Into the wild: disentangling non-wood terms and definitions for improved forest statistics

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SUMMARY

As scientists strive to make nature's value visible, a large portion of forests and wild biodiversity known as non-wood forest products (NWFPs) continues to remain largely invisible and unaccounted for. At the core of the problem is wide disaccord over what is a NWFP (and correlate terms), a debate which has been running in circles for nearly three decades. This paper reviews existing terms and definitions, with the aim of improving forest statistics and the visibility of NWFPs. The paper starts by (1) clarifying boundaries between agricultural and forest products, so forest products currently under agriculture can be "reclaimed"; (2) drawing on lessons from fisheries to distinguish between wild and farmed products, and associated activities; (3) moving beyond *product* towards *activity* classifications to capture gathering that may not be accounted for under crops or forest products because it takes place across landscapes and outside of these sectoral boundaries.

Keywords: non-wood forest products, wild products, terminology, statistics, biodiversity

Objectif nature: dénouer les termes et les définitions sans rapport au bois afin d'obtenir de meilleures statistiques forestières

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Alors que les scientifiques s'efforcent de rendre plus visible la valeur de la nature, une large portion des forêts et de la biodiversité naturelle connue sous le nom de produits forestiers autres que le bois (NWFPs) continue à demeurer largement invisible et non répertoriée. On trouve au cœur du problème un désaccord étendu quant à la nature des NWFPs (et des termes leur étant corollaires), un débat qui se mord la queue depuis presque trois décennies. Ce papier examine les termes et les définitions existants, dans le but d'améliorer les statistiques forestières et la visibilité des NWFPs. Le papier commence par (1) clarifier les limites entre les produits agricoles et forestiers, pour que les produits forestiers actuellement sous l'égide de l'agriculture puissent être «récupérés», (2) tirer des leçons des pêcheries qui distinguent les produits naturels des produits cultivés, et de leurs activités associées, (3) s'éloigner de la classification *produit* vers la classification *activité* pour inclure la récolte qui pourrait ne pas être notée dans les listes de récolte ou de produits forestiers si elle s'opère à cheval sur les paysages et à l'extérieur de ces limites sectorielles.

En plena naturaleza: cómo desenredar los términos y definiciones no madereros para mejorar las estadísticas forestales

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A medida que los científicos se esfuerzan por hacer más aparente el valor de la naturaleza, una gran proporción de los bosques y de la biodiversidad silvestre conocida como productos forestales no maderables (PFNM) permanece en gran medida invisible y no se tiene en cuenta. En el centro del problema está la gran discordia sobre lo que es un PFNM (y los términos relacionados), como parte de un debate cíclico activo durante casi tres décadas. Este artículo examina los términos y definiciones existentes, con el fin de mejorar las estadísticas forestales y la visibilidad de los PFNM. El artículo comienza por: (1) aclarar los límites entre los productos agrícolas y los forestales, de modo que se puedan "recuperar" como forestales los PFNM que actualmente se contabilizan como agricultura; (2) aprovechar las lecciones aprendidas de la pesca, para distinguir entre los productos silvestres y los cultivados, y las actividades asociadas; (3) pasar de una clasificación por productos a una clasificación por actividades, con el fin de capturar los aprovechamientos que tal vez no se contabilicen como parte de los cultivos, o como productos forestales, porque tienen lugar entre paisajes y fuera de esos límites sectoriales.

INTRODUCTION

Collecting data and monitoring and measuring progress on agricultural production and the associated use of natural resources is widely acknowledged as central to better decision making and achieving the Sustainable Development Goals (SDGs) (FAO 2017a, FAO 2018). At the same time, in spite of efforts by global scientists and economists to make nature's value visible (Sukhdev 2008, TEEB 2010, 2018) a large portion of forests and wild biodiversity, often referred to as non-wood forest products (NWFPs) or wild products, continues to remain largely invisible and unaccounted for (Rasmussen 2017, Sorrenti 2017). While a string of recent evidence suggests that forests, trees and wild products constitute an important source of resilience in the food system, are positively correlated with nutritious and diverse diets and support or even form the basis of people's incomes (Angelson *et al.* 2014, Bakkegaard *et al.* 2017, Hickey *et al.* 2016, HLPE 2017, Ickowitz *et al*. 2014, Ickowitz *et al.* 2016, Nielson *et al.* 2018, Powell *et al*. 2015, Rasolofoson *et al.* 2018, Rowland *et al*. 2016, Thuiller and Verburg 2014), comprehensive global data for forest products other than wood does not exist. Data is typically partial or fragmented and lacks comparability across countries and over time since few countries systematically monitor and collect this information (Sorrenti 2017, Muir and Sorrenti 2018). As a result, NWFPs are poorly represented in policies, planning and interventions related to forests, biodiversity, land-use, food and nutrition security, and related decision-making (Laird 2011).

Operating under the premise that as an organization FAO is mandated to facilitate the gathering and dissemination of information, including statistics, and that official statistics must be accompanied by definitions if they are to be of any use for comparison (Padovani 1995), the authors, in collaboration with the University of Padua, undertook this desk review of existing definitions and terms related to NWFPs and wild products. The question of terminology and definitions is not only an issue of semantics. Harmonization of terms and definitions is at the basis of statistical and economic activities and is also increasingly vital to alleviate the reporting requirements countries have towards various international conventions and bodies. It can also be an incentive to report on a sector if clarity of terms and definitions exist. Better data can in turn be a driver of transformation across sectors by acting as a basis for policy decisions, effective monitoring, target setting, designing food and nutrition security initiatives and so on (FAO 2018).

Better data on biodiversity, including wild and semi-wild products other than wood, can contribute to this transformation, however greater clarity on terms and definitions is needed. Arguably, the variety of terms in use (non-wood forest products, non-timber forest products, wild products, etc.) can be considered more or less synonyms; different individuals and institutions opt for different terms depending on their needs and objectives (Belcher 2003, FAO 1999). Moreover, most institutions and individuals will likely continue to use their term of choice, particularly if there are legal or fiscal implications which may be characteristic of a particular country or region. Without a more precise information, however, a significant portion of forests and wild biodiversity will continue to remain invisible to policy and decision makers. As such, the authors initiated this study to disentangle existing terms and definitions and break down their relative components in an effort to move beyond the terminology debate, improve NWFP data and make the sector and products more visible, particularly to those making important decisions about land and food production.

The authors begin by providing a brief history of NWFPs, follow with a summary of the age-old terminology debate (including an overview of key terms and definitions used to date), lay out the main reasons for disaccord and finally attempt to put an end to the circular terminology debate by proposing improvements. These include first clarifying the boundaries between agricultural and forest products, so forest products currently under agriculture can be "reclaimed"; (2) drawing on lessons from the fisheries sector with regards to distinguishing between wild catch and farmed fish, and associated activities; (3) and moving beyond *product* classification systems towards *activity* classifications to capture gathering of NWFPs that may not be accounted for under crops nor under forest products, given that they may be harvested outside of these boundaries (e.g. "bush", non-forest land). In doing so, we provide clarity on key bottlenecks that have contributed to the well-acknowledged data gap on NWFPs, and means to closing in on this gap to get a better understanding of the contributions of forests and wild gathering to lives and livelihoods.

METHODS

A desk review of existing NWFP definitions and terms in academic literature via traditional search engines (Scopus, Google Scholar, Web of Science) was used to undertake this study (Table 1). The search was not limited to forest sector literature; agricultural and food and nutrition journals were also reviewed. In addition to traditional forest-terms such as "non-wood forest products", "non-timber forest products" and "wild forest products", literature was also scanned for other terms such as "wild edible plants", "wild food plants", "neglected and underutilized species" and so on. Papers were subsequently analysed for relevance and "selected" if a unique definition was clearly provided. While the aim was to be as

TABLE 1 *Scopus search findings*

Search word	Results (no. of articles)
Non timber forest products	1304
Non-wood forest products	241
Wild edible plants	311
Wild food plants	128
Neglected and underutilized species	39

comprehensive as possible, not all variations of terms and definitions were chosen because it was impractical and not conducive to the purpose of the exercise, which was to outline the diversity of terms and definitions in use.

THE HISTORICAL TRAJECTORY OF NON-WOOD FOREST PRODUCTS

Long before the advent of agriculture some 10 000 years ago, humankind depended on foraging, understood as the practice of gathering resources from the wild, for food and health (Pringle 1998). Wild plants and animals have been used for food, shelter, utensils, health, fibre, energy for millennia by communities around the world, contributing to nutrition, providing cash income and shaping human activities, cultures and civilizations (Al-Harrasi 2019, FAO 2017b). Many of these resources, such as wild fruits, seeds, roots, nuts, fungi, and game derive from forests and are known as NWFPs or NTFPs[1]. Frankincense, for instance, the common name for the oleo-gum-resin of *Boswellia* trees, was widely used in Ancient Egypt and Rome, with trade dating back to at least 2000 BC (Kew 2014). The Phoenicians used Argan oil from the *Argania spinosa* tree for food and cosmetics (Morton and Voss 1997). Cinnamon is thought to have been a valuable commodity during the 13th and 14th centuries (although it is less clear if this refers to "true Cinnamon" (*Cinnamomum verum*), *Cinnamomum cassia* or other species yielding cinnamon or cassia bark) (Haw 2017). Countless other NWFPs such as vanilla, cloves and nutmeg drove the spice trade between Asia and Europe, and were key drivers of global expeditions from the 14th to 16th centuries, becoming important and valuable commodities (the word "spice" derives from Latin and means a commodity of special distinction or value) (Van der Veen and Morales 2015). Others such as gum Arabic *(Acacia sp.*), Brazil wood dye and Amazonian rubber (*Hevea brasilensis*) boasted significant trade during the colonial period (Sills *et al.* 2011). For at least 200 years, shea nut kernels and butter (*Vitellaria paradoxa*), known in francophone countries as *karité*, provided local communities in West and increasingly East Africa with food, skin-care products and household income; this continues today (Pouliot 2012, Wardell 2013).

Through time, the prospects of domestication allowed early cultivators to enhance productivity by means of modifying growth parameters, which saved time, effort and lowered the food security risks (although reducing leisure time) (Dyble *et al.* 2019). Many wild fruit- and nut-bearing trees came under domestication as horticultural crops. Fruit trees represented more complex forms of reproduction inasmuch as farmers could "fix" desired traits; they also represented a more settled way of life, as most trees bore fruit up to eight years after planting (Zohary *et al.* 2012). Domestication also represented a shift in food production from forest to cropland (Zohary *et al.* 2012). The seven "founder crops" of the Mediterranean, for example, from which staple agricultural products of long-standing economic importance derived are tree crops: olive oil, wine, raisins, dates and common figs (Zohary *et al.* 2012). These products are today commonly thought of as agricultural products. Throughout the world and over time, many other NWFPs like rubber, quinine, oil palm, and cocoa were brought into cultivation, with a profound impact on the world economy (Laws 2010). Other products like Brazil nuts and rattan were harvested on an industrial scale. Through time, most high value NWFPs became agricultural crops (Shanley *et al.* 2015), an issue which will be discussed at length throughout the course of this paper.

Technological developments emerging from the chemical industry during the late 19th century also led to the replacement of many NWFPs by cheaper synthetic substitutes or cultivated crops, including a large number of key internationally traded products such as gums, resins, balata, fibres and medicines, making some NWFPs on international markets obsolete (Sills *et al.* 2011). The synthetic dye aniline replaced the natural blue dye obtained from the indigo plant *Indigofera suffruticosa.* Similarly, artificial food colorants and dyes superseded cochineal (*Dactylopius coccus*), a key 17th century commodity, and in most parts of the world plastic quickly overtook vegetable ivory *(Phytelephas macrocarpa*) for making buttons, among other objects. Interestingly, this trend could be reversed with growing consumer interest in finding substitutes for plastic and ivory, among other "green" alternatives (Chu *et al.* 2015). In addition, countless other crops became domesticated on an industrial scale (Shanley *et al* 2015). Although most food-based NWFPs continued to enjoy widespread use at a subsistence level, many other NWFPs witnessed a decline in production and trade or a change in purpose (e.g. pine resins increasingly used as a fragrance and food flavour and less so for waterproofing ships) (FAO 1995).

Not all NWFPs suffered the same fate. The opening up of global trade for instance allowed some products such as brazil nuts, cork, bamboo shoots, argan oil, pine nuts and several mushrooms, among many others, to reach significant and recorded production and trade value. There have also been a number of NWFP success stories often characterized by "boom and bust cycles" (Homma 2012). Other NWFPs have been highly valued through time. The caterpillar fungus (*Cordyceps sinensis*), for instance, has long been utilized in traditional medicine, and is today contributing at least USD 1.8 billion to the Tibetan economy and between 70–90 percent of household income where it grows (Pouliot *et al.* 2018, Xia *et al.* 2017, Winkler 2008). Most NWFPs however continue to be almost invisible in official statistics, which has contributed to their poor representation on international policy agendas and in land-use planning, not least in forestry (Sorrenti 2017, Sills *et al.* 2011, Sorrenti 2017).

[1] The authors use the term "Non-wood forest products" instead of "Non-timber forest products" (NTFPs), which has a slightly different meaning. The terminology will be discussed at length throughout the course of this paper.

The honeymoon period for NWFPs known as the "rainforest crunch" (Dove 1993; Neumann 2000), coinciding with the 1992 Rio Conference establishing that tropical conservation needed to head in a more people-oriented direction and with the ground-breaking publication *Not By Timber Alone*, was however short-lived. Several challenges contributed to the waning of enthusiasm for NWFPs over the years. Some argued that NWFPs never lived up to up to their promise partly due to commercialization challenges that came to pass (Belcher 2003, 2005; Sunderland *et al.* 2011). Complicating matters is that NWFPs are often collected as a *complement* to the main land management objective(s), and hence are typically seen as marginal or "secondary" products (Shackleton and Pandey 2001, 2014). Compounding the challenge was and still is that NWFPs are a part of an informal economy, inasmuch as they are often collected for subsistence, without legal permits or traceability of any kind. These factors, coupled with the plethora of terms and definitions used to describe them, have contributed to the marginalization and underutilization of NWFPs in forestry and rural development.

THE AGE-OLD TERMINOLOGY DEBATE

References to "minor or secondary products of forests" date back to the beginning of the century at least. Products like brazil nuts, shea butter, oriental spices, myrrh and acai are cited in literature far before the modern notion of NWFPs emerged and include some of the oldest traded commodities (Iqbal 1993, Plotkin 1984, Salo *et al.* 2013). The term "naval stores", used to denote products obtained from resin tapping of mainly pine trees (genus *Pinus*) dates back to the 1600s when wooden ships were waterproofed using resin (FAO 1995a). Countless other products can be found in literature dating to the Ancient Egyptians, Romans, Greeks and Phoenicians (FAO 1995a, Haw 2017, Van der Veen and Morales 2015, Wardell 2013). As a category or group, NWFPs have been largely referred to as "minor" or "secondary" forest products regardless of their value to local people or the national/international economies since the beginning of the century at least (Robbins and Matthews 1974). Throughout much of the 1980s, NWFPs gained wide currency under the banner of "non-wood products", "non-timber values of forests" and related terms (Hecht 1988, Myers 1990, Peters 1989, Posey 1985). Peters *et al*. (1989) were particularly influential in moving the "valuation" of forests discussion beyond timber, arguing that timber-centric forest appraisals contributed to making alternative uses of land more desirable and provided market incentives for destructive logging and forest clearing, which stimulated much discussion about multiple-use management (1989). This discussion continues today (Sheppard *et al*. 2020).

The term "non-timber forest products", or NTFPs, defined as "*all biological materials other than timber which are extracted from forests for human use*", found fertile ground in this environment (De Beer and McDermott 1989). First and foremost, this all-encompassing umbrella term set out primarily to distinguish itself from industrial scale interests such as timber extraction. Both the part of the tree harvested and the scale at which this harvesting takes place (e.g. small scale versus large-scale, industrial harvesting) became key components of this term and definition. Notwithstanding, the authors acknowledged from the outset some inherent problems with the term, including lack of clarity on the definition of forests, and the inclusion (or not) of related services (and the associated definition of such). Criteria for scale would likewise prove inherently problematic.

FAO spearheaded efforts to develop a clear and consistent definition for NWFPs in 1995 through regional consultations (FAO 1995b), ultimately reaching consensus in 1999: "*Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests*". A fundamental difference between the terms adopted by FAO and de Beer and McDermott's NTFP was the exclusion of fuelwood and small woods used as domestic tools, equipment and for cultural purposes. The new FAO working definition proposed a clear distinction between wood and non-wood forest products as a basis for building a classification system (FAO 1999).

Over the years, much has been said about the term and associated challenges for data collection. Without a doubt, these newly established "all-encompassing" terms carried a political and conservation message (Belcher 2003), giving greater visibility to the sector. Nevertheless, various problems arose. Most agree that ambiguity in terminology made and still makes compiling official statistics, information and communicating lessons on the sector as a whole challenging (Cocksedge 2010, McLain and Jones 1997, 2001, Ruiz-Perez and Arnold 1996, Shackleton and Pandey, 2001, 2014, Vantomme 2003). Early on, Arnold and Ruiz-Perez (1995) posited that gaps in data and knowledge about the broader environments within which use and management take place make it difficult to predict future trends and thus elaborate policy. A decade later, Belcher *et al.* (2005) opined essentially some of the same problems, arguing that vast differences in the products and the social, economic and ecological contexts make it difficult to communicate lessons learned. Throughout the 1990s and at the start of the new millennium, authors like Iqbal (1993), Vantomme (2003), Cocksedge (2010) and more recently, Shackleton and Pandey (2014) voiced similar concerns, further identifying inventory, research and by extension, value estimates of key species as key impediments to demonstrating the value of NWFPs and further developing the sector.

Conceptually, Belcher (2003) argues that the distinction between wood and non-wood is of little use to community development, conservation or other aspects of forest management. Similarly, Mantau *et al.* (2007) opine that the dichotomisation of forest resources into timber and non-timber is overly simplistic, adding that reaching an operational definition for NWFPs is doubtful given the tremendous variety of products. The authors instead proposed a more holistic system, which distinguished between classes or groups of objects with similar characteristics, using comparative terms to highlight differences. In 1997, Padoch and Pinedo-Vasquez (1997) similarly argued that the dichotomy between timber

and non-timber resources was inappropriate: "We suggest instead that the scale of forestry operations and their degree of industrialization are more realistic and useful parameters" (pp 103). Discussions about multiple use forest management, or deliberate management of a particular forest area in a specific time period for various goods and services abound (Cronkleton *et al.* 2012, Herrero *et al.* 2013, Sabogal *et al.* 2013, Sheppard *et al.* 2020) yet have not contributed to breaking down the wood/non-wood divide. Some have argued that "NTFP" is still more useful than NWFP as it is a better reflection of local use (Shackleton and Pandey 2014).

Table 2 summarizes key terms and definitions found in literature, illustrating the degree of disharmony. The situation becomes more complicated if other sources, such as policies, legislative frameworks, standards and technical norms (e.g. for product classification, grading and certification) are consulted. For instance, a recent FAO study (Muir *et al*. forthcoming) looks at the various terms used in forest policies, not surprisingly finding a vast array of terms and definitions, even within the same policies. These range from the more common NWFP and NTFP to non-wood product or activity, non-wood plant resources, by-products, secondary, side-use, wild products, productive services of forest, non-wood resources, non-wood benefits, other forest products, non-wood forest resources, ecosystem services, wild fauna and flora, side-use, extractive, non-extractive, services, tourism, medicinal plants, special forest products, among others. Vidale and Tomasini (2018) found the same variety of terms used in standards and technical norms for product classification, grading and certification.

Table 2 groups "wild"-terms, terms that use the prefix non-, and other, related terms. Most of the wild-terms stress very little human intervention, if at all. These terms typically refer to plant-based products, although sometimes mention wild game. Some, but not all of the terms specify the source (e.g. forest). Overall, the prefix non- dominates, likely linked to the desire to distinguish these products from industrial, timber-centric forestry. It is important to note that for the purposes of official statistics, however, it is very rare to find a negative form to define a given thing. Overall, the terms with the non- prefix tend to agree on source (forest) although the definition of forest is not the same in all definitions and imply varying degrees of human intervention. For example, the FAO's Global Forest Resource Assessment (FRA) includes products like cork, gum Arabic, bamboo and rattan (FAO, 2015); the original incarnation of NTFP (DeBeer and McDermott, 1989) does not include products from plantations. Emery *et al*. (2006) arguably provide one of the most accurate interpretations of the environment in which these products are gathered, suggesting that they may be collected from different landscapes. Other terms used such as special products and botanical products illustrate that some of the terms are differentiated by degree of regulation. Others are products of culture and context (e.g. bush foods, wild crafting, non-traditional forest products). Finally, Dounias (2001, 2016) illustrates, through the terms para-cultivated and proto-cultivated, how the line between wild and farmed is not easily drawn (Table 2). The same challenge has complicated fisheries statistics, with a similar discussion surrounding wild and fattened fish.

A growing body of literature moreover suggests that so-called "wild" systems are not as virgin and pristine as previously thought (Levis *et al*. 2017, 2018, Maezumi *et al*. 2018, Willis *et al*. 2004). It is well documented that humans had a strong influence on forests in Central Africa, for instance, with vegetation across some parts of the region dominated by species indicative of cultivation (e.g. Marantaceae) (Oslisly *et al*. 2013). Similarly, Maezumi at al. (2018) demonstrate how persistent anthropogenic landscapes for the past 4 500 years led to a "hyper-dominance" of edible plants in modern forests in the eastern Amazon. Moreover, there are varying degrees of human intervention and the line between wild and domesticated is not only difficult to draw, but it is not static and may change depending on the context.

While there are sound reasons that justify the plethora of terms, the variety of terms and definitions creates challenges for compiling official statistics. It must be noted that the terms NWFP and NTFP, among the most commonly used terms, are not mutually exclusive; NTFP simply implies the inclusion of additional categories of wood products. So long as the purpose is explicitly stated from the outset of the data gathering exercise, both terms can be used. Additionally, while the wild versus cultivated dichotomy is complicated particularly from a botanical and ecological point of view, steps can be taken to break down the different scales of management to better enumerate the contribution of NWFPs and wild gathering to human society (Table 3) and in turn, better inform management and policy measures.

THE TROUBLE WITH NON-WOOD TERMS AND DEFINITIONS

- **Different organizational priorities or institutional make-up**

Institutional makeup and (changing) priorities have arguably shaped terminology and associated definitions. Anthropologist Mary Douglas (1986) posited in *How Institutions Think* that "institutions do the classifying". In other words, when institutions make classifications for us, "we seem to lose some independence that we might conceivably have had otherwise" (Douglas 1986). The term NWFP is arguably as much a fruit of the desire to develop a sound classification system as it is an institutional classification. The fuelwood crisis of the 1980s in the Sahel put fuelwood at the top of the forestry agenda, giving rise to an entirely separate group of practitioners dedicated exclusively to fuelwood and the setting-up of tree plantations for fuelwood and charcoal production. This dichotomy may have contributed to the decision to exclude activities related to wood in all of its forms from FAO's newly created programme on NWFPs in 1991, and wood from its definition on NWFPs. Other organizations likely have similar reasons for their term of choice.

TABLE 2 *Non-wood forest products, wild forest products and correlate terms*

	Term	Definition	Source
Wild- correlates	*Wild*	A 'wild' thing is anything which was not obtained by cultivation from seed and tending, but from collecting, breaking off, pulling, picking, shaking, seizing or catching for use by humans.	Trier, 1963, in Vera, 2000.
		Self-willed, wilful or uncontrolled in early Teutonic and Norse languages (from willed came wild); *wildeor*, a compound of *wild* and *deor*, meant beast, savage inhabiting a dismal region of forests.	Nash, R.F. in Wuerthner, Crist and Butler, 2014.
	Wild biodiversity	Wild foods, trees, forests, animals.	Powell *et al*., 2015.
	Wild nutrition	Nutrition from neglected crops, non-commercial foods, wild foods, indigenous edible species, "old foods".	Burlingame, 2000.
	Wild food/Wild food plants	Wild food is defined as anything edible that requires no human input to increase its production	Daudet, 2012.
		Plants, berries, fruit, nuts, mushrooms and game that are collected in the wild, to be consumed as food or drink.	Maes *et al*., 2013.
	Wild edible plants (WEP)	Defining features: (1) They are locally available and their use is based on traditional ecological knowledge; (2) They are a low-input, low-cost option for increasing nutrition and reducing the need to spend limited cash resources; (3) They provide greater benefits to vulnerable populations (poorer households, women, and children who are often disproportionately affected by climate events; (4) They contribute to livelihoods and are available during times of drought or conflict-driven famine; They tolerate water stress better than their domesticated relatives possessing an "*innate resilience to rapid climate change, which is often lacking in exotic species*"	Shumsky *et al.*, 2014.
	Wild forest products	WFPs are products other than wood derived from wild and semi-wild forests, as well as from sources in early stages of domestication, such as fruit trees, bushes, and orchards. This definition covers a wide range of resources and products including plants, fungi, fauna and soil.	Wolfslehner *et al.*, 2018.
	Wild forest food/ forest food	Wild forest foods are a subset of wild foods and refer to uncultivated foods from forested areas, such as bushmeat, fish, fruits, leafy vegetables, nuts and seeds (not including forest-based agriculture, e.g., shifting cultivation or agroforestry systems)	Rowland *et al.,* 2017.
	Wildcrafting/ wildcrafted products or species	The process of collecting from the wild; generally, a term applied to collecting material from the wild to sell or trade.	Vance *et al*., 2001.
Terms with prefix non-	*Non-wood forest products*	**Non-wood forest products (NWFPs) are goods of biological origin other than wood derived from forests, other wooded land and trees outside forests.**	FAO, 1999.
		Goods derived from forests that are tangible and physical objects of biological origin other than wood. *Explanatory notes 1. Generally includes non-wood plant and animal products collected from areas defined as forest. 2. Specifically includes the following regardless of whether from natural forests or plantations: gum arabic, rubber/latex and resin; Christmas trees, cork, bamboo and rattan. 3. Generally excludes products collected in tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. 4. Specifically excludes the following: 5. woody raw materials and products, such as chips, charcoal, fuelwood and wood used for tools, household equipment and carvings; grazing in the forest; fish and shellfish.*	FAO, 2015.
		[…] renewable resources that can be developed in a way that will improve people's livelihoods and that is compatible with or even encouraging of environmental conservation.	Belcher, 2003.

TABLE 2 (*Continued*)

	Term	Definition	Source
	Non-timber forest products	*The term NTFP encompasses all biological materials other than timber which are extracted from forests for human use; they are* extracted using simple technologies by rural people living in or near forests; managed, secondary or degraded forests are sources of non-timber forest products, plantations are not.	DeBeer and McDermott, 1989.
		[. . .] all tangible animal and plant forest products other than industrial wood, coming from natural forests, including managed secondary forests and enriched forests.	Ros-Tonen *et al*., 1995.
		Essential ingredients for NTFPs include: Biological products (i.e., not abiotic products or ecosystem services); Wild species (indigenous, naturalised, or alien) which means that the bulk of the total species population is self-replicating without human agency. A small proportion of the total species population may be only recently cultivated or domesticated at a local level, or self-reproducing within human-dominated systems; Harvested by humans, and thus fodder consumed by free-ranging animals would be excluded (as it would be accounted for under benefits from agriculture rather than NTFPs), unless it was harvested by humans and transported to the animals to consume; Consumptive and non-consumptive uses; available from any landscapes or ecosystems (including human dominated); the broad scale management objectives are set, monitored, and regulated by those on whose land the NTFP occurs; most, if not all, of the benefits from the direct or indirect use accrue to local livelihoods and wellbeing. The benefits accruing can act as an incentive to conserve the species or site if the necessary enabling factors and institutions are in place.	Shackleton *et al*., 2011.
		Plant and fungal material that is harvested as well as items that may be made from these materials; they may not be purely forest-related. This reflects the fact that woodlands contain open spaces, that peoples' gathering activities occur across different habitats and also that species do not necessarily occur where we might expect them.	Emery *et al*., 2006.
	Non-wood forest products and services (NWFPS)	The term Non-Wood Forest Products and Services (NWFPS) is one of the terms used when talking about the broad scope of functions, besides timber production, that forests fulfil.	Janse and Ottitsch, 2005.
	Non-traditional forest products	Non-traditional are biological and generally not cultivated. They are not timber; but can be made of wood. Collected in natural forests, these products are usually harvested and processed in small amounts. These products fall within four general categories: edibles such as mushrooms; medicinal and dietary supplements, including ginseng; floral products such as moss, grape vines, ferns, and other plant products used for decorations; and specialty wood products including hand crafted products such as carvings, utensils, and containers. They are also called non-timber forest products.	Hammet and Chamberlain, 1998.
Other related terms	*Minor forest produce*	"Minor forest produce" includes all non-timber forest produce of plant origin including bamboo, brush wood, stumps, cane, tussar, cocoons, honey, wax, lac, tendu or kendu leaves, medicinal plants and herbs, roots, tubers and the like.	Government of India, 2006.
	Minor forest product	The term "minor forest products" denotes all the animals, plants and things a forest produces, besides timber, which are used by man.	DeBeer and McDermott, 1989.
	Botanical forest products	Non-timber forest products are divided into two categories: *regulated* special forest products, which are derived from trees and are mainly taken from salvage timber (e.g. Christmas Trees, fuelwood, fence posts) and *unregulated* botanical forest products, which include: wild edible mushrooms; floral and greenery products; medicinal and pharmaceutical products; wild berries and fruit; herb and vegetable products; landscaping products; craft products; miscellaneous botanical forest products that do not fit into the above such as honey and "smoke woods".	Ministry of Forests and Range, British Columbia, 1995.
	Bush foods	Foods gathered or hunted from the surrounding area	Gittelsohn *et al.*, 1998

TABLE 2 (*Continued*)

	Term	Definition	Source
	Special forest products or Secondary forest products	Species harvested from forests for other than timber commodities. Refers to the same group of species—plants, lichens, fungi, and other organisms—collected from the forest for various uses including subsistence, education, research, recreation, and commercial enterprise.	Vance *et al.*, 2001.
Other related terms	*Neglected and underutilized species (NUS); "orphan crops/ minor crops"*	Those crops often considered 'minor' because they are less important than staple crops and agricultural commodities in terms of global production and market value. However, from the standpoint of the rural poor who depend on many of these species for their food security, nutrition and incomes, they are hardly minor.	IPGRI, 2002.
	Semi-cultivated/ semi-domesticated species	Techniques used to promote production of wild resources. E.g. By using special techniques to dig out the fleshy parts of the yam the Pygmy populations of Central Africa manage this wild resource in a way which guarantees a subsistence based on seasonal mobility.	Dounias, 2001.
	Para-cultivated species	Paracultivation defines a set of technical, social and cultural practices aiming at managing wild resources while keeping them in their natural environment; species which mobilize perennial harvesting practices aimed at managing the resources production while maintaining their original environment	Dounias, 2001, 2016.
	Proto-cultivated/ domesticated species	"first" domestication	Clement *et al.*, 2010, Dounias, 2016.

- **Contention over the exclusion of wood**

As aforementioned, according to FAO, NWFPs do not include wood and wood-based products, i.e. industrial wood, fuelwood or small woods such as poles, posts, utensils, masks, statues, chewsticks, bark products and chips are excluded from the category. DeBeer and McDermott (1989) argue that the "non-wood" label unsatisfactorily excludes important material resources derived from forests by rural people (DeBeer and McDermott, 1989). The wide use of NTFP over NWFP suggests this opinion is widespread (Table 1). Nevertheless, official statistics on fuelwood have been gathered by countries and compiled by FAO and other international agencies since the 1960s (with significant revisions during the 2000s) (Whiteman *et al.* 2002); the same attention has not been given to NWFPs, suggesting greater clarity is still needed on products other than wood. With this in mind, this does not prevent data users interested in NTFPs from adding woodfuel into the equation.

- **Differing legal or fiscal frameworks among countries**

NWFPs mean different things in different countries. Yet legal definitions for NWFPs do not necessarily align with international statistical classifications. "Minor Forest Produce" (MFP), for example, has distinct legal connotations in India (Government of India, 2006). The Panchayats (Local Government) Extensions to Scheduled Areas Act (PESA) in 1996 and the Scheduled Tribes and other Traditional Forest Dwellers Act, also known as Forest Rights Act of 2006, consolidate the tenure rights of individuals or communities over "Minor Forest Produce". The products are defined under the Act as "all non-timber forest produce of plant origin including bamboo, brush wood, stumps, cane in addition to tussar, cocoons, honey, wax, lac, or kendu leaves, medicinal plants, and herbs, roots, tubers and the like" (Government of India, 2006). The same term and definition is used to gather national statistics related to these products, yet these do not align with international statistical classifications.

In Canada, NTFPs are divided into two categories: regulated "special forest products", which are derived from trees and are mainly taken from salvage timber (e.g. Christmas Trees, fuelwood, fence posts) and unregulated botanical forest products (Ministry of Forests and Range, British Columbia, 1995). The latter include: wild edible mushrooms; floral and greenery products; medicinal and pharmaceutical products; wild berries and fruit; herb and vegetable products; landscaping products; and craft products, valued in the millions of dollars (Ministry of Forests and Range, British Columbia, 1995, Statistics Canada, 2017). They also include "miscellaneous botanical forest products" that do not fit into the above such as honey and smoke woods (Ministry of Forests and Range, British Columbia, 1995) (Table 2). Data for these products however is scarce and Statistics Canada only reports information on maple syrup and taps (Statistics Canada, 2017).

Some countries have (more or less) aligned legal definitions to international statistical classifications. Italy's national Classification of Economic Activities (ATECO), for instance, refers to "the gathering of wild non-wood products" (0230) and includes mushrooms, truffles, berries, fruits, balata and other similar gums, cork, lacs and resins, balsams, fibres, chestnuts (*Aesculus hippocastanum*) (ISTAT 2007). The definition excludes wood, the cultivation of mushrooms, truffles,

berries and nuts, and includes cork cultivation (ISTAT 2007). Italy's recent Law on wild gathering aligns with this definition (Law 30, n. 145, par. 692–699, art.1, 2018). As such, the definition also aligns to international classification systems, although the term is slightly different as it refers to "wild non-wood products".

- **Lack of consensus on what constitutes "forest"**

Issues with the sub-components of the term have existed since it was first coined. In 1999 FAO took steps to define each of the sub-terms for improved information-sharing (FAO 1999). These sub-terms have since evolved under the work of FAO's Forest Global Resources Assessment (FRA). A key issue has been the origin of the NWFPs in question and the associated definition of "forest". Plantations were explicitly excluded from De Beer and McDermott's (1989) definition, which specified that NTFPs come from natural forests, because an inherent part of this category is conservation. FRA (2015) specifically includes products such as gum arabic, rubber/latex and resin; Christmas trees, cork, bamboo and rattan regardless of whether from natural forests or plantations. Products collected in tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover however are generally *excluded*.

There are many examples that illustrate that the question of origin is not straightforward, as the same product can be harvested across different landscapes. Coconuts, for instance, still exist in the wild, but the lion's share comes from well-established tree crop plantations on agricultural lands, of which their value is typically attributed to agriculture rather than to forestry because the designated land category is "crop/agricultural land". Fodder is another more complicated example as it can derive from natural forests, agroforestry systems, trees outside of forests and/or grasslands (Merlo and Croitoru 2005). The Forest Stewardship Council (FSC) explicitly excludes plantations managed for NWFPs (e.g. rubber, oil palm, coconuts) from the scope of forests and forest certification (FSC 2017) on the basis of this grey area.

Country contexts or directives regarding what is a forest product (or what is an agricultural crop) moreover may not necessarily align with international classification systems. For example, in China the term "productive forest products" is used for any production on lands belonging to the Chinese Forestry Department not differentiating between wood and non-wood goods, nor origin (e.g. plantation versus products harvested in the wild) (State Forestry Administration of Forestry Statistics, 2017). Products that in most countries are considered agricultural crops such as apples, walnuts, cloves, olives, grapes, hazel and hickory nuts are thus reported under forest product statistics (State Forestry Administration of Forestry Statistics 2017). China therefore links the term to land-use. In Tunisia, alfalfa grass (fodder) is grown on lands classified as forests and managed by the Tunisian Forestry Department and thus considered a forest product (Merlo and Croitoru 2005). In Canada, NWFPs can include products gathered in the wild in either timber-productive or non-timber productive forests and lands such as mushrooms produced in forests under varying levels of management, maple syrup, or products from agroforestry systems such as wild ginseng or wild blueberries planted as field crops (Ministry of Forests and Range, British Columbia, 1995). Land-use is thus at the heart of the definitional issue, and illustrates a key challenge associated with global harmonization; it can however also be a means to settling the debate if statistical boundaries are clarified (Table 3).

Shackleton *et al*. (2011) posit that from the perspective of species-level conservation (versus ecosystem) NWFPs falling outside the strict definition of [natural] forest should still be included in the category. Ros-Tonen *et al*. (1995, 2005) opine that it is important to distinguish between NWFPs from natural forests and managed areas (forest and tree crops agriculture) from the perspective of designing sustainable forest management systems. The origin of NWFPs continues to be a contentious issue, not least when measured against the original incarnation of NTFP (DeBeer and McDermott 1989). Moreover, many if not most products derive from forests (or other land) that experience some degree of human intervention; as aforementioned, most scientists now doubt the extent to which "untouched" wild areas still exist (Levis *et al*. 2018, Maezumi *et al*. 2018, Levis *et al*. 2017, Willis *et al*. 2004). The determining factor here should be that if it derives *mostly* from forest or other wooded land it should be reported under forestry statistics as a NWFP.

- **Products versus services**

Products and services constitute other contentious sub-components of the term NWFP. The desire to underline the under-appreciated value of forests contributed to broadening the scope of NWFPs to include ecosystem services (Shackleton *et al*. 2011). These include services such as ecotourism, hunting but also processes like carbon sequestration, water from protected catchments, and so on (Lund 1998). In 1998, Lund proposed the term "non-wood forest resources" to account for these services. The inclusion of services is in fact not uncommon in NWFP definitions (Table 2). Yet for the purposes of data collection, the inclusion of intangible services like carbon sequestration, water provision and so on makes the value of the sector even more difficult to quantify. Shackleton *et al.* (2011) argue that the consensus appears to be gravitating away from the inclusion of abiotic products, following the popularization of the term ecosystem goods and services and their classification into four categories as used by the Millennium Ecosystem Assessments, and the different associated issues involving their conservation and use.

To varying degrees, different countries also include activities such as hunting and ecotourism, particularly medicinal plant- and wildlife-based tourism in tropical forests in their definitions (Muir *et al*., forthcoming). Some countries exclude these services from their definition because they are covered under separate policies or strategies due to widespread use or cultural or historical importance. For example, although Scotland has a policy on NWFPs, hunting is not included in this policy as it is addressed separately (Forestry

Commission Scotland 2009). It is worthy to note that in some industrialized countries, NWFPs are increasingly being commercialized as recreational services, where forest owners are selling "experiences", such as mycotourism in Spain, "traditional product" discovery in Italy (e.g. chestnut and truffle roads), forest bathing in Japan (and increasingly elsewhere such as in Europe and North America), suggesting that recreational/tourism services might be worthy of inclusion in future definitions (Wolfslehner *et al.* 2018). For the purposes of statistical gathering, however, this is ultimately settled by the type of statistical classification system to which it might belong i.e. on products or goods, such as the Harmonized System (HS), the Central Product Classification (CPC) or by the activity, for example the International Standard Industrial Classification of All Economic Activities (ISIC) (UN 2008, UNSD 2015, WCO 2017).

- **Difficulty drawing the line between wild and domesticated (cropped)**

Different interpretations regarding the degree to which NWFPs should only include products harvested from the wild and/or if domesticated or semi-domesticated products should also fit into the category have made the debate on definitions particularly challenging. Currently, the UN ISIC defines the gathering of NWFPs as the collection of wild growing materials (class 0230) (originally in the ISIC as "the gathering of uncultivated materials" to differentiate the products from crops) (UN 2008). From a botanical point of view, however, all current domesticated varieties derive from wild ancestors (and many from natural forests) and this tends to be the historical trajectory of most NWFPs, quite simply because domestication allowed for greater efficiencies in production and time/energy involved in harvesting. Products such as rubber (*Hevea brasiliensis*) or oil palm (*Elaeis guianeensis*), walnuts and almonds, for example, are often no longer considered NWFPs because they are mostly plantation-derived, despite the fact that extraction from the wild continues (e.g. Indonesia, West Africa, the Amazon). Yet these products have rich historical legacies as having been key NWFPs in the past (Sills *et al*. 2011). Many NWFP species are actually in a dynamic process of domestication, or a "cultivation continuum", moving from traditional gathering/hunting practices in forests towards more intensive cultivation on farms (Vantomme 2011). Homma (2012), in his seminal pieces on plant extractivism in the Amazon, describes at length the process that extends from the discovery of wild resources to extractivism, management, domestication (e.g. "crops") and ultimately the discovery of synthetic substitutes, which is the path of some (but not all) NWFPs of commercial value (Homma 2012).

Furthermore, this trajectory is not necessarily linear. Many products may be simultaneously farmed and also collected in the wild. Rosa canina, or *Mespilus germanica* for instance have been widely cultivated in Europe (particularly until the 17th century) and can also be found growing in the wild (Meyer *et al*. 2012). The wild versus domesticated discussion presents obvious challenges from a botanical point of view. A good compromise for the purposes of data gathering could be to clarify the boundaries between products deriving from different land-use classifications and types of management (or lack thereof) to the degree possible (Table 3).

- **Disaccord over the inclusion of both animal- and plant-based products as NWFPs**

NWFPs are classified in many different ways according to their end use: edible products, medicine, fodder for domestic animals, perfumes and cosmetics; colorants; ornamentals; utensils, handicrafts, and construction materials; and exudates like gums, resins, and latex, many of which derive from both plants and animals. Yet international standards used for statistical gathering set by UN such as the CPC or the ISIC refer to NWFPs as plant-based products extracted from the wild (UN 2008). However, many institutions, FAO among them, also consider animal products (wild game, bushmeat, insects, furskin, trophies) as well as apiculture products (honey, beeswax, propolis, etc) NWFPs. While these commonly feature in definitions of NWFPs, they generally make up a different class according to international standards. In official statistics, most animal products feature in the veterinary/zoological system as game, for which there is some information available (Sorrenti 2017). Some countries (mostly in Europe and Northern America) have taken steps to collect statistics on game meat but with limited success (UNECE and FAO 2018). Inland/freshwater fish are also not considered under gathering of NWFPs and feature under fishery statistics. This dichotomy is also reflected in many country policies which separate plant- and animal-based NWFPs (Forestry Commission Scotland 2009, Muir *et al.* forthcoming), but again this does not stop the data user from deriving this information.

Generally speaking, better data is available for plant-based NWFPs, with the exception of honey. According to available statistics, 90 percent of the total commercialised output by countries originates from five major categories of NWFP use, in order of their reported economic values: food (fruits, berries, vegetables, mushrooms, nuts); exudates (gum arabic, pine resins); other plant products (bamboo, rattan, cork); honey; and ornamental plants, mainly Christmas trees and plant materials used for decorative purposes (Vantomme 2003). This estimate does not consider however bushmeat, insects or inland/freshwater fish.

MOVING BEYOND THE WOOD/NON-WOOD DIVIDE

(1) Beyond forests

Over the years, scientists and institutions have proposed a multitude of terms and definitions (Table 2) more or less driven by different objectives and opinions on the aforementioned challenges (Belcher 2003). Most recently, Shackleton *et al*. (2011) propose a working definition which seeks to address many of these bottlenecks. Others have sought to overcome NWFP invisibility by addressing "major" NWFPs

determined by the degree of commercialization and trade, without directly fleshing out terms and definitions. Vantomme (2003) for instance moves beyond definitions to propose a phased approach to compiling statistics which first address NWFPs that are of national relevance and for which monitoring and evaluation is needed for policy and forest/rural development decision-makers. This would be followed by a second phase addressing "minor" NWFPs. As stated by Vantomme (2003), countries can make NWFPs more visible in their existing national production and trade statistics by including specific product codes for NWFPs into their existing national product classification system, with the aim of including them in international statistical classifications in the future. Similarly, Padovani (1995) proposed focussing on products with a long tradition of international trade such as cork, gums, vegetable oils, essential oils and waxes. These proposals remain valid and important steps, yet methods for improving NWFP statistics must begin with terms and definitions.

Despite sound and justified cultural, legal, ecological and institutional reasons which make convergence on terms and definitions difficult, harmonization is not impossible. The authors however refrain from proposing a new term and definition given the well documented abundance. They also acknowledge that, however unfortunate the negative prefix of the term is, non-wood and non-timber forest products appear be have gained wide currency as terms of choice and many people now identify them. The term NWFPs in particular has also been adopted by international statistical classification systems, which can take many years to amend. ISIC for instance has been revised only six times since 1948 (UN 2008). It should thus be a point of departure for improving classifications, even though the authors acknowledge that terms like wild forest products, natural forest products or environmental products are more suitable for communicating with stakeholders, particularly those outside of the forest sector.

The first proposal is thus to continue using the term non-wood forest products, already in use in international classification systems. The current FAO definition (FAO 2015), which is already being used to collect data in over 230 countries, should however be amended to include products from *other wooded land* into its current definition:

> *Non-wood forest products are goods derived from forests* ***and other wooded land*** *that are tangible and physical objects of biological origin other than wood.*

This links the term to land use and is moreover more coherent with the FAO FRA 2015 definition of *forest*, in other words, land designated as forest *and other wooded land*. It is also more coherent with how wood products statistics are collected. Currently, different criteria are being applied to wood and non-wood products in international classification systems, inasmuch as wood products can also exist in planted/managed forests while NWFPs cannot exist in controlled environments (with the exception of some products like cork and gum Arabic). Until now, only products collected in the wild and from forests have featured (if at all) under official NWFP statistics: under the CPC, NWFPs feature under section 032 as "natural gums and resins, gums-resins and oleoresins", "natural cork, raw or simply prepared", "other wild edible products" and "parts of plants used primarily for dyeing and tanning, vegetable products n.e.c." (UNSD 2015). The explanatory text captures NWFPs that *exist only in the wild;* those that imply a form of human intervention are explicitly excluded. As per the CPC classification, all NWFPs that are to some degree managed or cultivated, which today includes a wide array of products should be considered agricultural products. This is not consistent with the collection of official statistics on wood. For example, chestnuts are currently considered agricultural products while chestnut wood as a product of forests and logging. The same can be said for pine nuts and pine wood, brazil nuts and wood, and so on. These products could easily be "re-attributed" to forestry instead of agriculture to paint a more accurate picture of forest sector contributions to lives and livelihoods.

A further explanatory note is recommended in the FRA to broaden the FAO (2015) definition further to include products such as fruit/nut bearing trees which may be produced on an industrial scale such as karité nuts, kola nuts, brazil nuts, pine nuts, among others, which are currently accounted for in agriculture, despite deriving from forests (UNSD 2015). Table 3 summarizes these definitional improvements. "Reclaiming" farmed forest products, many of which are economically and culturally important and historical NWFPs (brazil nuts, acai and so on) would enable more products to be captured under the term,. While some products would still be left out of this definition (e.g. fodder, utensils, handicrafts and construction materials, colorants with animals or parts, non-edible animal products use for tools, for instance) it is because their values are very rarely quantified and reported, and trade is not existing or in very small volumes. These products can still be captured using the appropriate codes under the classification activity, including the "gathering of NWFPs" (UN 2008).

Some countries have already demonstrated that this approach is possible. Finland for instance has collected data on wild, edible forest mushrooms since 1980 on the following species: *Boletus pinophilus, Boletus reticulatus, Cantharellus cibarius, Lactarius rufus, Lactarius trivialis, Lactarius utilis* and others (Sorrenti 2017). Japan's Statistics Bureau collects data on forest mushrooms, and the Forest Agency on the production of matsutake specifically (Sorrenti 2017). Korea, Italy and Brazil also have rich data on forest nuts e.g. chestnut, brazil nuts (which are only harvested in wild stands), pine nuts (although these are attributed mainly to agricultural production in international statistical databases).

(2) Closing in on the wild versus farmed debate

The second proposal is to draw upon lessons from the fisheries sector to break down the different degrees of management. Forestry and fisheries faced similar historical trajectories in terms of public scrutiny during the late 1980s and 1990s respectively, in part generated by media events shedding light on the depletion of forest resources and fish stocks (Pauly and

TABLE 3 *Positioning NWFPs in agricultural statistics*

Product	Wild products	Non-wood forest products			Agricultural products			Fishery products		
		Goods derived from forests and other wooded land that are tangible and physical objects of biological origin other than wood.			Any product, raw or processed, marketed for human consumption or animal feed.			Fish, molluscs, crustaceans and other aquatic animals, residues and aquatic plants.		
		Wild forest products	Semi-wild forest products	Managed forest products	Agroforestry products	Crop products	Livestock products	Fish catch	Enhanced capture	Aquaculture
Definition	Untended biological resources other than wood obtained from gathering.	Untended biological resources other than wood gathered in forests and other wooded land.	Biological resources other than wood gathered in forests and other wooded land subject to some form of human intervention to increase productivity.	Biological resources other than wood gathered in managed tree production systems where primary designated land use is forest.	Products collected in agroforestry systems when crops are grown under tree cover where primary designated land use is agriculture.	Actual harvested production from the field or orchards.	Products from live and slaughtered animals.	Fishery products taken for all purposes – commercial, industrial, recreational, subsistence – and by all types of fishing units (fisherman, vessels, gear, etc.).	Fishery products raised in open spaces (e.g. oceans, lakes) where they grow using natural food supplies and released for instance by national authorities and re-captured by fisherman as wild animals.	Farming of aquatic organisms through a form of intervention in the natural rearing processes such as regular stocking or feeding.
Notes	Medicinal and aromatic plants, for instance, collected on shrublands outside forests or other wooded land.	Wild fruit, nuts, vegetables, mushrooms, game, edible insects, honey, fodder, building/ construction materials.	e.g. acai production in Amazonia; wild tubers/yams in sub-Saharan Africa.	Specifically includes the following regardless of whether from natural forests or plantations: gum arabic, rubber/ latex and resin; Christmas trees, cork, bamboo and rattan. *Forest nuts and berries should also be included if from forest/other wooded land.*	For example, multipurpose trees on crop lands. *Land use criteria is the defining factor in this case.*	Includes products collected in tree stands in agricultural production systems, such as fruit tree plantations and oil palm plantation.	*Includes honey and beeswax; *honey harvested from forest should be included as a NWFP.*	Refers to catches of fisheries products operating inland, fresh and brackish water areas and inshore, offshore and high-seas fishing areas.	Also includes wild caught fish raised temporarily in holding facilities.	Implies individual or corporate ownership of the stock being cultivated.

Source: FAO 2015a; FAO 2019; EUROSTAT 2014. (author's own elaboration)

Zeller 2003). Much like public mistrust of the forest sector associated with illegal logging and the destruction of rainforests and wildlife in the tropics, the fisheries sector also faced public environmental concerns over the unsustainability of the industry and growing number of endangered species such as the Southern Bluefin tuna (*Thunnus maccoyi*) and Northern cod (*Gadus morhua*) (Pauly and Zeller 2003). Assessing the health of ecosystems, including resources assessment and the impact fisheries operations, were a key motivation behind improving official fisheries statistics, particularly during the early 2000s with the development of the "strategy for improving information on status and trends of capture fisheries" (FAO 2003) by the Advisory Committee on Fisheries Research (ACFR) and subsequent steps. In the forest sector, official statistics on forest resources have been collected by FAO for over 70 years largely motivated by the same concerns, but the information on "forest products other than wood" was only collected between 1954 and 1971 by FAO, leaving a large part of the forest (NWFPs) unaccounted for, largely due to the aforementioned challenges of terminology, definitions, and breadth of products in the category. FAO FRA has made attempts to collect data on NWFPs since 2000. The approach used was to identify and describe products of national relevance "for which monitoring and evaluation are most urgently needed" (FAO 2000). The products highlighted in FAO FRA 2000 include those widely used on national markets or gathered for export as a first attempt to help countries improve data collection (FAO 2000). That said, only a fraction of countries report data on NWFPs.

The approach of fisheries, which distinguishes wild versus farmed fish, could prove equally functional in improving official statistics on NWFPs, which currently include only wild products. In fisheries, wild catch refers to "fishery products taken for all purposes – commercial, industrial, recreational, subsistence – and by all types of fishing units (fisherman, vessels, gear, etc.). Aquaculture meanwhile implies "a form of intervention in the natural rearing processes such as regular stocking or feeding" (EUROSTAT 2014). In between these two ends are "enhanced capture" species (e.g. semi-wild), which include those raised in open spaces (e.g. oceans, lakes) where they grow using natural food supplies and released for instance by national authorities, or wild caught fish raised temporarily in holding facilities (FAO 2015b). Breaking down the different types of NWFPs produced on the wild to farmed gradient (Table 3), much like has already been done in fisheries, could prove equally effective to better capture NWFPs in official statistics.

There is also an opportunity to obtain a better picture of NWFP use through the lens of access and use rights, similar to the approach used in fisheries. Aquaculture implies individual or corporate ownership of the stock being cultivated (EUROSTAT 2014). Fish in fact are considered common resources requiring collective management, which has led to a range of regulatory policies and legislation on fishing techniques permitted; they are typically not owned until they have been caught (EUROSTAT 2014). Similarly, it would be possible to obtain better information on NWFPs on the basis of access and use rights (i.e. wild harvested products where one has access or harvesting rights versus cultivated products for which one has ownership/tenure rights). This information can be obtained for some products through permits or licenses (e.g. hunting, mushroom picking, etc.) or tenure rights (e.g. plantation). While there are potential complications (e.g. with customary rights) this approach could contribute to getting a more accurate picture of people involved in the activity of collection or managing NWFPs.

(3) Beyond forests…towards wild gathering

For too long, NWFP data gathering (or the absence of such) has focussed on product classification systems. However, the very nature of NWFP gathering entails harvesting of products across landscapes (Emory 2006, Powell 2015). Thus, while the forest/agriculture boundary can illuminate production and consumption of NWFPs, there are still many products that will not be captured because they are harvested from outside of these sectoral boundaries (i.e. so-called "bush", natural systems outside or in between forests and cropland, or wild resources gathered on agricultural land). Nowhere is this more evident than in the collection of household-level data, where respondents often have a difficult time "placing" the origin of harvest because more often than not, gathering occurs across landscapes. Ongoing landscape transformations complicates this exercise (Ramussen *et al*. 2017). Far easier would be to distinguish between products that households cultivate and tend to directly on their homestead and those that they gather elsewhere (for example from land that is commonly owned or for which they have access to, and which may entail varying degrees of management) (Table 3).

As such, the third proposal is to move beyond product classification systems towards activity classifications to capture gathering of NWFPs that may not be accounted for under crops nor under forest products, given that they may be harvested in between these boundaries. Gathering of NWFPs already exists in the ISIC under Group 023, Class 0230 of Section A on Agriculture, Forestry and Fishing. The division includes the "extraction and gathering of wild growing non-wood forest products", specifically mushrooms, truffles, berries, nuts, balata and other rubber-like gums, cork, lac and resins, balsams, vegetable hair, eelgrass, acorns, horse chestnuts, mosses and lichens." While some of the same problems arise with regards to wild or uncultivated versus managed production (e.g. cork, truffles, mushrooms, etc.), the emphasis on gathering could capture products that may be more difficult to place as they are harvested on different types of land.

The European Community has a similar classification system known as "Statistical Classification of Economic Activities in the European Community" to coordinate statistical information among industries (NACE codes). Under the NACE code system there is a specific business category for "gathering of wild growing NWFPs", code 02.30, however, similar to the ISIC, there is limited information reported under this category because many NWFP activities continue to remain informal, and the more formal activities are typically reported as agricultural even if they involve NWFP

harvesting (shea nuts, gums and resins, brazil nuts) (Vidale 2018). The introduction of legislative measures to regulate gathering of NWFPs could, in some contexts, support the gathering of information on a largely informal and invisible sector, and at the same time support the monitoring of wild resources. In late 2018, for example, Italy introduced a standard gathering income tax of 100 Euros (essentially tax exemption) for the gathering of different types of NWFPs such as mushrooms, truffles, berries, medicinal and aromatic plants, so long as sales from these activities do not exceed 7 000 Euros (Law 30, n. 145, par. 692–699, art.1, 2018). This is set to give unprecedented visibility to activities carried out by part-time or occasional collectors, as demonstrated in the first few months of its implementation. (These measures and methods may not always work, as some contexts require "a lighter hand" (Laird *et al*. 2011). For game meat, among other products, similar information can be obtained from permits for hunting or gathering of NWFPs. A recent UNECE/FAO questionnaire aiming to capture production of game meat in Europe concluded that future questionnaires should request number of hunting licenses, which could be a good indicator of the value of game (UNECE and FAO 2018). While much work is still needed on this front, it is clear that efforts to improve NWFP visibility should also include the activity of gathering rather than on products alone.

CONCLUSION

The semantic confusion on NWFPs should come as no surprise. As aforementioned, NWFPs refer to a broad range of species from all over the world with extremely different ecologies and livelihood roles, and equally diverse market chains, end products and consumers (Laird *et al.* 2011, Shackleton and Pandey 2014, Wong *et al.* 2001). Nevertheless, since the term was coined, there has been wide acknowledgement that the proliferation of terms has created a lot of confusion among scientists, statisticians and decision makers, inhibiting understanding and progress in research and development, communication and reporting (Belcher 2003). The plethora of terms and definitions in particular have made it impossible to collect globally comparable data through time. As a result, information on NWFPs is patchy and incomparable across countries. Undoubtedly, the sheer number of products and different end uses coupled with challenges surrounding non-standard units of measurement and terminology issues all make NWFP quantification problematic. Cultural and contextual differences regarding how these products are perceived in different countries/regions and by different entities will however likely mean that they will continue to be referred to colloquially with varied terms and definitions. Differing national legal and fiscal connotations equally suggest a single universal term is highly unlikely.

At the same time, statistical gathering need not necessarily adhere to botanical or cultural standards; these classifications often require compromises. As such, some important but not impossible "first steps" should be taken to make NWFPs and wild products more visible in official statistics. In sum, these include (1) amending the current FRA definition to include *other wooded land* and forest products from plantations (e.g. pine nuts, chestnuts, brazil nuts) if they adhere to FRA's definition of land use and criteria for height and canopy cover for forests and other wooded land, and to reclaim "farmed/managed" forest products currently under agriculture; (2) related to this, providing countries/statistical entities with improved guidance on accounting for both wild and managed NWFPs in official statistics (Table 3); and (3) capturing NWFP contributions through the *activity* of gathering in and outside of forests. The aforementioned proposals will not satisfy all NWFP practitioners, nor do they necessarily settle the wood/non-wood divide, however they are practical steps that, if taken on board by statistical entities (e.g. international statistical agencies, national statistical offices and/or government ministries) can help paint a more accurate picture of NWFP contributions to economies, livelihoods and diets, and ultimately better inform policy, land-use decisions and nutrition interventions, where these products remain under or un-represented largely because there is currently very little data to "make a case".

Future steps should include building on existing efforts to integrate questions about NWFPs and gathering practices into livelihood, agricultural and dietary surveys (FAO *et al*. 2016), including exploring opportunities to disaggregate data across agro-ecological zones with the support of geo-referenced health data; building statistical capacity to collect information on these products and practices (guidance and clarity on terms and definitions is a good first step); integrating NWFPs in forest inventories (Lynch *et al*. 2004); and, as appropriate, aligning fiscal and legal measures with international statistical classifications to better capture the gathering of NWFPs (e.g. Law 30, n. 145, par. 692–699, art.1, 2018). Finally, in parallel with improvements in official statistics (which can take time and be costly) (WCO 2014), more innovative approaches will also be required to better enumerate the contribution of NWFPs and wild products to lives and livelihoods. Recent methods to estimate the "hidden harvest" of fish, which tends to go unreported in official statistics, could for instance be applied to NWFPs (Fluet-Chouinard *et al.* 2018). Non-traditional data sources should also be explored, for example data generated by citizens through mobile data ("citizen science"), commercial data sets, and/or satellite data, among others (Fritz *et al.* 2019).

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views or policies of the Food and Agriculture Organization of the United Nations.

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