Who are forest-dependent people? A taxonomy to aid livelihood and land use decision-making in forested regions

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\textbf{Abstract}

The relationship between forests and people is of substantial interest to peoples and agencies that govern and use them, private sector actors that seek to manage and profit from them, NGOs who support and implement conservation and development projects, and researchers who study these relationships and others. The term 'forest-dependent people' is widely used to describe human populations that gain some form of benefits from forests. But despite its long history and widespread use, there are substantial divergences in who the term refers to, what each of its constituent words mean, and how many forest-dependent people are globally. This paper identifies the range of existing uses and definitions of the term 'forest-dependent people', and summarizes them in a systematic taxonomy. Our taxonomy exposes the dimensions that characterize the relationships between people and forests, and leads to two conclusions: First, an absolute, universally accepted definition of the term is untenable. Rather, users of the term 'forest-dependent people' need to comprehensively define their population of interest with reference to the context and purpose of their forest- and people-related objectives. The framework and language of our taxonomy aims to aid such efforts. Second, conservation and development program funders, designers, and implementers must reconsider whether forest dependence is an appropriate target for policy objectives.

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1. Introduction

Forests are a source of food, fuel, fiber, and income for millions of people globally. Forest-based industries provide employment and revenue for many others (\textit{Angelsen et al., 2014}). Forests also generate environmental services on local, regional, and global scales (\textit{Bishop and Landell-Mills, 2002; Ojea et al., 2016}). These interactions between forests and people are of significant interest to researchers who study them, and to government agencies, private sector actors, and NGOs, who fund and implement conservation and development projects to improve environmental and socio-economic outcomes in and around forests. Such interest is mounting, particularly in the context of forest certification, payments for environmental services programs, and forest-based climate change mitigation mechanisms (e.g. REDD+) that aim to achieve both forest conservation and socio-economic development (\textit{Kanowski et al., 2011; Thompson et al., 2011}).

The term 'forest-dependent people' is widely used to describe human populations that derive benefits from forests in some way. In particular, the term is often used to refer to rural people living in poverty, including indigenous and traditional people, in substantially-forested developing countries. In academic literature, the term 'forest-dependent people' is frequently used to define the population of interest to a particular study: a Google Scholar search in October 2015 returned 2373 articles that use the exact term (\textit{Fig. 1}). Donor agencies and NGOs refer to forest-dependent people in multiple contexts. For example, many research projects (\textit{CIFOR, 2014; Miah, 2014}) and some entire research organizations (\textit{CIFOR, 2008}) are named or oriented around the term 'forest-dependent people'. Additionally, some NGOs and donors use the term to define targeted beneficiaries of their actions and programs.

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improving the livelihoods of forest-dependent people is a stated objective of the UN (UN, 2008), and people’s dependency on forests is highlighted in the UN Sustainable Development Goal 15 (UN, 2015). Finally, some donors measure the success of their programs using metrics and indicators that explicitly incorporate the term (ICF, 2014). Interpretation of the term ‘forest-dependent people’ is therefore of central importance to research, funding, and program activities aimed at forest–people interactions.

Despite the widespread use of the term ‘forest-dependent people’, there is little discussion and less agreement about who the term includes (Byron and Arnold, 1999). Papers that do formally define the term, or which at least describe attributes of the people they refer to, do so in multiple, divergent ways. The lack of agreed definitions means that it is also extremely difficult to compare across cases when the term ‘forest-dependent people’ is used in different ways. If two studies use different definitions and report contrasting outcomes of the impact of a particular development program on a population of forest-dependent people, it cannot be known whether that difference is a consequence of differences in definitions, different methods used to operationalize similar definitions, in the data used to derive forest dependence estimates, or for some other unknown reasons. At the very least, donors, governments, project managers, and NGOs need a clear sense of the definitions being used to compare cases of forest dependence and the relevant context, and to understand the impact of their programs and investments in the forest sector (Caplow et al., 2011).

There is also enormous uncertainty about how many forest-dependent people there are in the world (Chao, 2012). Multiple estimates exist at both global and national levels, but they vary by orders of magnitude, in part because of the wide variance in definitions. Beyond lack of clarity over who counts as ‘forest dependent’, a major challenge in generating meaningful estimates lies in the difficulties in bringing together demographic, socio-economic, and forest cover data (Calibre Consultants, 2012). These difficulties in comparing and estimating numbers mean that it is very difficult to understand the scale of any challenge or solution that concerns forest-dependent people, and to know where efforts to study or support forest-dependent people should be targeted or have been effective.

Forest-dependent people have most frequently been defined according to their membership in demographic groups that adopt particular livelihood strategies (Byron and Arnold, 1999; Shepherd, 2012). Such definitions of forest-dependence include “hunters and gatherers”, “shifting cultivators”, “wealthier farmers”, and “poor farmers” (Byron and Arnold, 1999, 797–799). However, such an approach to understanding forest dependence clusters diverse individuals and groups of people into somewhat arbitrarily-determined categories of livelihood strategies. Resulting typologies of forest dependence not only fail to capture the multiple dimensions of relationships between people and forests, they also fail to recognize that an individual may be dependent on forests in ways that blur category boundaries and that the specific categories are always subject to challenge because of their very arbitrariness. As importantly, such a definition of forest dependence is exceedingly difficult to operationalize across contexts and landscapes. A more systematic, disaggregated approach to the relationships between people and forests is necessary for a more comprehensive and generalizable understanding of who forest-dependent people are. This study takes a critical step in that direction by identifying the range of existing uses and definitions of the term ‘forest-dependent people’, and summarizing these in a systematic taxonomy.

2. Methods

2.1. Literature search

We conducted a literature review to explore and summarize existing uses of the term ‘forest-dependent people’. Our review began with the top 100 results for a Google Scholar search on the exact phrase ‘forest dependent people’ in November 2014. Google Scholar was more useful than Web of Science, as it captured grey literature (e.g. program documents and reports) from donors, NGOs, and program agencies, as well as research papers. We additionally employed a ‘snowball’ approach, to include an additional 30 papers that were cited by the top hundred papers identified during our initial keyword search. Our aim was to cover the most common characterizations of the phrase, ‘forest-dependent people’. For each identified paper, we extracted all characterizations (i.e. definitions or descriptions) of ‘forest-dependent people’, and disaggregated the characterizations into singular ‘dimensions’ that relate to a specific single aspect of a relationship between forests and peoples’ livelihoods. We identified eighteen dimensions along which the term was defined (see Results). Among the 130 articles reviewed, all but two of these dimensions had at least five examples; the majority (12/18) had at least 10 examples. Thus, we deemed that by this point we had achieved our objective of identifying the key dimensions along which ‘forest-dependent people’ are defined, and that there would be rapidly diminishing returns of reviewing additional papers. Only papers written in English were reviewed, since this is the dominant language of international policy.

2.2. Taxonomy construction

We created a new taxonomy of forest-dependent people based on our review. Our taxonomy represents the key dimensions that characterize relationships between forests and people’s livelihoods as described in the literature. We created a new taxonomic ‘branch’ for each dimension of forest dependence we encountered. Under each branch of the taxonomy, we cite references that explicitly discuss or implicitly allude to that dimension of forest dependence. However, citation of a particular paper within a particular branch does not imply that that paper characterized forest dependence only in that manner.

3. Results

The literature on forest-dependent people uses the term in a wide range of contexts, with corresponding variation in the characterization, scope, and use of the term. The term has been...
used in at least 2373 publications since 1991 (the first use of the term we encountered; (Kusel and Fortmann, 1991)) (Fig. 1). In total, we reviewed 130 different publications that used the term ‘forest-dependent people’. Of these, 22 did not indicate how they characterized the term. The remaining 108 provided either an explicit definition or, more commonly, an informal description of how the term was interpreted or characterized in the context of that publication (Appendix A in the supplementary material).

Fifty two of the 130 reviewed papers focused only on countries (one or more) within the tropics, while 14 papers focused only on countries (one or more) outside of the tropics. Sixty two papers took a multi-country perspective that included countries both within and outside of the tropics. Two papers did not indicate a geographic perspective. Fifty four papers focused solely on low-income, lower-middle-income, or upper-middle-income countries, while nine papers focused solely on high-income or high-income OECD countries. Sixty five papers included countries from both groups (World Bank, 2016).

Characterizations of ‘forest-dependent people’ varied considerably, particularly with respect to the part of the term that received the greatest attention. Some characterizations included references to the forest as a source of goods and services. The dimensions considered within such characterizations help to define what constitutes a forest product, or a forest service. Some characterizations included reference to dimensions of dependence. These dimensions highlight the contributions that forests make to livelihoods, and address the question of what constitutes significant use of, or reliance on, forests. Finally, some characterizations included references to the social or demographic groups of people who use forests. These characterizations emphasized the importance of the relationship between people and forests, including from a spatial perspective. In sum, different authors’ characterizations highlighted one or more alternate parts of the term to conceptualize forest-dependent people, forest-dependent people, or forest-dependent people. Therefore, we here disaggregate the term ‘forest-dependent people’, and consider the different dimensions of each component.

Fig. 2 presents our taxonomy of the relationships between forests and people, using information from our review (Fig. 2). All of the dimensions of forest dependence in this taxonomy have been suggested by different authors to be constituent components of a definition of ‘forest-dependent people’.

3.1. Dimensions that focus on ‘forest’

A first set of dimensions are based on the nature of the benefits that forests provide to humans. Although there is considerable discussion of what constitutes a ‘forest’ (FAO, 2000; Sasaki and Putz, 2009), it is widely acknowledged that forests – however defined – are sources of both products and services. These products and services constitute values that people derive from forests.

3.1.1. Forest-dependent people may extract products from forests

The physical collection of forest products is the most direct way in which humans use forests. Harvested resources include wood products, bushmeat and fish, and non-timber forest products. Characterizations of forest-dependent people can refer to humans that harvest one or more of these groups of products (Byron and Arnold, 1999; Angelsen and Wunder, 2003; Calibre Consultants, 2012; Chao, 2012).

a) Harvesting of wood products, including timber, firewood, and charcoal, from forests is one of the most common interactions between people and forests. Firewood is the principal form of cooking fuel for many people (e.g. 70% of rural people in India; (Khare et al., 2000)), and many others construct their homes from forest-sourced timber (e.g. more than 20 million Ghana-ians; (Appiah et al., 2009)), or sell charcoal as a source of income (Fisher, 2004; Larson, 2010).

b) Across the tropics, people derive protein from forests. Hunting for bushmeat is a primary source of protein for many people (e.g. 220–380,000 t of bushmeat are extracted from Ghana’s forests annually; (Gyimah and Dadebo, 2010)), while fishing from rivers in forest landscapes is the staple form of protein for many more (Ros-Tonen and Wiersum, 2005). In many places, surplus bushmeat and fish are sold for income (Ndoye and Tiegouhong, 2004).

c) Countless forest plant species are sources of non-timber (or non-wood) forest products (NTPPs or NWFPs) from forests (Timko et al., 2010). Such products include food (e.g. mushrooms and fruits; Arora, 1994), medicine (Belcher, 2005), fodder (Easterling et al., 2007), construction materials (e.g. palm leaves for roofing), and materials for artisanal production (Calibre Consultants, 2012).

3.1.2. Forest-dependent people may benefit from forest-derived environmental services

In addition to physical resources, forests generate many critical environmental services that support the well-being of humans. These services include regulating, supporting, and cultural services. Characterizations of forest-dependent people can refer to humans that benefit from one or more of these environmental services (Bishop and Landell-Mills, 2002; Dubois, 2003).

a) The regulation of hydrological and carbon cycles by forests support the livelihoods of people living both proximate to and far from those forests. Communities living within or close to forests may benefit from the provision of fresh drinking water; maintenance of waterways that support fish stocks or provide irrigation; or control of erosion and flooding (FAO, 1978; Dubois, 2003). On a regional and global scale, forests regulate the climate, storing and sequestering carbon, and affecting rainfall patterns (FAO, 1998; UNECE, 2014).

b) Some environmental services support the livelihoods of people living in or near forests. For example, insects that rely on forest habitats pollinate crops and cycle soil nutrients (FAO, 1998).

c) Finally, cultural environmental services are less easily quantified but are extremely important to the lives of many people. They include the recreational and spiritual values that people derive from forests (Byron and Arnold, 1999; Colfer et al., 2006).

3.2. Dimensions that focus on ‘dependent’

This second set of dimensions refer to the strength of the connections between forests and human wellbeing. While the use of the word ‘dependency’ in the context of development policy has been critiqued (Lall, 1975; Fraser and Gordon, 1994), most authors that focus on dependency in the context of forests and people use the term to infer that forest-dependent people’s livelihoods may be reliant on forests to some degree. Their livelihoods may be conditional on access to forest-derived benefits; that is, their livelihoods would suffer if forest access was reduced (Byron and Arnold, 1999). Most authors refer to relationships with people’s livelihoods, but non-livelihood related dependency also falls under this heading. Our review revealed two main ways in which human wellbeing may be reliant on forests.

3.2.1. Dependence may be interpreted in terms of livelihoods

a) People may be considered to be forest dependent if their subsistence livelihoods are in part derived from forests. That is, if some part of their own diet, housing, transport, fuel, or medicine comes from forests (Arora, 1994; Dubois, 1996; Ruiz Pérez, 1996; Vayda, 1997; FAO, 1998; Byron and Arnold, 1999; Dubois, 2003;
Holvoet and Muys, 2004; Fauchald et al., 2009; Tieguhong and Nkamgnia, 2012).

b) People may additionally or alternatively be considered to be forest dependent if their commercial livelihood is in part derived from forest products or services. That is, if some part of their income is derived from a forest-based economic activity (McSweeney, 2002; Easterling et al., 2007; Cronkleton et al., 2008; Timko et al., 2010). Such activities include: (i) Selling forest products (Haynes, 2003), such as timber, bushmeat, or NTFPs to neighbors or in formal markets; or selling environmental services, such as for ecotourism or via a payments for environmental services program. (ii) Engagement in agroforestry projects: growing trees, or commercially managing remnant forests (Raboanarielina, 2011). (iii) Working in forest enterprises, such as plantation management or timber mill operation (Humphrey, 1990; Kaimowitz, 2003; Tieguhong and Nkamgnia, 2012).

### 3.2.2. Dependence may be interpreted in terms of reliance

Having established that people’s dependence on forests can be described in terms of the contribution of forests to subsistence or commercial livelihoods, the degree of dependence may be considered in one or more ways. That is, dependence may relate to the extent to which people are reliant on forests, including the extent to which livelihoods would be worse off if forest access were to be reduced.

| Level I | Level II | Level III |
|---------|----------|-----------|
| 1. Forest | a. Products | i. Wood products |
| | | ii. Bushmeat |
| | | iii. Non-timber forest products |
| | b. Environmental services | i. Regulatory |
| | | ii. Supporting |
| | | iii. Cultural |
| 2. Dependent | a. Livelihoods emphasis | i. Subsistence |
| | | ii. Commercial |
| | | i. Non-livelihood benefits |
| | | ii. Proportion |
| | | iii. Frequency |
| | | iv. Substitutive |
| 3. People | a. Spatial relationship | i. Within |
| | | ii. Proximate |
| | | iii. Rural |
| | | iv. Access |
| | | v. Rights |
| | | vi. Downstream |

Fig. 2. A taxonomy of characterizations of ‘forest-dependent people’.
a) Dependence can have a meaning beyond livelihoods, and may include non-livelihood benefits to human wellbeing. In particular, urban dwellers who do not directly rely on forests for their subsistence or commercial livelihoods may none-the-less derive critical benefits from forests in the form of environmental services (e.g. protection of watersheds in which their food is grown, or climate regulation) (FAO, 1996).

b) One metric is to consider the proportion of a person’s livelihood that is derived from forests. This may be the proportion of a particular resource that is sourced from forests, or the proportion of multiple benefits sourced from forests (Pimentel et al., 1997; Bahuguna, 2000; Nayak and Berkes, 2008). For example, does all of a household’s income come from the sale of a particular NTFP, or do forest products rather supplement a predominantly agrarian income? Few authors stipulate what proportion should constitute dependence, but rather use language such as ‘most’, ‘mainly’, or ‘primarily’ (Poffenberger, 1996; McSweeney, 2002; Angelsen and Wunder, 2003).

c) Alternatively or additionally, forest dependence may be considered as the frequency with which a forest resource is collected or purchased (Adhikari et al., 2004; Timko and Kozak, 2014). For example, if a household regularly derives its protein principally from domestic livestock, but occasionally consumes bushmeat, they may be considered less forest dependent than a household whose staple protein supply is usually from fish caught in forest waterways.

d) Finally, dependence may be considered with respect to the extent to which forest-derived livelihood benefits may be non-substitutable, and the extent to which a person has an alternative available to them (Humphrey, 1990; Colfer, 1995; Cronkleton et al., 2008; Youn, 2009). If their forest-derived benefit could be substituted through a non-forest derived alternative, at low or no additional cost, then their dependence may be considered lesser than that for a person who has no alternative source for the same benefit.

3.3. Dimensions that focus on ‘people’

A third set of dimensions focus on the identification of relevant populations of people. These dimensions refer to the physical nature of the relationship between forests and people who derive benefits from them, emphasizing the spatial dimension.

3.3.1. Forest-dependent people may have a strong spatial relationship with a forest

a) People who live within forests (i.e. for whom forest is the dominant land use in all directions from their home) are often considered to be forest-dependent people. These include many traditional and indigenous communities, who have lived within forests for many generations (Halpin, 1990; Lynch, 1992; Wunder, 2001).

b) Forest-dependent people may additionally include those who live proximate to forests Belcher et al., 2015. That is, they live within a certain distance of a forest edge. In many cases, their commercial livelihoods may not be forest-based (e.g. they may be farmers; (Colfer et al., 2006; Fisher and Hirsch, 2008)), but because of their proximity or access to the forest they may depend on forests for some aspect of their livelihoods – for example, as a source of fuel, food, or supporting environmental services (Kusel, 1996; Lynch, 1998; Brown et al., 2002; Belcher, 2005; Bose et al., 2012).

c) Living in rural areas is considered by many authors to be a necessary dimension of forest dependence. That is, under this dimension, people living near to forests in urban areas would not be considered forest dependent (Schmithüsen et al., 1999; Uddin and Mukul, 2007; Osman-Elasha et al., 2009).

d) A fourth spatial dimension of forest dependence relates to people who have direct access to forests. This dimension considers people who live within or proximate to forests, but additionally extends to those who are connected by roads or waterways (Neumann and Hirsch, 2000; Padmanabha and Shell, 2007). Examples may include people who live in towns, but who visit forests to hunt for bushmeat or to recreate. Conversely, it may exclude people who live proximate to forests but who are prevented by barriers from accessing forest resources. Such barriers may be physical (e.g. fences) or institutional (e.g. strictly protected areas).

e) A further dimension, which could refine those based on proximity and access above, is to think about forest dependence as only signifying people who not only have access to forests but also have rights to forests (Djogo and Syaf, 2004). These access or user rights may be de jure or de facto, formal or customary (Poffenberger, 1996).

f) A final spatial dimension relates to downstream beneficiaries of forest products and services. This dimension refers to people who do not live within, proximate to, or with direct access to forests, but who none-the-less derive value from forests. Examples include downstream inhabitants of a forested watershed, who benefit from hydrological services; people who visit distant forests for recreational pursuits; consumers of forest products bought at urban domestic or international markets (Calibre Consultants, 2012); and, at the extreme, the global community, which benefits from the climate regulatory services that forests provide (UNECE, 2014).

4. Discussion

Our review revealed more than 155 different characterizations of ‘forest-dependent people’, with the earliest encountered use of the term by Kusel and Fortmann (1991) (Appendix A in the Supplementary material). A few authors did not characterize the term at all (e.g. Angelsen and Kaimowitz, 1999; Bhattacharya and Basnyat, 2003), in some cases perhaps because the term was used only in passing, and forest livelihoods were not the focus of the paper. Other authors provided multiple alternative characterizations within a single study or paper (e.g. Humphrey, 1990; Dubois, 2003). Some characterizations were extremely broad: for example, “poor people living in and around forests and using them to some degree” (Belcher, 2005, 83), and “anyone who ever makes any opportunistic use of some product of the forest” (Byron and Arnold, 1999, 789). Others were much narrower in scope: for example, people “whose livelihoods are directly or indirectly associated with forestry” (Tieghong and Nkamngia, 2012, 197). Of course, not all characterizations were intended to be universal definitions to be transferable across contexts or studies; many authors characterized forest-dependent people in relation to specific systems or with a particular purpose. However, the multiple characterizations used in the papers we reviewed illustrate the divergent ways in which the same term is used within the published literature. Similarly, not all characterizations were independent – many papers cited or adapted each other’s characterizations. But the adoption of one author’s characterization by a different author indicates that this second author recognized merit in the original characterization.

Our taxonomy contributes to an understanding of the multiple dimensions in which forest-dependent people can be characterized. In all, it identifies eighteen different dimensions. Many papers characterized forest-dependent people using two or more dimensions (Humphrey, 1990; Kusel, 1996; Calibre Consultants, 2012). Some dimensions of forest-dependent people are mutually exclu-
sive: for example, forest dependence cannot be restricted to those living in and around forests if one’s characterization of forest dependence includes regulatory climate services on a global scale. Other dimensions can be complementary: for example, forest-dependent people could be considered to be those who live in or proximate to forests, and who frequently extract forest products for their commercial livelihoods (e.g. Fisher et al., 1997, 4 “People who live inside forests… and who are heavily dependent on forests for their livelihood primarily on a subsistence basis.”). Combinations of different dimensions lead to the identification of widely varying populations as ‘forest-dependent people’, confirming our hypothesis that defining forest-dependent people solely according to membership in social or demographic groups that adopt particular livelihood strategies (Byron and Arnold, 1999; Shepherd, 2012) is not a wholly satisfactory way of tackling the question of ‘who are forest-dependent people?’.

4.1. So who are forest-dependent people?

Our review demonstrates that the term ‘forest-dependent people’ has been used to refer to a diverse array of individuals and groups. These people include indigenous Amazonians (Dubois, 1996), swidden farmers in Papua (Lawry and McLain, 2012), and cattle grazers in India (Khare et al., 2000), as well as people employed in the forestry sector in Canada (Hajjar et al., 2014), forest dwellers in the Russian Far East and Siberia (Vandergert and Newell, 2003), and communities economically dependent on timber and forest tourism in California (Kusel and Fortmann, 1991). As such, we found that use of the term extended beyond the conservation- and development literature that addresses poverty in and around tropical forests.

Further, the relationships between forests and people can be characterized with respect to at least 18 different dimensions. Some of these characterizations are directly incompatible: for example, “people… living in or adjacent to tropical forests” (Pimentel et al., 1997, 99) and “consumers of forest products among the urban poor” (Dubois, 2003, 69) are by definition different groups of people.

The diversity of individuals and groups captured under the umbrella of the term ‘forest-dependent people’, and the diversity of dimensions in which the relationships between forest and people’s livelihood can be explored, leads us to conclude that an absolute, universally accepted definition of the term does not exist and may be untenable. First, as stated above, many authors define forest-dependent people in relation to a specific purpose. That is, they do not aspire to make statements that are universally generalizable, but rather appropriate the term for a particular context, to describe a unique sub-set of people that matches the system of interest to them in a particular place at a particular time. Second, a universal definition would necessitate some parameterization and definition of terms (e.g. what proportion or frequency constitutes ‘dependence’?). Attempts to universally define and parameterize these terms are unlikely to satisfy all users, given the inherent variability between contexts. As such, we do not attempt to provide a workable or comprehensive definition of the term ourselves, nor do we advocate for such a definition.

Rather, our first objective in this discussion is to encourage users of the term ‘forest-dependent people’ (and analogous terms) to more carefully define and parameterize who they are using the term to refer to. We suggest that, on its own, the term ‘forest-dependent people’ is at best meaningless, and at worst misleading. Our review demonstrates that many papers using the term do so in passing, without articulating the relationship between the implicit meaning they ascribe to the term and the groups of people that the term signifies for them. We therefore advocate that those using the term lend more careful and explicit attention to their characterization of the term by attending to the context or purpose for which it is being used. Our taxonomy provides a framework and language for selecting the most appropriate dimensions.

It could be contended that other terms may describe the population of interest better than the term ‘forest-dependent people’. Indeed, during our review we encountered multiple alternative terms, which were used to refer to similar populations of people. These analogous terms included: ‘forest-dependent communities’, ‘forest-based people’, ‘forest-reliant people’, ‘forest peoples’, ‘forest users’, and ‘forest-based livelihoods’. However, the frequency with which the term ‘forest-dependent people’ has been used in recent publications suggests that it continues to be heavily used (Fig. 1). It also is not clear that alternative terms are any better defined. ‘Forest-dependent people’ may be an imperfect term, but it represents something about a set of people of interest to many individuals and agencies. These alternative terms likely face the same challenges of being loosely defined and open to multiple interpretations, though may convey fewer connotations or assumptions.

It could also be contended that the term ‘forest-dependent people’ carries political weight that may be unrelated to its definitional clarity. Indeed, it seems likely that the term’s origins lie in a desire by some development practitioners and researchers in the 1990s to generate visibility for, and to advocate on behalf of, marginalized constituencies of people living in poverty in rural forested areas, and/or to highlight social development incentives for conserving tropical forests. In this sense, a literal interpretation of all of its instances (as done in this article) may miss capturing the spirit in which the term has often been used. However, as we explain in our introduction, the term is currently being used in ways that are much more specific: for example, to define target populations for funding and research, and to measure progress and impact. Such quantitative objectives demand the use of well-defined terms to unambiguously identify populations of interest.

4.2. Is forest dependence necessarily a good thing?

Our second ambition in this discussion is to question whether forest dependence is an appropriate trait for policy- or program-makers to target. Development agencies and NGOs variously state that an aim of their forest sector investments is to change either the number of forest-dependent people, or the extent to which those people are reliant on forests, or the benefit flows from forests to people (ICF, 2014; RRI, 2015). However, it is not intuitively obvious that either increasing or decreasing forest dependence in any of these dimensions is a policy objective that necessarily benefits the people in question or that is always desirable.

A long-running debate in the literature on forests and livelihoods asks whether forests act principally as a safety net or a poverty trap (Wunder, 2001; Angelsen and Wunder, 2003; Cronkleton et al., 2008; Sunderlin et al., 2008; Nkem et al., 2010). The safety net perspective argues that forest-dependent people living in poverty are supported by forests, particularly in response to shocks that generate crises such as food scarcity (Staddon, 2001; Dubois, 2003; Kaimowitz, 2003). The poverty trap perspective argues that forest-dependent people may be constrained in their opportunities for development and improved well-being precisely because they depend on forests (Delacote, 2009). The debate remains unresolved, but in the absence of an answer (and without an agreed definition of who forest-dependent people are) it is not clear whether forest dependence is ever, usually, or always a desirable state of being. Greater benefit flows from forests to people could conceivably help to support livelihoods and lift people out of poverty. Conversely, greater reliance on (often diminishing) forest resources by growing numbers of people could generate unsustainable conservation and development pressures.

It may be that increasing the autonomy of forest-dependent people to manage forest resources and to direct their own devel-
opment trajectories is a more appropriate policy objective than is uniformly trying to influence the extent of forest dependence across a wide range of contexts. That is, promoting increased local control over forest resources might be one mechanism for supporting sustainable livelihoods among rural people living in poverty in or near to forests in developing countries (Schmithüsen et al, 1999, Banerjee, 2000; Hajjar et al, 2012). Secure land tenure and forest management rights can empower communities to manage the forests in a manner that contributes to sustainable livelihood benefits (Chhatre and Agrawal, 2009; Ming’ate et al, 2014). Community control over forest resources can extend from complete ownership and management autonomy, to co-management with state or private agencies.

5. Conclusion

Forest-dependent people are frequently cited as the target of research and development programs, but the demographic is inconsistently and inadequately defined by researchers, practitioners, and donors. Our taxonomy highlights 18 dimensions that may characterize the relationships between forests and people’s livelihoods. Some of these dimensions are complementary, but others are mutually exclusive. Therefore, it is important to attend to the specific ways in which forest dependence is being signified if findings from research on the subject is to be comparable, and if the impact of policy interventions are to be assessed. The framework and language that this taxonomy provides may aid users of the term ‘forest-dependent people’ to define their population of interest more comprehensively, for the context and purpose. More broadly, we question whether forest dependence is an appropriate trait for policy objectives, and suggest that increasing the autonomy of forest-dependent people to manage forest resources may be a route to achieve livelihood development objectives.

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Appendix A. Supplementary data

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References

Adhikari, M. Nagata, S., Adhikari, M., 2004. Rural household and forest: an evaluation of household’s dependency on community forest in Nepal. J. For. Res. 9, 33–44.
Angelsen, A., Kaimowitz, D., 1999. Rethinking the causes of deforestation: lessons from economic models. World Bank Res. Obs. 14, 73–98.
Angelsen, A., Wunder, S., 2003. Exploring the forest–poverty link: key concepts, issues and research implications. CIFOR, Bogor.
Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N.J., Bauch, S., Börner, J., Smith-Hall, C., Wunder, S., 2014. Environmental income and rural livelihoods: a global-comparative analysis. World Dev. 64, 512–528.
Appiah, M., Blay, D., Damnyag, L., Dwomoh, F.K., Pappinen, A., Luukkanen, O., 2009. Dependence on forest resources and tropical deforestation in Ghana. Environ. Dev. Sustain. 11, 471–487.
Aroda, D., 1994. From state regulation to people’s participation: case of forest management in India. Econ. Political Wkly. 29, 691–698.
Baguhuna, V.K., 2000. Forests in the economy of the rural poor: an estimation of the dependency level. AMBIO: J. Hum. Environ. 29, 126–129.
Banerjee, A.K., 2000. Devolving forest management in Asia-Pacific countries. In: Easterling, T., Durst, P.B., Victor, M. (Eds.), Decentralization and Devolution of Forest Management in Asia and the Pacific. RECOFTC Report N.18 and RAP Publication 2000/1, Bangkok, Thailand.
Belter, B.M., 2005. Forest product markets, forests and poverty reduction. Int. For. Rev. 7 (2), 82–85.
Belter, B., Achdijawi, R., Dewi, S., 2015. Forest-based livelihoods strategies conditioned by market remoteness and forest proximity in Jharkhand, India. World Development 66, 269–279.
Bhatta-charya, A., Basnyat, B., 2003. Empowering people through joint forest management: a study from Madhya Pradesh (India). Int. For. Rev. 5, 370–378.
Bioversity International, 2015. Reconciling the Needs of the Logging Industry with That of Forest-Dependent. [http://www.afdb.org/en/projects-and-operations/project-portfolio/project/p-21-c00-24/].
Bishop, J., Landell-Mills, N., 2002. Forest environmental services: an overview. In: Bishop, J., Pagliolo, S., Landell-Mills, N. (Eds.), Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. Earthscan, London.
Bose, P., Arts, B., van Dijk, H., 2012. ‘Forest ‘governmentality’: a genealogy of subject-making of forest-dependent ‘scheduled tribes’ in India. Land Use Policy 29, 664–673.
Brown, D., Schreckenberg, K., Shepherd, G., Wells, A., 2002. Forestry as an entry point for governance reform. ODIL For. Brief. 1, 1–6.
Byron, N., Arnold, M., 1999. What futures for the people of the tropical forests? World Dev. 27, 789–805.
CIFOR, 2008. CIFOR’s strategy 2008–2018: Making a Difference for Forests and People. CIFOR, Bogor.
CIFOR, 2014. GCS-Tenure Project: Tenure Security and Forest-Dependent Communities. A Global Comparative Study 2014–2016. CIFOR, Bogor.
Calibre Consultants, 2012. Numbers of Forest Dependent People: A Feasibility Study. Calibre Consultants and the Statistical Services Centre (SSC), University of Reading, Reading.
Caplow, S., Jagger, P., Lawlor, K., Sills, E., 2011. Evaluating land use and livelihood impacts of early forest carbon projects: lessons for learning about REDD+. Environ. Sci. Policy 14, 152–167.
Chao, S., 2012. Forest Peoples: Numbers Across the World. Forest Peoples Programme, Moreton-on-Marsh.
Chhatre, A., Agrawal, A., 2009. Trade-offs and synergies between carbon storage and livelihood benefits from forested areas. Proc. Natl. Acad. Sci. U.S. A. 106, 17667–17670.
ClimateWorks, 2015. ClimateWorks Portfolios: Forests and Land Use. http://www. climateworks.org/porfolios/forests-land-use/.
Coller, C., Shell, D., Kaimowitz, D., Kishi, M., 2006. Forests and human health in the tropics: some important connections. UNASILVA-FAO, 57, 3.
Coller, C.J.P., 1995. Who counts most in sustainable forest management? In: Working Paper No. 7. CIFOR, Bogor.
Cronkleton, P., Evans, K., Albornoz, M., De Jong, W., 2008. Towards Well-being: Helping Local Governments Respond to Forest Dependent People, Experiences from the Northern Bolivian Amazon. CIFOR, Bogor.
Delacote, P., 2000. Common as insurance: safety nets or poverty traps? Environ. Dev. Econ. 14, 305–322.
Djogo, T., Syal, R., 2004. Decentralization Without Accountability: Power and Authority over Local Forest Governance in Indonesia. Indiana University, Digital Library of the Commonwealth (DLC).
Dubois, J.C., 1996. Uses of Wood and Non-wood Forest Products by Amazon Forest Dwellers. UNASILVA-FAO, pp. 8–15.
Dubois, O., 2003. Forest-based poverty reduction: a brief review of facts, figures, challenges and possible ways forward. In: Oksanen, T., Pajari, B., Tuomasukka, T. (Eds.), Forests in Poverty Reduction Strategies: Capturing the Potential. European Forest Institute, European Forest Institute (EFI) Proceedings No. 47 pp. 65–81.
Easterling, W., Aggarwal, P., Batima, P., Brander, K., Erda, L., Howden, S., Kirilenko, A., Morton, J., Soussana, J., Schmidhuber, J., 2007. Food, fibre and forest products. Climate change 2007: impacts, adaptation and vulnerability. In: Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., Hanson, C.E. (Eds.), Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, pp. 273–313.
FAO, 1978. Forestry Paper 7: Forestry for Local Community Development. FAO—Food and Agriculture Organization of the United Nations, Rome http:// www.fao.org/docrep/009/i2692e/i2692e00.htm.
FAO, 1998. Asia-Pacific Forestry Towards 2010: Report of the Asia-Pacific Forestry Sector Outlook Study. FAO—Food and Agriculture Organization of the United Nations, Rome http://www.fao.org/docrep/W9615E/w9615e00.htm#Contents. FAO, 2000. FRA 2000. On Definitions of Forest and Forest Change. http://www.fao. org/docrep/001/ad656e/ad656e00.htm.
Fuchs, O., 2009. Yearbook of International Environmental Law, vol. 26. Oxford University Press, Oxford.
Fisher, F., 2004. Household welfare and forest dependence in Southern Malawi. Environ. Dev. Econ. 9, 135–154.
Fisher, R., Hirsch, P., 2008. Poverty and agrarian–forest interactions in Thailand. Geoogr. Res. 46, 135–154.
Fisher, R., Sirimongkonpit, S., Veer, C., 1997. People and forests in Asia and the Pacific: situation and prospects. Asia-Pacific Forestry Towards 2010. Asia-Pacific Forestry Sector Outlook Study Working Paper Series (FAO).
Fraser, N., Gordon, L., 1994. A genealogy of dependency: tracing a keyword in its US welfare state. Signs: 309–336.

Gymah, R., Dadebo, M., 2010. Mapping of Key Forest Governance Reform in Ghana and the Role of Growing Forest Partnerships (draft). Forestry Commission, Ghana www.growingforestpartnerships.org/sites/growingforestpartnerships/files/spf.pdf

Hajar, R., McGowan, E., Mosbølky, M., Koza, R.A., 2014. Opinions on strategies for forest adaptation to future climate conditions in western Canada: surveys of the general public and leaders of forest-dependent communities. Can. J. For. Res. 44, 1525–1533.

Hajar, R.F., Koza, R.A., Innes, J.L., 2012. Is decentralization leading to real decision-making power for forest-dependent communities? Case studies from Mexico and Brazil. Ecol. Soc. 17, 12.

Halpin, S., 1975. Is ‘dependent’ peoples and the Tropical Forestry Action Plan. Center for International Development and Environment, World Resources Institute, Washington, D.C.

Haynes, R.W., 2003. Assessing the viability and adaptability of forest-dependent communities in the U.S. States. Geo. Tech. Rep., PWN-GTR-567. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Holojt, B., Myus, B., 2004. Sustainable forest management worldwide: a comparative assessment of standards. Int. For. Rev. 6, 99–122.

Humphrey, C.R., 1990. Timber dependent communities. In: Luloff, A.E., Swanson, L.E. (Eds.), American Rural Communities. Westview Press Inc., Boulder, CO.

ICF, 2014. The UK’s International Climate Fund. http://ica-independent.gov.uk/wp-content/uploads/2014/01/ICF-Study-The-UK-International-Climate-Fund-ToRs.pdf

Kaimowitz, D., 2003. Forest law enforcement and rural livelihoods. Int. For. Rev. 5, 197–210.

Kanowski, P.J., McDermott, C.L., Cashmore, B.W., 2011. Implementing REDD+: lessons from analysis of forest governance. Environ. Sci. Policy 14, 111–117.

Kare, A., Mayers, J., Morrison, E., 2000. Joint Forest Management: Policy, Practice and Prospects. IIED, London.

Kusel, J., 1996. Well-Being in Forest-Dependent Communities, Part I: A New Approach. Centers for Water and Wildland Resources. University of California Davis.

Kusel, J., Fortmann, L., 1991. Well-Being in Forest-Dependent Communities. Forest and Rangeland Resources Assessment Program. Department of Forestry and Resource Management, University of California Berkeley.

Lalli, S., 1975. Is ‘dependent’ peoples and the Tropical Forest Action Plan. Center for International Development and Environment, World Resources Institute, Washington, D.C.

Lynch, O.J., 1992. Securing community-based tenurial rights in the tropical forests of Asia. Issues in development. Report WRI Washington.

Lynch, O.J., 1998. Law, Pluralism and the Promotion of Sustainable Community-Based Forest Management. UNASYLVA-FAO, pp. 52–56.

McSweeney, K., 2002. Who is forest-dependent? Capturing local variation in forest-product sale, Eastern Honduras. Prof. Geogr. 54, 158–174.

Miah, M.D., 2014. Trade-Offs Between Forest Conservation and Livelihoods of the Forest Dependent People in the Chittagong Hill Tracts: REDD+ Strategy Development in Bangladesh. The Rufford Small Grants Foundation, London.

Ming’ate, F.L.M., Rennie, H.G., Memon, A., 2014. Potential for co-management approaches to strengthen livelihoods of forest dependent communities: a Kenyan case. Land Use Policy 41, 304–312.

MSFP, 2011. Multi-Stakeholder Forestry Programme (MSFP): Common Programme Document. http://www.msfp.org.cn/uploads/cmsfiles/file/MSFP%20Program%20Document_20110414055115.pdf.

Nayak, P.K., Berkes, F., 2008. Politics of co-optation: community forest management versus joint forest management in Orissa, India. Environ. Manage. 41, 707–718.

Ndoye, O., Tiegouhong, J.C., 2004. Forest resources and rural livelihoods: the conflict between timber and non-timber forest products in the Congo Basin. Scand. J. For. Res. 19, 36–44.

Neumann, R.P., Hirsch, E., 2000. Commercialisation of Non-Timber Forest Products: Review and Analysis of Research. CIFOR, Bogor.

Nkem, J., Kalame, F.B., Idinoba, M., Somorin, O.A., Ndoye, O., Awono, A., 2010. Shaping forest safety nets with markets: adaptation to climate change under changing roles of tropical forests in Congo Basin. Environ. Sci. Policy 13, 498–508.

Ojea, E., Loureiro, M.L., Allé, M., Barrio, M., 2016. Ecosystem Services and REDD: Estimating the Benefits of Non-Carbon Services in Worldwide Forests. World Development 78, 246–261.

Osman-Elasha, B., Parrotta, J., Adger, N., Brockhaus, M., Colfer, C.J.P., Sohngen, B., Daftalla, T., Joyce, L.A., Nkem, J., Robledo, C., 2009. Future socio-economic impacts and vulnerabilities. IUFRO World Ser. 22, 101–122.

Padmanabha, M., Shiel, D., 2007. Finding and promoting a local conservation discussion on a globally important tropical forest landscape. Biodivers. Conserv. 16, 137–151.

Pimentel, D., McNair, M., Buck, L., Pimentel, M., Kamit, J., 1997. The value of forests to world food security. Hum. Ecol. 25, 91–120.

Polfenberger, M., 1996. Communities and Forest Management: A Report of the IUCN Working Group on Community Involvement in Forest Management with Recommendations to the Intergovernmental Panel on Forests. IUCN.

Raboanarivelona, C.M., 2011. Community Perspectives on Conservation, Forest Environmental and Social Well-Being in Zanahana National Park, Madagascar. Pennsylvania State University.

Ross-Tonen, M.A., Wiersum, K.F., 2005. The scope for improving rural livelihoods through non-timber forest products: an evolving research agenda. For. Trees Soc. 28, 129–138.

RRI, 2015. Multilateral Memorandum of Understanding Concerning Cooperation on the Rights and Resources Initiative. http://www.rightsandresources.org/wp-content/uploads/2014/01/doc.161.pdf.

Ruiz Pérez, M., 1996. Current issues in non-timber forest products research. In: Proceedings of the Workshop Research on NTFP, Hot Springs, Zimbabwe, 28 August–2 September, 1995. CIFOR, Bogor.

Sasaki, N., Putz, F.E., 2009. Critical need for new definitions of forest and forest degradation in global climate change agreements. Conserv. Lett. 2, 226–232.

Schmitzsen, F., Salim, E., Ullstein, O., 1999. Our forests, our future. In: Report of the World Commission on Forests and Sustainable Development. Commonwealth Forestry Association. International Institute for Sustainable Development, Winnipeg.

Shepherd, G., 2012. Rethinking Forest Reliance: Findings About Poverty, Livelihood Resilience and Forests from IUCN’s ‘Livelihoods and Landscapes’ Strategy. CIFOR, Gland.

Staddon, C., 2001. Local forest-dependence in postcommunist Bulgaria: a case study. Geojournal 55, 517–528.

Sunderlin, W.D., Dewi, S., Puntodevo, A., Müller, D., Angelis, A., Epprecht, M., 2008. Why forests are important for global poverty alleviation: a spatial explanation. Ecol. Soc. 13, 24.

Thompson, M.C., Barahah, M., Carr, E.R., 2011. Seeing REDD+ as a project of forest co-management. Environ. Sci. Policy 14, 100–110.

Tiegouhong, J., Nkamgna, E., 2012. Household dependence on forests around lobeke National Park, Cameroon. Int. For. Rev. 14, 196–212.

Timko, J., Waaber, P., Koza, R., 2010. The socio-economic contribution of non-timber forest products to rural livelihoods in Sub-Saharan Africa: knowledge gaps and new directions. Int. For. Rev. 12, 284–294.

Timko, J.A., Koza, R.A., 2014. Using a gender perspective to explore forest dependence in rural HIV/AIDS-affected Malawian households. Popul. Environ. 35, 441–454.

Uddin, M.B., Mukul, S.A., 2007. Improving forest dependent livelihoods through NTFPs and home gardens: a case study from Satkhira National Park. In: Making Conservation Work: Lining Rural Livelihoods and Protected Areas in Bangladesh. East-West Center, Honolulu, and Nishorgo Program of the Bangladesh Forest Department, Dhaka, Bangladesh.

UN, 2008. Non-legally Binding Instrument on All Types of Forests. United Nations General Assembly Resolution A/RES/62/98. United Nations, New York http://www.un.org/ en/ga/search/view_doc.asp?symbol=A/RES/62/98&Lang=E.

UN, 2015. Sustainable Development Goal 15: Sustainably Manage Forests, Combat Desertification, Halting and Reverse Land Degradation, halt Biodiversity Loss. http://www.un.org/sustainabledevelopment/biodiversity/.

UNECF, 2014. We Are All Forest Dependent People. United Nations Economic Commission for Europe http://www.unece.org/index.php?id=35464.

Vandergeist, P., Newell, J., 2003. Illegal logging in the Russian Far East and Siberia. Int. For. Rev. 5, 303–306.

Vayda, A.P., 1997. Managing forests and improving the livelihoods of forest-dependent people: reflections on CIFOR’s social science research in relation to its mandate for generalisable strategic research. Center for International Forestry Research (CIFOR) Working Paper No. 16, Bogor, Indonesia.

World Bank, 2006. Data: Country and Lending Groups. http://data.worldbank.org/about/country-and-lending-groups.

Wunder, S., 2001. Poverty alleviation and tropical forests—what scope for synergies? World Dev. 29, 1817–1833.

Young, Y.C., 2009. Use of forest resources, traditional forest-related knowledge and livelihood of forest dependent communities: cases in South Korea. For. Ecol. Manage. 257, 2027–2034.