employment opportunities provided by forests and trees in sectors and activities, not covered under ISIC divisions 02, 16 and 17, but which would deserve to be included under GCS sub-indicator 14.1, including for instance: ecotourism; NWFPs; tree crops and agroforestry products, as well as the related transformation value chains.

14.2) Consumption of woodfuel per capita

This sub-indicator would measure the consumption of woodfuel per capita (in m³ per 1000 persons and per year). Woodfuel, used for cooking food and boiling water, makes an essential contribution to the utilization dimension of FSN. Around 2.4 billion people, including two-thirds of the households in Africa, use wood as their main source of energy for cooking food (FAO 2014), thus improving food safety and micronutrients’ bio-availability. 764 million people use woodfuel to boil and sterilize water (FAO 2014), contributing to improve hygiene and sanitary conditions and to reduce the incidence of diarrhoea which is a major cause of malnutrition. In 2016, unsafe drinking-water and lack of sanitation and hand hygiene caused nearly 1.2 million deaths, including almost 300 000 of

children aged under 5 years who died due to diarrhoea (WHO 2019). Woodfuel collection and use is also an important source of income and livelihoods in developing countries.

As a first step, woodfuel consumption per capita could be calculated at the national level, based on FAOSTAT data. Later on, the sub-indicator could be refined to cover only woodfuel consumption from households (residential use), and only for those households using wood as a source of energy. In parallel, efforts should be made to improve knowledge on disaggregated wood uses in households (e.g., cooking, boiling water, heating, etc.).

14.3) Consumption of fruits (or only of fruits from trees) per capita

This sub-indicator, calculated from FAOSTAT Food Balance Sheets, would measure fruit consumption per capita (in kg per capita and per year). It would illustrate the contribution of forests and trees to a balanced diet, not only for forest-dependent communities but also, through local, national and even international markets, for people living far from forests, through the provision of fruits rich in fibre and micronutrients. Even if this indicator is mainly related to nutrition, it also gives an indication on pollination. As fruit production depends on pollination, and given the importance of forests and trees as a source of food and undisturbed habitat for wild pollinators, this sub-indicator would also illustrate the critical importance for food production of the ecosystem services provided by forests and trees.

Two options have been considered during the expert workshop for this indicator:

- either, include all fruits, based on FAOSTAT standard definition, considering that the majority of fruits produced globally are harvested from trees (McMullin *et al.* 2019) and that additionally there are numerous berries that are collected from forests;
- or, use an ad-hoc definition, including only fruits harvested from trees.

14.4) Consumption of nuts per capita

This sub-indicator, calculated from FAOSTAT Food Balance Sheets, would measure nut consumption per capita (in kg per capita and per year). It would illustrate the contribution of forests and trees to a balanced diet, not only for forest-dependent communities but also, through local, national and even international markets, for people living far from forests, through the provision of nuts that are rich in healthy fats, protein, and micronutrients.

Two options have been considered during the expert workshop for this indicator: either use FAOSTAT standard definition for “nuts and products”, or create an ad-hoc list, that could include some products elsewhere classified (like karite nut, classified in oil crops) or remove other products (such as kola nuts whose nutritional value can be discussed, even if kola nuts can be an important part of diet, lifestyle and a source of income).

14.5) Percentage of farming households having part of their livelihood coming from forests and trees

This sub-indicator would measure the percentage of farming households benefitting from forests and trees. It would reflect the diverse contributions that forests and trees make to the livelihoods of farmers, as sources of food, income and all ecosystem services essential to agriculture and food production now and in the long-term. It would illustrate in particular the buffering role of forests

and trees, which may act as a safety net in period of crisis, making an important contribution to the fourth dimension of FSN (stability) (HLPE 2017).

This sub-indicator would complement sub-indicator 14.1 on employment, by covering better the range of people depending on forests and trees for their FSN and livelihood. It could also constitute a proxy of the number of farmers that depend to various degrees on the ecosystem services provided by forests and trees to agriculture production (the link between the two often being the proximity to forests and trees).

This information could be collected by adding a simple qualitative question in national agricultural censuses: “Do you draw any benefits from forests, trees and/or agroforestry? (“Yes/No” answer)”. Depending on their national and sub-national priorities, countries could decide to refine this question, with various options of closed lists of possible answers as well as, the case being, quantitative estimations, to better identify the different categories of benefits provided by forests and trees, including: products for auto-consumption; income; ecosystem services; social and cultural benefits.

Discussion

Altogether, as shown in table 1, these five sub-indicators would allow to cover the main contributions of forests and trees to the different dimensions of FSN at national level.

Table 1: Links of the proposed sub-indicators to the four dimensions of FSN

	Availability	Accessibility	Utilization	Stability
14.1) Employment provided by forests and trees		Provides income that can be used to buy food		Often a buffering function in times of needs
14.2) Woodfuel consumption		Important source of income especially for the most vulnerable	Used for cooking by 2,4 billion people and also for boiling water	Often an activity providing income in times of need
14.3) Fruit consumption	Tree provides the majority of fruits at global level		A key source of nutrients	
14.4) Nut consumption	Trees provide all nuts		Key sources of healthy fats, protein & micronutrients	
14.5) Percentage of farming households having part of their livelihood coming from forests and trees	Reflects diverse contributions of ecosystems to agricultural production (including products that are sources of important	Contribution of forests trees and agroforestry to livelihoods Source of income		An indicator of the buffering role of forests and trees.

	nutrients) and households			
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Source: CPF (2019b)

However, this set of sub-indicators still vastly understate the importance of forests for food because there are no nationally representative data on the value of wild food and of ecosystem services from forests and trees for agriculture and food production. In order to address these gaps, it was suggested during the expert workshop to explore ways to implement the following recommendations:

- Strengthen the collection of data on NWFPs in FAO Global Forest Resources Assessments;
- Address the need to better reflect the specific contributions of wild foods to FSN, including through further work on sub-indicator 14.5 and on “forest proximity”. Consider adding in national agriculture censuses additional, optional questions on wild foods, covering products of importance for balanced diets at national and sub-national levels.
- Add a few questions in agriculture censuses to try to capture farmer’s perceptions of a range of ecosystem services from forests and trees;
- Develop and test the feasibility of a sub-indicator reflecting “forest proximity” and indicate the diverse contributions that forests and trees make to farming livelihoods and/or to ecosystem services supporting food and feed production. Various options could be explored, including:
 - percentage of river length protected by riparian forest;
 - surface at pollinator distance from forests;
 - percentage of population having access (distance and use rights) to a forest for food-feed-wood collection;

It seems possible to construct a set of sub-indicators allowing to assess and monitor the different contributions of forests and trees to FSN at national level. However, such a solution is not ideal for an indicator that is to be itself part of a wider set. To be more easily taken into account, indicator 14 should be a single indicator. There could be two ways to go from sub-indicators to a single one: select one of them or construct a synthetic one. To select a single one of these sub-indicators would suppose that there is a correlation between the one selected and the others. Empirically, at local level such a correlation might be true, as most of the contributions are linked to the proximity to forests and trees. However, it remains to be shown that it is true at national level. It would also risk reducing the contributions of forests and trees to a single dimension of FSN, likely direct provision of food, hiding the other dimensions in spite of their importance. On the other hand, apart from the methodological difficulties to construct it, a synthetic indicator could better aggregate the four dimensions of FSN, could also give the possibility to better integrate ecosystem services and contributions of wild foods, but would have the classical drawback that it is less directly readable.

Conclusions/ wider implications of findings

These proposals have been endorsed by the Expert Workshop dedicated to tiers 2 and 3 indicators of the GCS. The discussion has highlighted both the critical need for sound indicators and measurement of relations between forests and food security, for instance to enable policy development, but also the challenges for this. It was decided to create a specific work stream that would finalize the first set of sub-indicators in a concrete and practical way, for quick use and to

further explore options to complement them (CPF 2019a). At its 25th session the Committee on Forestry requested FAO to “implement the recommendations of the Expert Workshop hosted by FAO on the “Global Core Set of Forest-related Indicators” with regard to further work on Tier 2 and Tier 3 indicators and steps needed to utilize the full potential of the Global Core Set of Forest-related Indicators at all levels, in collaboration with CPF members and other relevant international organizations and processes” (FAO 2020b).

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