



Why are non-wood forest products still the poor relative in Global Forest Resources Assessments?

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ABSTRACT

To conserve and use forests sustainably, it is helpful to have accurate and regular assessments of their health and status. A key tool in this regard is the regular global overview provided by the Food and Agriculture Programme (FAO) in their Global Forest Resources Assessments (GFRA), now issued every five years. As of 2000, the GFRA required member countries to report statistics related to non-wood forest products (NWFPs). However, the NWFP statistics in the country appendices to the GFRA bear little resemblance to the situation on the ground, as shown by our assessment of entries for India, Nigeria, and South Africa against verified in-country studies. Our analysis shows that GFRA often inaccurately report NWFP quantities, lack consistency between reports, omit data on amounts or values even when in-country studies exist, list the top ten NWFPs inaccurately, and fail to cite sources. Taken together, these shortcomings mean that the NWFP country statistics in the GFRA cannot be used to make comparisons between countries, regions or globally, track trends, or make policy or management decisions. The underlying reasons for these shortcomings are considered. Lastly, we suggest nine steps that need to be implemented to make the NWFP section of the GFRA reports a reliable and valued source of data and global analysis, that can be used by policy- and decision-makers and researchers globally.

1. Introduction

Globally, forests have long been regarded as key ecosystems because of their wide extent (slightly less than one-third of the earth's land area), high biodiversity, contributions to the livelihoods of billions of people and their role in global climate regulation (Brockerhoff et al., 2017; Taye et al., 2021). Because of these multiple and important roles, the status, conservation, and sustainable use of forests have been prioritised in global fora and agreements over several decades (Singh, 2013; Tegene et al., 2018; Muthee et al., 2022), which are then expected to be implemented at national and sub-national scales.

To conserve and use forests sustainably it is helpful to have accurate and regular assessments of their health and status. A key mechanism in this regard is the regular global overview provided by the Food and Agriculture Programme (FAO) in their Global Forest Resources Assessments (GFRA), now issued every five years. The first global assessment was compiled in 1948 when forest product shortages were a major concern (MacDicken, 2015), and focussed on the extent and productivity of natural and plantation forests. Information on the state of forests underpins policy responses and consequently national planning

processes and resource allocations (Braatz, 2010; MacDicken, 2015), and hence national forest inventories are no longer just about wood production (Vidal et al., 2016). However, collection of data for a global synthesis is not without challenges, including inconstancy in applications of definitions, unstandardised inventory methods and precision, and lack of human or financial resources in many countries to gather the required data (Singh, 2013; MacDicken, 2015; Vidal et al., 2016; Chen et al., 2020; Nesha et al., 2021). Thus, the GFRA has evolved with each successive reporting period to improve data accuracy and coverage, to reduce or eliminate data gaps, and to include new variables relating to forest ecosystem services, management and policies (Singh, 2013). The most recent edition (GFRA 2020) was compiled from information and data submitted by 236 reporting countries and territories for 22 pre-developed tables spanning 60 “broad categories” (FAO, 2020).

An illustration of the expanding view of forest benefits and values was the inclusion of non-wood forest products (NWFPs) in the GFRA reports from 2005 onwards. This was prompted by the clear evidence that forests provide more than just timber and ecosystem services, and that billions of people use or depend on products from forests as a major facet of their livelihoods (Fromentin et al., 2022; Shackleton and de Vos,

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2022). For example, as early as 1992, Lynch reported that there were more than 500 million “forest dependent” people globally, which was expanded by the World Bank (2004) to 1.6 billion people who “depend partly or fully on forest products to sustain their livelihoods”. This figure corresponds with Newton et al. (2020) determination of the number of people globally living within 5 km of a forest of at least 50% tree canopy cover (so excluding most dry forests). The level of dependence varies across forest types and country socio-economic contexts, but is highest for remote, forest-dwelling communities. The global comparative study of Angelsen et al. (2014) reported a mean value of 22% of cash and non-cash incomes to rural households was from forest products, ranging from 6% to 63% across study locations. This excludes their ubiquitous importance as safety-nets in times of household shocks (Wunder et al., 2014), or their roles in cultural traditions and identity (Jonson et al., 2020). The absence of NWFPs in the previous global assessments meant that a significant benefit stream from forests was not being reflected (Lovrić et al., 2020), nor addressed in forest or development policies in support of livelihoods and poverty alleviation (Shackleton and Pandey, 2014). For instance, the value of Non-timber forest products (NTFPs) in Europe is equivalent to 71% of the annual roundwood harvest (Lovrić et al., 2020). In India the value of NTFPs was estimated at almost double that derived from timber products (ITTO, 2009), whilst in Bolivia the export revenues from Brazil nuts alone is more than double that from raw and semi-processed timber (Cronkleton and Pacheco, 2010). And yet, whilst the European, Indian and Bolivian forest policies acknowledge the importance of NTFPs, they still emphasise timber products and regulating services, as do the GFRA reports. Chamberlain and Smith-Hall (2024) further emphasise the significant trade in NTFPs as the foundation for a springboard into the growing global bioeconomy.

The inclusion of statistics about NWFPs in the GFRA was therefore a landmark opportunity to (i) prompt national governments and reporting institutions to recognise the importance of NWFPs, (ii) improve the global and national policies related to NWFP access, value addition and sustainable use, and (iii) track changes in yields and values, in the same way that GFRA statistics on forest extent and productivity have been, and continue to be, used to inform policy and management responses and aspirations (e.g. Atisa, 2020; Gilani and Innes, 2020). To this end, the GFRA instructs reporting agencies to provide information on the ten “most important” NWFPs “in order of importance”. The order is to be determined by the value of the total removals, and in situations of no data on value of removals, then expert opinion can be reported. However, the latest GFRA (i.e. 2020) concludes that the information on NWFPs “is still poor”. This is partially due to inconsistency in application of definitions between reporting countries and limited standardisation of data. Despite this admission, the GFRA (2020) presents a summary analysis of the statistics provided by the reporting countries, which we argue needs to be viewed with caution in light of the problems reported, and others which we highlight in our case study countries later on. For example, GFRA (2020) summary finds that the global value of NWFPs was about US\$7.7 billion in 2015, even though many of the country reports do not provide any value estimates. Consequently, this summary value is inaccurate by several orders of magnitude (for example, the estimated value of NTFPs in India alone was reported as US\$ 27 billion in 2007 (ITTO, 2009)) and in Europe it was €23.3 billion in 2020 (Lovrić et al., 2020) and therefore of little utility for policy development. Indeed, it might even negatively affect policy development around NWFPs as some decision-makers might use the huge underestimates to make adverse decisions about NWFPs. Moreover, half of the short summary chapter on NWFPs in the GFRA (2020) dwells on roundwood and fuelwood trends, neither of which are NWFPs according to the FAO's definition.

Within the context of the above, the objective of this paper is to examine the usefulness and validity of the NWFP statistics reported in the GFRA using a case country approach and thereafter to consider how any shortcomings might be addressed. We do so by answering three research questions, namely (i) How well do the country statistics

provided in the GFRA reflect the use and value of NWFPs in the specified countries? (ii) If they are not a valid reflection, why might that be so? (iii) How can any shortcomings be addressed to strengthen the validity of the NWFP statistics?

2. Approach

To address the first question a two-stage approach was adopted using our respective home countries of South Africa, Nigeria and India as case examples. The first phase was to extract and summarise the NWFPs statistics reported in the “Country Reports” attached to each GFRA report since 2005. Summarisation took the form of tabulating the NWFPs reported on for each GFRA along with any estimates of amounts extracted. This allowed for easy comparison between consecutive GFRA reports. The second phase was to identify and summarise pertinent literature on NTFP or NWFP use and extraction in each country. This was not an exhaustive nor systematic review as all we wished to ascertain was how well the GFRA data reflect that from in-country studies (although from our expert knowledge based on long experience in each country we already knew that there was poor correspondence, which was what prompted us to write the paper in the first place). The primary means of identifying in-country literature was our expert knowledge of the NTFP sector in each of our respective countries, supplemented by searches in Google Scholar and Scopus for “Non timber*” OR “Non-wood*” AND “use” OR “harvest” OR “value”. Research questions (ii) and (iii) were considered through a reflexive process based on our deep knowledge and personal experience of the NTFP sector (for over 35 years for two of us) and literature generally.

In assessing the GFRA (2020) statistics against in-country studies on their use or value, it is necessary to note that the majority of studies in the literature report on, and use, the more widely used term NTFPs rather than NWFPs. If studies reporting on NTFPs listed the products individually, we could remove the wood products (usually fuelwood and building timber) and then adjust the reported results to reflect NWFPs only. But in instances where we could not do that, we have retained the original authors' use of the term NTFPs so not to misrepresent any of their results. Thus, readers will find use of both the terms NWFPs and NTFPs in the text. At the time of writing the exchange rates of the local currency to one US dollar were 18.7 Rand (South Africa), 460 Naira (Nigeria) and 82 Rupees (India).

3. Results and discussion

3.1. How well do the GFRA statistics reflect the use and/value of NWFPs in each country?

We consider this question for each of our home countries individually, starting with South Africa, followed by Nigeria and then India.

3.1.1. South Africa

South Africa is a large, semi-arid country with a population of approximately 60 million people. Levels of formal education are low, with attendant high levels of unemployment (about 34%) and widespread poverty. There is extensive use of NTFPs in rural areas (Shackleton et al., 2007) and also urban ones (Kaoma and Shackleton, 2015; Garekai and Shackleton, 2020). The most widely used NTFP is fuelwood (Shackleton et al., 2022). Use of NTFPs is driven by a complex mix of poverty and culture for specific types, and use makes measurable contributions to poverty alleviation and as safety-nets during adverse times (Shackleton et al., 2007). Being a semi-arid country, the bulk of the forests are dry forests, synonymous with savannas. The forest biome consisting of subtropical and temperate closed-canopy forests covers less than 0.5% of South Africa. NTFPs are recognised in South Africa's National Forestry Action Programme (1997), but there is no implementation plan, budget or agency that monitors their direct use, trade or promotes sustainable use. Formal commercial enterprises based on

NWFPs are required to submit an environmental impact assessment for the species they use, but once granted there is no independent or state monitoring of quantities extracted.

In the GFRA reports the reporting of NWFP use and quantities from South Africa has been extremely variable over the last 20 years in terms of the NWFPs listed as the top ten and also quantities (Table 1). For example, the GFRA 2020 includes some NWFPs that were not mentioned in any of the preceding FRAs, such as tree bark, bushmeat, browse and *Eucalyptus* oils. Similarly, the FRA 2010 also had several NWFPs unique to it, namely medicinal plants, resin and porcupine quills. The FRA 2015 has no entries at all, whilst the FRA 2020 lacks any reports of quantities or values. Common across the assessments is that sources of whatever information is provided are not mentioned. The reported quantity for marula fruit (*Sclerocarya caffra* subsp. *birrea*) is for a single large-scale commercial operation and thus ignores the larger widespread domestic use and small-scale trade in fruits as well as an alcoholic beverage made from the fruits. Similarly, the harvesting of fern fronds in the Knysna forest ceased some time ago (SANParks, 2014) and hence inclusion in the 2020 list seems spurious. The high variability in NWFPs reported and the general absence of quantities or use of incorrect quantities negates any prospect of detecting trends in the data or using it for decision-making.

Within this context, the veracity of the GFRA entries can be considered against a rich diversity of local level and summative studies on the use of or trade in a variety of individual NWFPs, along with livelihood studies that enumerate the proportion of households using a range of NWFPs. Whilst many are local level, it is relatively uncomplicated to calculate means or medians across a sample of studies and extrapolate to larger spatial scales, as done by Mander et al. (2007) for medicinal plants and Shackleton et al. (2021) for fuelwood to determine national consumption.

One of the earliest summaries bringing together data from multiple local level studies in the dry forests (or savannas) on the prevalence of use of a range of NWFPs was Shackleton and Shackleton (2004)

Table 1

The NWFPs and respective quantities for South Africa listed in the last four FRAs (2005–2020).

GFRA 2005		GFRA 2010		GFRA 2015	GRFRA 2020
NWFP	Quantity (t)	NWFP	Quantity (t)	NWFP	NWFP
Marula fruit	1700	Marula fruit	2200	No entries in any of the tables	Tree bark
Wild fruits	173,999	Medicinal plants	20,000		Vegetables
<ul style="list-style-type: none"> All entries in the remaining predefined categories are reported as "n/a" In the table to report NWFP values, the entry is "no data is available for this table value" 		Honey	1580		Bushmeat
		Cultivated mushrooms	n/a		Honey
		Seven-week fern	300		Browse
		Resin	n/a		Mushrooms
		Mopane worms	n/a		Edible insects
		Wild fruits	n/a		Eucalyptus oils
		Wild spinaches	n/a		Ferns
		Porcupine needles	n/a		Wild fruits
		<ul style="list-style-type: none"> Values are provided for each NWFP where a quantity is provided Total value is given as R8 billion No specific sources are provided just the comment "Data is based on estimates provided by sources" 			<ul style="list-style-type: none"> No quantities or values provided There is no mention of source/s of the information provided

Table 2

The mean proportion of households using NWFPs in rural villages in the dry forests of South Africa across two studies.

NWFP	Mean % of rural households using	
	Shackleton and Shackleton (2004)	Mugido and Shackleton (2017)
Wild vegetables	96	84
Wooden utensils	95	55
Grass brushes	91	81
Wild fruits	88	20
Twig brushes	87	81
Weaving fibres	55	49
Edible insects	54	Not included
Bushmeat ¹	52	9
Wild honey	51	16
Medicinal plants ²	49	34
Thatch grass	49	6
Wild mushrooms	25	17

¹ The % of households using bushmeat was under-reported due to it being illegal to hunt.

² The % of households using medicinal plants was under-reported due to being sanctioned by certain churches/religious beliefs.

(Table 2). The largest survey of NWFP use by rural households in South Africa was Mugido and Shackleton (2017) and shows a lower prevalence of use (Table 2), which may be a reflection of one or more of (i) the increasing urbanisation and engagement in the market economy reducing use and reliance on NWFPs, (ii) the inclusion of some non-forests sites in the data set, or (iii) different methodologies. Nevertheless, both studies show significant use of a range of NWFPs at household level, which if aggregated up to national level indicates that very large quantities are used, orders of magnitude more than the quantities and NWFP types reflected in the GFRA tables.

The Shackleton and Shackleton (2004) chapter reported the mean amounts used (averaged across several local level studies) for some NWFPs, such as 58 kg/hh/yr for wild vegetables, 104 kg/hh/yr for wild fruits and 4.5 grass and 4.6 twig hand brushes per household annually. Multiplying such numbers by the number of rural households living in the dry forest areas of the country at the time would have yielded some coarse, albeit not unreliable, estimates of national demand. For example, Mander et al. (2007) report that approximately 27 million South Africans use traditional medicines, at an average of 750 g per year, resulting in annual demand of 20,000 tons (albeit not all from forests).

With respect to trade income, there are dozens of studies on the incomes earned by subsistence traders in a diversity of NWFPs, such as mopane worms (an edible caterpillar) (Baiyegunhi and Oppong, 2016), hand brushes made from different species (e.g. Cocks and Dold, 2004; Mjoli and Shackleton, 2015) and one or more medicinal plant species (e.g. Dold and Cocks, 2002; Ah Goo and De Wit, 2015). Most are at local or district level, but nevertheless they are indicative and if there are studies from several locations they can be extrapolated to provide estimates at larger scales if assumptions are made explicit. At a national level Mugido and Shackleton (2017) reported from the largest survey in South Africa of NTFP use that 6.4% of sampled rural households sold one or more NTFPs, earning a mean of R5,621 per household annually. With approximately nine million rural households, this would equate to approximately R3.2 billion annually in subsistence trade, which dwarfs the values associated with formal, commercial trade chains in many NWFPs mentioned in the GFRA. As does the value of medicinal plant use in South Africa, which was estimated as R520 million in 2006 prices, with a further R2.6 billion via prescriptions by traditional healers (Mander et al., 2007). Mander et al. (2007) estimated that there were 133,000 households "dependent on the trade in medicinal plants in South Africa". Examples of a few other highly commercialised NWFPs based mostly on wild harvests that are not mentioned in the GFRA for South Africa include gels from *Aloe ferox* (with an estimated annual

value of R150–600 million (Grace, 2011)), honeybush tea (*Cyclopia* spp.) about 200 tons at R4,500 per ton) (Joubert et al., 2011) and *Pelargonium sidoides* roots for herbal medicines (26.3 tons; Lewu et al., 2007). The game meat industry based on free-ranging native species is reputedly worth R9.1 billion p.a. (Dept of Environmental Affairs, 2024). The national Dept of Forestry and Fisheries (2016) reported that 6497 tons of medicinal plant materials were exported from South Africa in 2015. This is the department that submits statistics to GFRA, and yet medicinal plants were not mentioned in GFRA 2020 (although some of the “tree bark” mentioned must have been for medicinal products).

3.1.2. Nigeria

Nigeria is the most populous country in Africa with roughly 224 million people belonging to approximately 350 ethnic groups (UNFPA, 2023). Geographically, Nigeria is sub-divided into six sub-regions, namely the North east, North west and North central regions, along with the South east, South west and South south regions. Nigeria is experiencing deteriorating economic conditions, underpinning increasing poverty (World Bank, 2021). Poverty is mostly associated with rural and forest settlements or people living in proximity to such locations, which is one catalyst for higher dependence on NTFPs found in such locations. Overall, NTFPs support more than 105 million rural people and forest-dependent communities (World Bank 2021). The GFRA statistics on NWFPs for Nigeria in 2015 and 2020 are shown in Table 3. Despite the absence of data on NWFPs for Nigeria in the 2015 FRA report, and the limited information provided in the 2020 report which only listed the top ten NWFPs with no quantitative values or units, a significant amount of NWFP data are available. Tens of papers (local, state, and regional levels) have been published on the use, value, and dependence on NTFPs in different parts of Nigeria in the last two decades, and more than a dozen were published between 2002 and 2015. With these multiple published studies, it is questionable why no data were reported for NWFP in FRA 2015 and why only a list of NWFPs was provided in GFRA 2020. Specifically, studies such as Babatunde et al. (2013) listed important NWFPs and their value in a local government area (LGA) of Osun State (South west). Equally, Aiyeloja et al. (2012) valued 12 NWFPs in the four largest local markets in Ihalala LGA of Anambra State. In the North central, Norbert and Ekwubile (2015) identified NWFPs prioritised by the Ibaji people of Kogi State and investigated the value of these products.

Furthermore, the use and contribution of NTFPs have been investigated in various studies in different regions of the country (Jimoh and Haruna, 2007; Ezebilo and Mattsson, 2010; Suleiman et al., 2017; Chigbogu, 2018; Ado et al., 2019; Chiebonam et al., 2020; Oladipupo-Alade et al., 2021; Falana et al., 2022). These studies indicate that significant proportions of households use and depend on NTFPs. Other studies (Aiyeloja and Ajewole, 2006; Aiyeloja et al., 2012; Babatunde et al., 2013; Ancha et al., 2015; Babatunde et al., 2020; Oghenekevwe et al., 2021; Babatunde et al., 2022) have analysed the market value of various NTFPs to elucidate the magnitude of the commercial trade. For instance, Babatunde et al. (2022) reported the market price of 1 l of

honey to be ₦1000, 1 kg of bushmeat to be ₦500, and 1 kg of gums as ₦900, etc. While it may be difficult to extrapolate such data for the entire country due to differences in prices in different regions, it shows that adequate data are available if a thorough search is done.

Additionally, it is unclear how the ten NWFPs reported in GFRA 2020 were selected and where the information was sourced. Given that the occurrence and prevalence of these products vary among the major ecological zones of the country, it may be challenging to present a list of ten products that will adequately represent what is important for an ecologically and culturally diverse country like Nigeria. From Table 4, it is evident that people prioritise NWFPs differently, with the exception of fruits, nuts, and seeds (of various species), no other NWFP was present in all the geographical zones.

3.1.3. India

In India, NTFPs are deeply associated with socio-economic and cultural life of forest dependent communities inhabiting a wide diversity of ecological and geo-climatic regions (Anonymous 2009, Pandey & Bisaria 1998). It is estimated that 275 million poor rural people in India, that is 27% of the total population, depend on NTFPs for at least part of their subsistence and cash livelihoods. NTFPs also serve as a vital livelihood safety-net in times of hardship. According to the Government of India report (2006), at least 35 million workdays of employment per year were generated in the NTFP trade sector, which includes the collection and processing of economically valuable NTFPs. About 70% of the NTFP collection in India takes place in the ‘tribal belt’ of the country, whereas 55% of employment in the forestry sector is attributed to the NTFP sector. Table 5 summarises the entries from the GFRA reports for 2010, 2015, and 2020. If compared to the “Forestry Statistics” compilation in India which provides the basic information on the removal of NWFPs presented by individual States and Union Territories, it does not provide national totals because it maintains reporting units of the States and does not convert them into common units like metric tons. For example, the production of tendu leaves is reported in “standard bags”, bamboo in “running meters” and grass and fodder in “kilograms”. Therefore, we converted them as follows to provide national yearly removals: standard bag of Bidi leaves = 40 kg; Canes: kops = 1 billet, 1 bundle = 50 billet, 1 billet = 3.65 m, 1 m = 0.534 kg; Resin blaze (Lip & Cup Method) = 1 kg; Resin 1 blaze using under Rill Method = 3 kg; Grass & Fodder 1 bundle = 35 kg; Bamboo: 2400 running meters = 1 tin).

Table 4

Ten important NWFPs from the six geographical zones in Nigeria (based on % of households using) (No data available for the North east region).

S/N	North west	North central	South west	South east	South south
1	Medicinal herb	Oil palm	Bush meat	Fruit, seed, and nut	African star apple
2	Fruit nut	Bush mango	Fruit	Bitter kola	Bush mango
3	Fodder	African pear	Honey	Bitter leaf	African bread
4	Honey	African mesquite	Forage and fodder	Elephant grass	Monkey kola
5	Gum	Locust bean	Vegetable	Bush meat	African pear
6		Black pepper	Sponge	Mushrooms	Palm fruit
7		African star apple	Rope	Oil palm	Locust bean
8		Neem	Snail	Rubber	Plum
9		Teak leaf	Nut	Snail	Bitter kola
10		Mushrooms	Wrapping leaves	Cane	Cashew nut
Source	Suleiman et al. (2017)	Norbert and Ekwubile (2015)	Olawuyi et al. (2021)	Chidebere-Mark et al. (2016)	Emiri and Nnodim (2021)

Table 3

The NWFP for Nigeria listed in the last two FRAs (2015–2020).

GFRA 2015			GFRA 2020		
NWFP	Quantity	Value	NWFP	Quantity	Value
			Fruits		
			Cane/Rattan		
			Honey		
			Herbs		
			Locust beans		
			Dyes		
			Gums		
			Mushrooms		
No statistics presented. All entries filled as “N/A”			Bush meat	No data for quantity, unit and value	
			Bitter cola		

Table 5

NWFPs and respective quantities for India listed in the last three FRAs (2015–2020). (All quantities at metric tons unless other indicated).

No	2010			2015 ¹		2020		
	NWFP	Quantity	Value (1000 local currency)	NWFP	Value (1000 local currency)	NWFP	Quantity	Value (1000 local currency)
1	Tendu leaves (<i>Diospyros melanoxylon</i>)	334,549	2,396,793	Sal seeds (<i>Shorea robusta</i>)	114,017	Tendu leaves (<i>Diospyros melanoxylon</i>)	652,677	8,391,470
2	Gums (<i>Butea monosperma</i>)	461	1,772,798	Tendu leaves (<i>Diospyros melanoxylon</i>)	108,729	Resins (<i>Pinus</i> spp.)	1057	893,645
3	Bamboo (<i>Dendrocalamus</i> spp.)	1,290,271	610,596	Gums	44,527	Honey	32,852*	354,507
4	Resin (<i>Pinus roxburghii</i>)	38,139	514,248	Resins	10,848	Sal Seed (<i>Shorea robusta</i>)	128,998*	151,578
5	Fodder	230,124	109,888	Bamboo (<i>Dandrocalamus</i> spp.)	4,198,700	Grass	4196	108,635
6	Drugs	4550	11,614	Canes/rattan (<i>Calamus</i> spp.)	2742	Lac	3849*	76,623
7	Cane/rattan (<i>Calamus</i> spp.)	17,674	2531	Lac	30,915	Gum	12,063*	72,389
8	Lac (<i>Schleichera oleosa</i>)	48.6	909	Drugs	N/A	Mahua (<i>Madhuca latifolia</i>)	20,942*	33,263
9	Sal seeds (<i>Shorea robusta</i>)	57,796	73	Fodder	111,833,800	Amla (<i>Emblica officinalis</i>)	784*	3520
10				Others	N/A	Wax	11*	88

¹ No quantity data for 2015.

* Local units.

Considering the data reported in the GRFA reports in Table 5 against local level studies and State reports shows that several are vastly underestimated, such as for sal seeds, gums and resins, honey, mahua and amla, whilst others (such as fodder and sal) show inexplicably large shifts between GFRA reporting periods that raise questions around how the estimates were made.

Considering a few instances statistically, the estimated availability of sal seed in India is 1.5 million tons per year and about 20–30 million forest dwellers depend on the collection of sal seeds, leaves, and resins (Kumar et al., 2016; Mishra et al., 2021). This is close to ten times more than reported in the GRFA (2020) report. A major part of India's honey production, approximately 60,000 t per annum, comes from wild bees and the herbal industry in India is the largest consumer of honey (Varghese et al., 2015). This estimate is almost double that reported in GFRA (2020). Additionally, Mahua (*Madhuca longifolia*) is an NTFP that contributes significantly to the tribal economy in India, as well as multiple domestic uses (food, medicine, fodder, fuel, local drinks) (Sikarwar, 2002; Dalal et al., 2018; Nair et al., 2021). Consequently, the estimates of quantities extracted in the GRFA are regarded as marked underestimates even though the harvest season lasts only 15–25 days (Ashraf & Nair 2021). Sawant et al. (2022) estimated that India produces approximately 1–1.16 million tons of gooseberries annually, which is 30–40% more than the quantities reported in GFRA (2020). For natural resins and gums (NRGs), they are one of the major NTFPs of India (with about 120 gum and resin-yielding species) that have a significant role in the paper, textiles, cosmetics and medicinal sectors (Sharma et al., 2018). The average annual export quantity of NRGs was 218,971 tons between 1998 and 2013 (Yogi et al., 2017), which is almost 17 times more than reported in the GRFA (2020). Moreover, during the last 15 years, export quantities have been increasing at about 10.7% annually, with 543,621 exported in 2014/15 (Yogi et al., 2017).

In summary, it is clear from the three country case studies, that the current state and hence value of the NWFP data reported in the various GFRA is inadequate and thus cannot be used to analyse trends about the NWFP sector nor to make informed decisions at national or higher scales. The shortcomings vary between the three country case studies, as well as between GFRA reports for a specific country. Broadly, they relate to (i) the reported ten most valuable NWFPs have little or no correspondence to the most 'important' or widely used NWFPs within a country. (ii) Inconsistencies in the NWFPs reported from one GFRA to

the next, which then precludes any tracking or analysis of trends. (iii) No motivation or explanation regarding how the listed NWFPs in each GFRA were selected. (iv) The absence of data on amounts or values for some or all the NWFPs listed. (v) Grossly inaccurate reflections of quantities. (vi) The absence of sources for the reported data. Previous authors have also commented on the notoriously poor and frequently inaccurate data on NWFPs in various national or global databases or syntheses (Sorrenti, 2017; Lovrić et al., 2020),

3.2. Why are NWFPs poorly reported in the GFRA?

The reporting of forest statistics through the GFRA process has evolved over time (Singh, 2013), with continuous improvements to the definitions, specification of variables, data standardisation and capacity development of country reporting agencies. However, many commentators observe that it is more of an ongoing process than a finished product, citing a number of challenges that still need to be addressed (Chen et al., 2020; Nesha et al., 2021). Based on the literature and our experience with the NWFP sector in our respective countries and more broadly, it appears that many of the challenges that hinder the accuracy of NWFP statistics are similar to those found in other sections of the GFRA. We consider the most significant ones below. Although each is considered in isolation, in reality they are usually intertwined and interdependent, with multiple challenges interconnecting with one another.

First is the continued lack of recognition of the NWFP sector by forest and associated departments, as well as development planners, in many countries around the world (Shackleton and Pandey, 2014; Chamberlain and Smith-Hall, 2024). Emphasis remains on timber production, perhaps now alongside regulating services such as carbon sequestration and water regulation. In many regions, harvesting of NWFPs is not permitted or strictly controlled, even against ancestral rights of access and use. In such countries, NWFP products are still viewed as of marginal value and less important than timber.

Second is that there is a considerable absence or lack of coordinated NWFP monitoring and record-keeping by most countries, even among those that acknowledge their importance to local people and economies. The sheer diversity of species and products has hindered enthusiasm to develop the necessary diversity of measurement and monitoring systems (Sorrenti, 2017; Lovrić et al., 2023). Concomitantly, the multitude of

local markets and the substantive collection of NWFPs for home consumption has precluded any means for regular enumeration of volumes extracted. The absence of any internationally agreed methods to inventory NWFPs of particular types has also left it up to individual country institutions.

A consequence of the poor recognition of NWFPs in forests and economies is that many forest departments do not allocate sufficient human and financial resources to the NWFP sector, especially in relation to inventories and records (Shackleton and Pandey, 2014). This lack of resources then reinforces the limited attention given to NWFPs and the absence of records of their value. Ironically, the trade in NTFPs can be legally taxed via permits to generate income for forest departments, but the funds are not used to manage the NTFPs. Even more widespread are the informal taxes or bribes that NTFP traders in many regions are required to pay to collect, transport or store NTFPs (e.g. Tieguhong et al., 2015), which bleed the value chain without any returns to the NTFP or forest sector.

Lastly, we interpret the turnover in which NWFPs are reported in successive GFRA for particular countries is likely to be a reflection of staff turnover in the reporting institutions rather than a change in the ten most important NWFPs for a country. Changes in staff responsible for reporting statistics mean that there is no continuity with respect to sources consulted and criteria for deciding which NWFPs to include. This source of variability in the data could be addressed through adequate institutionalisation of how and where NWFP data were accessed for each reporting period, so that new staff will have clear information and processes to build on.

3.3. How can the NWFP component of the GFRA be improved?

The current shortcomings in the reporting of NWFP statistics in the GFRA country reports make most of the statistics presented redundant. They cannot be used to draw any meaningful conclusions on the state of the NWFP sector in any of the three case study countries, what the trends are, and hence guide policy at national or higher scales. This needs to be addressed. Below we provide an outline of the steps on how this might be achieved. However, before any of these are likely to be adopted a prerequisite foundation is the need for national and sub-national policies to acknowledge the values and various roles of NTFPs in forest, conservation, economic, development and poverty alleviation policy frameworks (Shackleton and Pandey, 2014; Chamberlain and Smith-Hall, 2024). The evidence on the significant economic and non-economic values and roles of NTFPs is now overwhelming and cannot be ignored by policy-makers. As Delgado et al. (2016) state, forest policies must move from simply recognition of the NTFP sector, to active support.

3.3.1. Get started

The first step, we believe, is to recognise the need to start somewhere, rather than trying to design a perfect system from the outset, which becomes bogged down in the details. The diversity of NWFP species, types and markets make it a daunting task, and so it becomes easier to avoid doing anything rather than to engage with it. Start small, with a single NWFP if necessary, and build from there as knowledge and experience accumulates. Indeed, the reporting on forest and timber statistics has evolved through time with each GFRA (Singh, 2013). The same philosophy should be embraced for the NWFP sector.

3.3.2. Identify which NWFPs to report on and continue with them through time

A key consideration is which NWFPs a particular country will report on to the GFRA. First, is to consider how that will be decided and by who. We would advocate for an inclusive process that brings together users, processors, marketers, researchers, government and non-government sectors and civil society. That group can then decide the criteria to be considered to identify the most important NWFPs in their

country, such as one or more of market value, quantities extracted, forest impacts, significance in local culture, ease of enumeration and monitoring, relevance as an indicator species for broader forest functioning or health, and so on. Where possible and appropriate within a country, it may be desirable to include NWFPs from across the range of 17 types categorised by the FAO. For example, seek to have at least one wild food, medicinal plant, handicraft and honey, rather than four wild fruits. But it might be that in some countries there is no use of plant or animal NWFPs within one or more of the GFRA categories.

Having selected the NWFPs to report on, it is imperative that the same ones are reported on through time rather than varying which NWFPs are reported on from one GFRA to the next. If new NWFPs gain prominence in a particular period and need to be reported on, then add them to the list and monitoring programme, rather than have them replace NWFPs already being reported on. However, this is only possible if capacities and resources allow. If they don't, then the value of adding a new NWFP and losing another that has been reported on for a particular period needs to be carefully considered against the value of long-term data in allowing interpretation of indicative trends for the sector rather than specific individual NWFPs. Regular changes to the list of NWFPs reported on negates the benefits of being able to assess trends.

3.3.3. Identify available expertise

Many national or state forest departments do not have sufficient expertise or capacity to undertake inventories and monitoring of forests generally, let alone NWFPs (Vidal et al., 2016; FAO, 2020). Irrespective, it is vital that the relevant government department identify suitable institutions, ideally in-country, that can develop and execute baseline inventories of the listed NTFPs in terms of distribution, yields, demand and both subsistence and trade or market values. Much, albeit not all, of the literature available in each of our countries comes from academic institutions. This suggests that strategic partnerships with such institutions could be mutually beneficial. In time and with suitable training, such functions might be transferrable to national or state forest departments.

3.3.4. Design and implement a NWFP monitoring system

The same institutions should then design a robust, sensitive and cost-efficient monitoring system to allow detection of trends for each selected NWFP at five or ten-year intervals concordant with the GFRA reporting cycle. Where possible, consideration should be given to citizen science approaches that involve the public or specific NWFP users in collecting data, allowing greater spatial coverage and for a more cost-effective monitoring programme. Citizen science involvement can also be beneficial in inspiring appreciation of the values of NTFPs and the local or traditional culture behind their use and processing techniques; it can also lead to an increased sense of stewardship for the resources and the landscape (Jonson et al. 2021). Involving the youth in citizen science monitoring of NTFPs can improve local ecological knowledge and affinity to the landscape (Jonson et al. 2021). Qualitative rankings or indicators of trends are likely to be more cost-effective than repeated quantitative measurements and can be effective if based on sound guidelines to constrain inter-operator variability. If some of the target NWFPs are tree-based (such as wild fruits or arboreal parasites) a more cost-effective approach is likely to be achieved through adjustments to existing forest inventory protocols to simultaneously include the tree-based NWFPs. Similarly, the design of the system should dovetail with other systems and reporting instruments on forests, biodiversity, poverty and economies to ease the reporting burden (Braatz, 2010).

3.3.5. Inter-country or regional collaboration

Some NWFP products or species are common between neighbouring countries. Therefore, there are advantages to encouraging and facilitating regional or inter-country collaboration around methods and monitoring systems for any NWFPs in common, as has been advocated for assessment of forests and deforestation rates (Singh, 2013). It will

allow for sharing of knowledge, approaches and training, thereby being more cost-effective. It also allows comparison of data between countries because they have been collected in a similar manner. This is also important for NWFPs that have cross-broader markets.

3.3.6. For concentrated markets involve top end actors in reporting

For NWFPs with relatively few market role-players, engage those role-players in the reporting process. This is because it is easier to work with a small number of companies or institutions to keep records of product volumes and prices, than to deal with a large number of dispersed collectors or growers.

3.3.7. Ensure sources of information are recorded and reported

Reporting the source of any data is as important as the data itself. If the sources of data reported in the GFRA are not provided, it becomes impossible to verify the data accuracy or methods used to collect them, which then compromises comparisons between GFRA reports at different time periods. The GFRA should rather not report the data if no source is provided by the reporting country.

3.3.8. Budget for NWFP capacity development, monitoring and reporting

Several of the steps described above are only possible if there is sufficient budget to cover the costs of in-house or external expertise. Consequently, annual budgets of national or state forest departments need to be realigned to afford NWFPs the attention they deserve and commensurate with their value (Shackleton and Pandey, 2014). In many countries the value of NWFPs far exceeds the value of timber products and yet the budget allocations typically reflect the opposite. Global agencies such as the FAO, IUFRO and ITTO should advocate for proportionate funding to the NWFP sector, not just in terms of inventory and monitoring, but also in conservation, sustainable use, and product and market development.

3.3.9. Curriculum reform at forestry training institutions

The conservation and sustainable management of NWFPs requires a cohort of informed and professionally trained forest and conservation officers. We are currently aware of some training institutions in our respective countries where the curriculum just mentions NWFPs in passing. Graduates complete their course knowing what NWFPs are, but not how to monitor or manage them, nor promote their sustainable use whilst contributing to local livelihoods. Thus, the GFRA programme, through the FAO, needs to advocate for appropriate changes in training curricula in countries where it is lacking. Additionally, the development of globally accessible online resources will be useful for in-service training and capacity building.

4. Conclusion

Drawing on information and data from three case study countries, this paper has shown that the veracity of the NWFP statistics reported in the GFRA reports is questionable, to the degree that the data certainly cannot be used to analyse trends in the NWFP sector through time in each country, nor to make informed decisions at national or international scales. Broad shortcomings include the selected “top 10 most important NWFPs” reported in the GFRA not being the top ten nationally, inconsistencies in which NWFP are reported on in successive GFRA reports (which then precludes any analysis of trends), grossly inaccurate reflections of quantities, and the frequent lack of data and data sources when quantities are provided. The reasons for the inadequate reporting of NWFP statistics in the GFRA are likely to vary between countries, but it is a further affirmation of the limited acknowledgement and management of NWFPs in all but a few countries (Shackleton and Pandey, 2014). The poor state of NWFP reporting is unlikely to change until global and national agencies fully recognise the contribution of NTFPs to the livelihoods, income, wellbeing and culture of billions of people globally and significant proportions of national populations within

countries. Embedding NTFPs in the growing discourses and strategies around promoting the bioeconomy may provide impetus for such (Smith-Hall and Chamberlain, 2023). We suggest that this requires greater advocacy from international institutions with a forest conservation and management mandate, such as the FAO, IUFRO and ITTO. We take heart from observing that many of the current problems with NWFP statistics in the GFRA are the same ones that used to plague (and maybe still do, to some degree) the collection of statistics on forest extent and productivity (see Singh, 2013), but with strengthening of definitions of terms and variables, simplification of reporting procedures and capacity building within countries, the statistics in the GFRA improved. Thus, we believe same should be possible in relation to the NWFP statistics and hence their value in supporting informed policy and decision-making into the future.

Author statement

The authors state that this is their work and that it has not been published elsewhere, nor is it under consideration by any other journal. The authors further declare that they have no conflicts of interest in submitting this work to Forest Policy & Economics.

CRediT authorship contribution statement

C.M. Shackleton: Conceptualization, Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing, Investigation. **O. Adeyemi:** Formal analysis, Methodology, Writing – original draft, Writing – review & editing, Investigation. **S. Setty:** Formal analysis, Investigation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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