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Supporting pathways to prosperity in forest landscapes – A PRIME framework

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ABSTRACT

We develop a framework to conceptualize the multiple ways forests contribute to poverty reduction and inform development interventions in forest landscapes. We identify five key strategies for reducing poverty in forest landscapes: a) improvements in productivity (P) of forest land and labor; b) governance reform to strengthen community, household and women's rights (R) over forests and land; c) investments (I) in institutions, infrastructure and public services that facilitate forest-based entrepreneurship; d) increased access to markets (M) for timber or non-timber forest products; and e) mechanisms that enhance and enable the flow of benefits from forest ecosystem services (E) to the poor. We test the utility of the framework through a review of the forestry portfolio of the World Bank Group, the largest public investor in forestry. Many of these projects include several, but not all, PRIME components. We devote particular attention to forest-related investments in two contrasting countries, Vietnam and Mexico, to examine synergies among the pathways. Results suggest that each strategy in the PRIME framework may play an important role in alleviating poverty, but pronounced impacts may require multiple pathways to be jointly pursued. The PRIME framework can guide research to address knowledge gaps on pathways to prosperity in forest landscapes, serve as an easily remembered checklist for managers, and nudge forest program designers in government and development organizations, who are interested in poverty reduction, to focus on the importance of both a comprehensive framework and synergies across different pathways.

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1. Introduction

For many households, particularly those in remote forest locations, the movement from poverty to relative prosperity is likely to be a slow, inter-generational process. One dominant economic strategy for such households is resource extraction (Angelsen, Jagger, Babigumira, Belcher, & Hogarth, 2014; Pacheco, 2009). Many smallholders use forests for food, timber and other economic benefits (Brack, Glover, & Wellesley, 2016; Hosonuma et al., 2012; Sunderlin et al., 2005). But whether such extractive activities contribute to *sustained* poverty reduction remains uncertain (Miller and Hajjar, current issue; Suich, Howe, & Mace, 2015; Delacote, 2009). Where growth in markets for forest products contributes to income generation, it is unclear what actions may enable house-

holds to move up the economic ladder (Humphries, Holmes, de Andrade, McGrath, & Dantas, 2018; Wunder, Angelsen, & Belcher, 2014; Scherr, White, & Kaimowitz, 2004). Similarly, little is known about the influence of forest conservation interventions on household asset accumulation and poverty reduction under differing socio-economic conditions (McKinnon et al., 2015; Suich et al., 2015). If we peer within households to focus on gender asymmetry, pathways out of poverty for women, who are often the most forest-reliant, are particularly obscure (Colfer, Sijapati Basnett, & Elias, 2016; Mwangi, Meinzen-Dick, & Sun, 2011).

Over the last few decades, rural poverty, particularly the linkages between agricultural growth and poverty, have been dissected in myriad ways (Christiaensen & Martin, 2018; Dethier & Effenberger, 2012; Christiaensen, Demery, & Kuhl, 2011). There has been a concerted effort to understand how land as an asset can support large swaths of rural households to emerge from poverty (Thornton et al., 2018; Jayne, Chamberlin, & Headey, 2014). Yet, even though millions of households depend on forests directly and indirectly for subsistence needs (Angelsen et al., 2014; Turner

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et al., 2012; Sunderlin et al., 2005), forests as a resource-base for prosperity has received far less attention, making it difficult to draw general conclusions about the implications of forest associated interventions on human well-being (Miller and Hajjar this issue; Cheng et al., 2017, 2019; McKinnon et al., 2015). In this paper, we seek to address this gap by integrating ideas from the economics, rural development and conservation literature into a comprehensive framework for poverty reduction in remote forest landscapes.

Poverty reduction in forest landscapes is important from an environmental sustainability point of view. Household subsistence activities are among an important set of drivers of deforestation and forest degradation (Hosonuma et al., 2012). Further, conservation strategies can come under pressure because they can be viewed as restricting agricultural development (McKinnon et al., 2015). Thus, conservation and development agencies have invested in a series of approaches – ranging from integrated conservation and development programs beginning in the 1980s (Brandon & Wells, 1992) to community-based natural resource management (Shyamsundar & Ghate, 2014; Samii, Paler, Chavis, Kulkarni, & Lisiński, 2014) to governance changes and incentive-based measures such as Payments for Ecosystem Services and Reduced Emissions from Deforestation and Forest Degradation (REDD) (Agrawal, Hajjar, Liao, Rasmussen, & Watkins, 2018; Jayachandran et al., 2017; Corbera & Schroeder, 2011; Pattanayak, Wunder, & Ferraro, 2010). The poverty reduction components of such activities have met with uncertain success, often because of limitations posed by geography (Sunderlin et al., 2005), inability to address complex problems (Barrett, Travis, & Dasgupta, 2011), or insufficient attention to differentiated effects, including gender (Larson et al., 2018; Sunderland et al., 2014). There is now mounting interest in the benefits of landscape approaches, which typically bring together multiple stakeholders to reconcile competing social, economic and environmental objectives (Reed, Van Vianen, Deakin, Barlow, & Sunderland, 2016; Sayer et al., 2013). These different approaches suggest the need for a comprehensive framework for poverty reduction that considers the geographic constraints posed by remote forest areas and the interests of and tactics used by people to subsist and prosper in such landscapes.

From a poverty reduction and economic development perspective, the lack of clear evidence on pathways to prosperity for the forest-reliant poor poses important practical questions.¹ Should policies and programs promote non-forest opportunities for the poor or should existing uses of forests be strengthened? Can forestry productivity be adjusted such that the gains from timber harvests, non-timber forest products (NTFPs) and ecosystem services accrue to poor households? Under what conditions do forest reforms strengthening community and indigenous rights enable poverty reduction? And, what risks do poverty-reducing economic investments pose to forests?

These questions are not new (Sunderlin et al., 2005; Fisher, 2004; Wunder, 2001), and a rich literature has developed identifying the income that the poor obtain from forests (Shepherd; Walelign et al., and Joshi et al., in this issue, Suich et al., 2015; Angelsen et al., 2014; Vedeld, Angelsen, Bojő, Sjaastad, & Kobugabe Berg, 2007) and the role forests play in supporting food security and providing a safety net (Miller and Hajjar, this issue; Wunder et al., 2014; Shackleton, Delang, & Angelsen, 2011; Pattanayak & Sills, 2001). There is also emerging evidence of the importance of forest ecosystem services in securing clean water, decreasing erosion and reducing the effects of storms (Mori, Lertzman, & Gustafsson, 2017;

Barbier et al., 2011; Bennett, Peterson, & Gordon, 2009) – benefits that are important to the poor, even if they do not accrue entirely to poor households. However, the literature offers more clarity on the role of forests in ‘poverty prevention’ rather than ‘poverty reduction’ (Shackleton et al., 2011; Angelsen & Wunder, 2003). We build on this literature to ask what combination of critical investments in people, resources and institutions can enable forests to go beyond a supportive role to play an even bigger part in sustainable poverty reduction.

In forest landscapes, households may be stuck in location-determined poverty traps, making it difficult for them to emerge from poverty even amid country-wide growth and economic development (Barbier & Hochard, 2018; Kray & McKenzie, 2014; Barrett et al., 2011; Jalan & Ravallion, 2002). Where there are poverty traps, self-reinforcing behavior can keep households or even communities under certain asset thresholds (Boonstra, Björkvik, Haider, & Masterson, 2016). Thus, prosperity in remote rural areas may require explicit strategies to overcome geographic constraints (Barbier & Hochard, 2018; World Bank, 2007). For instance, poverty reduction in forested areas may entail strengthening the use of economic goods and services from forests (e.g. timber, NTFPs and ecosystem services), along with investments that enable the poor to overcome location-based limitations. While the presence of geographic poverty traps is well-known in development economics, the literature that ties the presence of poverty traps to forest-poverty, so-called poverty-environment traps, is somewhat limited (Barbier & Hochard, 2018; Barbier, 2010).

Government, non-government organizations (NGOs), and private sector actors have invested billions of dollars in forest conservation and management in the past quarter century. For instance, overseas development assistance in forestry and related activities doubled in the six-year period of 2002–04 to 2008–10, from approximately USD 560 million to USD 1.26 billion (Agrawal et al., 2013). Amongst the many global institutions that work on forests and poverty, the role of the World Bank Group (WBG) is quite unique. The WBG typically invests in large-scale efforts to reduce poverty, working closely with government agencies that lead implementation. For instance, in 2016, the WBG committed nearly \$64.2 billion in loans, grants, equity investments and guarantees to its members and private businesses (World Bank, 2016d). In addition, it is also the leading public funder of forestry and conservation in developing countries. During the period 2002–2015, the WBG invested a total of USD 6.5 billion in forestry activities and was actively working on some 106 projects related to forests in 2015 (World Bank, 2016a). The World Bank’s large-scale activities related to forestry and poverty reduction provide a useful empirical base for deriving insights into practical strategies that have been tried to alleviate poverty in relation to forests.

In this article, we develop a broad conceptual framework, labelled PRIME, that specifies five non-mutually exclusive pathways to prosperity in forest landscapes. The framework is intended to support governments, local authorities, development organizations, researchers, NGOs and others in designing and testing interventions for poverty alleviation in forested areas. In section 2 below, the framework is developed and discussed, paying attention to how it fits in with existing analytical and practical approaches to addressing forest-poverty dynamics. In Section 3, the PRIME framework is applied to the forestry investment portfolio of the World Bank Group, the largest public investor in forestry. We use a portfolio review approach to assess which combinations of pathways are used in forest projects to improve people’s welfare. We also explore two country-specific examples to illustrate the potential applicability of the PRIME framework in differing local contexts. We conclude with a discussion of lessons and further steps required to operationalize the framework.

¹ The term forest-dependent or forest reliant poor is commonly used to refer to households who ‘gain some form of benefits’ from forests (Newton et al., 2016).

2. Potential forest-focused pathways to prosperity

Many households living in forest areas rely on timber and NTFPs to meet a significant part of their nutritional, energy and housing needs (Wunder et al., 2014; Angelsen & Wunder, 2003). Forest resources also serve as an input to agricultural and livestock production systems (Cavendish, 2000) and smooth consumption by acting as an insurance-type mechanism (Wunder, Börner, Shively, Wyman, 2014; Pattanayak & Sills, 2001). Furthermore, ecosystem services, such as storm-protection services of mangroves, can make poor communities less vulnerable to natural disasters (Das & Vincent, 2009). Cohn et al., (this issue) show how the Amazonian forest's climate regulation (extreme heat reduction) can benefit poor households' agricultural yields. While these subsistence and safety net aspects of forests are important to ensure that poor households do not fall further into poverty, this article focuses on the kinds of policies and interventions that help people climb out of poverty (Krishna, 2011; Barrett, 2005). The critical question to address then becomes: what investments in people, forest resources and institutions can enhance the benefits obtained from forests, so they can become pathways towards prosperity?

Rural households typically move out of poverty by pursuing one or more of three main strategies: agricultural entrepreneurship, off-farm jobs or migration (ILO, 2014; Schneider & Gugerty, 2011). Diversification of income sources is an important and almost universally used tactic by poor households to improve their well-being (Krishna, 2011; Banerjee & Duflo, 2007, 2011). Households diversify livelihood activities in response to their own assets and abilities and the risks and opportunities that they perceive (Barrett et al., 2011).

Remote forest areas, however, offer limited prospects for households to improve returns to land, diversify economic activities or convert their access to natural capital into other forms of capital (Sunderlin et al., 2005; MEA, 2005). Households also face high costs of long-term migration. Path dependencies (for instance, low endowments or historic low public investments), external factors (competitive global markets), or dynamics shaped by social and ecological interactions (remoteness of location and social isolation) can keep households, communities and socio-ecological systems trapped in an undesirable state (Boonstra et al., 2016; Barbier, 2016; Tidball, Frantzeskaki, & Elmqvist, 2016; Barrett et al., 2011). Poverty traps can occur when the characteristics of certain remote regions make household investments less productive relative to non-remote areas (Barbier & Hochard, 2018; Kray & McKenzie, 2014; Jalan and Ravallion, 2002).

Given the remoteness of many forest landscapes and the possible presence of geographic-poverty traps, poverty reduction will require a combination of household specific and geographic interventions. Arguably, long-term poverty reduction in forest landscapes, as elsewhere, will require strengthening agency and entitlements, i.e. empowering the poor to make decisions that affect their lives (Banerjee & Duflo, 2011; Leach, Mearns, & Scoones, 1999); improvements in education (Banerjee et al., 2007; Duflo, 2001) and health (Dupas & Miguel, 2016; Kremer & Miguel, 2004); and higher and more diversified incomes (Vedeld et al., 2007; World Bank, 2007). It will also require resilient forest ecosystems that can endure shocks and offer a sustainable resource base (Miura et al., 2015, Arrow, Dasgupta, Goulder, Mumford, & Oleson, 2012; Das & Vincent, 2009).

In recent years, several conceptual frameworks connecting conservation and human well-being and poverty have emerged (Suich et al., 2015; Yang, McKinnon, & Turner, 2015; Milner-Gulland et al., 2014, Fisher et al., 2014; MEA, 2005). Perhaps the best known of these is the Millennium Ecosystem Assessment framework linking ecosystem services to different constituents of well-being (income, security, health, social cohesion and agency) (MEA, 2005) and the

Sustainable Livelihoods Approach, which connects financial, social, physical and natural capital to economic activities, acknowledging the role of institutions and contextual factors (Ashley & Carney, 1999). More recently, the United Kingdom's Ecosystem Services for Poverty Alleviation program has also contributed to holistic frameworks (Fisher et al., 2014). While many of these frameworks address the multi-dimensionality of poverty and ecosystems, much of the underlying empirical literature does not focus on pathways out of poverty, let alone test mechanisms that reduce poverty (Suich et al., 2015).

Conceptual frameworks are, at a minimum, a checklist that enable a careful consideration of different factors that affect a specific issue. They can be observational constructs, i.e. they are deductive and build on empirical data. Alternatively, they can be 'thinking-tools' or conceptual models, often diagrammatic, that motivate further exploration of theories of change through data collection (Fisher et al., 2014, 2013). In this context, we offer a framework for structuring and understanding which forest-related interventions, and bundles of interventions, can help achieve poverty reduction. This broad framework, presented in Fig. 1, was developed both deductively from a review of the development economics, poverty, and forest literature, and inductively, from implementation experience in multiple institutions' projects and programs, field experience across multiple countries, and discussions with experts.

We build on existing frameworks – for instance, Suich et al. (2015), who, based on a vast literature review, identify some 16 ways in which improvements in one ecosystem service (water) may be tied to poverty reduction; or Fisher et al. (2014), who offer a diagrammatic representation showing poverty reduction linked to different types of ecosystem services, conditioned by human endowments, preferences and governance systems. We take a similar approach but focus on forests and emphasize the geographic poverty traps and institutional barriers that need to be addressed to move people out of poverty. We examine mechanisms known to contribute to rural poverty reduction and pinpoint a subset of *forest-related* interventions associated with the use of timber, NTFPs and ecosystem services that apply in forested landscapes. Further, noting the importance of social differentiation in addressing poverty (Fisher et al., 2014; Suich et al., 2015), we identify gender as an important cross-cutting issue.

Our conceptual framework (Fig. 1) identifies five broad forest-based poverty reduction pathways to improve economic returns, reduce risks and create new opportunities in remote forest landscapes. This framework, labelled as PRIME, stands for: a) improvements in productivity (P) of forest land and labor; b) governance reform by strengthening community, household and women's rights (R) and entitlements over forests and land; c) regional complementary investments (I) in institutions, infrastructure, and public services that facilitate forest resource use and reduce risks; d) increased access to markets (M) for timber or NTFPs; and e) mechanisms that enhance and enable the flow of benefits from forest ecosystem services (E) to the poor.

The PRIME framework (Fig. 1) considers poverty to be multi-dimensional, with poverty reduction requiring a) improvements in agency and voice; b) higher and more diversified incomes; and c) progress in social attributes such as health and education. In the medium term, prosperity in remote forested landscapes would need better agricultural and forestry entrepreneurship, in addition to growth in off-farm and off-forest jobs, access to external markets and public infrastructure and institutions (World Bank, 2015; Schneider & Gugerty, 2011; Banerjee & Duflo, 2007; World Bank, 2007). In such contexts, we argue that *forest-specific interventions* could facilitate forest entrepreneurship by bolstering people's ability to make sound forestry decisions, improving forest land

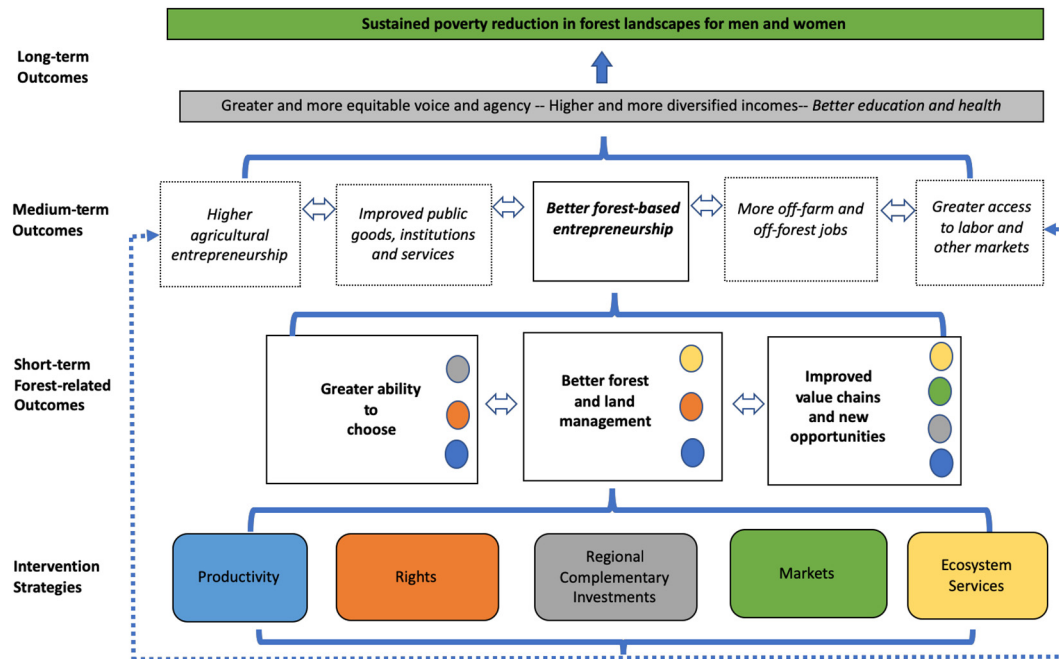


Fig. 1. The Productivity, Rights, complementary Investments, Markets and Ecosystem services (PRIME) framework offers a comprehensive interconnected set of potential intervention strategies to reduce poverty in forest landscapes. The PRIME strategies (identified through the colored ovals) directly contribute to poverty reduction through improved forest-based entrepreneurship by strengthening agency, improving the resource base and bolstering value chains for forest products. Indirect poverty reduction impacts (dotted lines) may occur through spillover effects via improvements in agricultural entrepreneurship, public goods and institutions and labor markets.

management and strengthening value chains for forest products. For example, interventions that strengthen productivity (P), identified by the blue oval in Fig. 1, would increase skills and enable more efficient use of forests for commerce (Humphries et al., 2018; Rohadi, Kallio, Krisnawati, & Manalu, 2010). Secure rights over forest resources (R, shown through orange ovals) can lower risks and facilitate longer term investments (Fisher et al., 2013; Meinzen-Dick, 2009). Given the remoteness of forested landscapes, factors that reduce geographic and institutional (I) constraints (grey ovals) can increase incomes and lower risks by improving market access (Barbier & Hochard, 2018) and reducing transaction costs. Livelihoods would also benefit from interventions that contributed to a durable flow of returns from resource-based markets (M, green ovals) and ecosystem services (E, yellow ovals) (Sunderlin et al., 2015; Angelsen et al., 2014). Thus, PRIME interventions, channeled through forestry, will impact the larger goal of poverty reduction by strengthening agency, increasing income and reducing some risks. These strategies may also have indirect effects on other poverty attributes through spillover effects (as identified in Fig. 1). However, several strategies may have to occur simultaneously or build on each other to be effective. For instance, security over rights of access to resources and a productive resource base may be a pre-requisite for resource-based markets to grow, or, capacity building in new skills may be required for communities to be able to take advantage of regional investments. This conceptual model also assumes the presence of basic underlying elements of political and economic freedom and rule of law.

We explore below how each of these pathways and synergies across pathways can contribute to alleviating poverty. We draw on empirical, mainly case study, literature to identify both barriers and opportunities for strengthening different pathways, paying attention to social differentiation.

2.1. Income generation by improving skills and productivity (P)

Growth in land and labor productivity is integral to rural development (de Janvry & Sadoulet, 2010; Irz, Lin, Thirtle, & Wiggins,

2001). Thus, increasing the returns to production forestry, by using best practices and controlling fire, pests and disease, and better management of natural forests for timber and NTFPs are essential for poverty reduction in forest landscapes.

Currently, 31% of the world's forests are primarily production forests and an additional 28% are multiple-use forests (FAO, 2015). While plantation forests are a small proportion of overall forest area (7%), their share is growing, as are smallholder plantations (FAO, 2006). Timber is commercially the most important forest product, generating a gross value added of USD 606 billion in 2011 (FAO, 2014). However, some fundamental timber market characteristics create barriers to entry for the poor. Timber planting, harvesting and processing is a capital and technology-intensive investment that requires secure tenure (Angelsen & Wunder, 2003), exhibits economies of scale (Wunder, 2001), may require access to specialized markets (Belcher & Kusters, 2004; Angelsen & Wunder, 2003), faces complex regulatory and political environments (Belcher, 2005), and may offer only limited formal employment and can even marginalize local community members (Blaser & Zabel, 2015; Mayers, 2006; McKenney, Chea, Tola, & Evans, 2004).

Despite these constraints, smallholder forestry can contribute to poverty reduction through interventions that strengthen poor household and community skills in forestry (Rohadi et al., 2010) and business management (Pacheco, 2012; Medina, Pokorny, & Campbell, 2009). Examples include smallholder forestry in Brazil, where technical, credit and startup capital from the government has contributed to profitable small-scale timber production (Humphries et al., 2018; Humphries et al., 2012) or Southern China, where household income from bamboo cultivation could potentially double by improving productivity, reducing post-harvest losses and increasing market effectiveness through technical support (Hogarth, Belcher, Campbell, & Stacey, 2013; Hogarth & Belcher, 2013). This empirical evidence highlights the critical linkages across PRIME strategies, suggesting that smallholder forestry is effective mainly where markets exist, rights are secure, transport is possible and public-sector institutions facilitate credit

availability and reduce regulatory burdens. The paper by Sanchez-Badini et al., in this special issue and the Vietnam case study in Section 3 further discuss some of these considerations.

Productivity-enhancing poverty reduction strategies will also need to address social disparities across groups and within households (Mai, Mwangi, & Wan, 2011; Aguilar, Quesada-Aguilar, & Shaw, 2011). There are major differences, for instance, in how, why and where men and women access, use, manage and benefit from forests (Jagger, Luckert, Ducelle, Lund, & Sunderlin, 2014; Mwangi et al., 2011; Peach Brown, 2011; Agrawal, 2009; Bechtel, 2010). Focused attention to social differences, through participatory consultations and gender working groups and learning networks (Agarwal, 2015; Gurung, Giri, Setyowati, & Lebow, 2011), can help re-engineer forest management structures (Buchy, 2012; WOCAN, 2016) and create new types of benefit-sharing mechanisms (Shames, Wollenberg, Buck, Kristjanson, Masiga, & Biryahaho, 2012).

2.2. Wealth accumulation through rights and empowerment (R)

A second strategy is to increase the wealth and agency of the poor by strengthening their rights (R) over natural capital, including forests and trees. Environmental entitlements and property rights, both private and collective, shape how ecosystem services contribute to poverty reduction (Fisher et al., 2013; Sikor & Nguyen, 2007; Leach et al., 1999). Secure rights can reduce uncertainty over resource access, allowing households to make longer-term investments (Meinzen-Dick, 2009).

The growth of community-based forest management in the last decades highlights the importance of forest rights (FAO, 2016). Largely driven by changes in Latin America and China, community control over forests has increased from a share of 21% in 2002 to 30% in 2013 (RRI, 2014). This coincides with increasing evidence that indigenous and community rights can contribute to reductions in forest deforestation and degradation (Blackman, Lima, & Asner, 2017; Robinson, Holland, & Naughton-Treves, 2014; Shyamsundar & Ghate, 2014; Persha, Agrawal, & Chhatre, 2011; Chhatre & Agrawal, 2009).

Investing in resource rights has significant implications for marginalized communities, including women and indigenous peoples (Colfer, Elias, & Jammadass, 2015; Agrawal, 2009; World Bank, 2016c). However, rights, by themselves, are inadequate if the poor face other significant barriers (Delville, 2010), which underscores the importance of the interconnections among PRIME strategies. Various studies suggest that the effectiveness of rights-oriented policies on poverty reduction can be undermined by legal requirements and costs associated with co-management with the state (Cronkleton, Pulhin, & Saigal, 2012); failure to consider customary, secondary and informal rights (Meinzen-Dick, 2009); elite capture and an uneven economic playing field (Stickler, Huntington, Haflett, Petrova, & Bouvier, 2016; Larson & Dahal, 2012); and limited skills of communities to engage with markets (Pacheco, 2012). Further, while women are by no means the only ones facing disproportionate challenges, there remain persistent gender gaps in access to land and tree tenure (Colfer et al., 2016). Interventions that address social differentiation targeted solely at women are not necessarily the answer; rather, additional efforts to address gender bias in technology access and dissemination, women's labor constraints and limitations in women's sanctioning authority may be needed (Mwangi et al., 2011).

2.3. Investing in regional institutions, infrastructure and public services (I)

Poverty reduction in forest landscapes will not be possible without regional complementary investments (I) in institutions

that govern forest use as well as the infrastructure and public services that support value-addition in remote areas. Poverty in remote rural areas is partly a result of limited access to public services and connectivity, which can inhibit both agency and the growth of markets (Barbier & Hochard, 2018; Kray & McKenzie, 2014). Geographic constraints also limit the supply of 'off-forest' and 'off-farm' jobs.

Strong evidence points to the positive impacts of roads, electricity, health care and other services on poverty reduction (van de Walle, Ravallion, Mendiratta, & Koolwal, 2015; Khandker, Barnes, & Samad, 2013; Chomitz, 2007; Deininger & Okidi, 2003). Policies that support market development and lessen regulatory and financial constraints are also essential for market exchange. In the case of forestry, bureaucratic rules often complicate forest enterprise development and make it risky for households to engage in forest entrepreneurship (Pacheco, Mejía, Cano, & de Jong, 2016; Pacheco, 2012; Ros-Tonen & Kusters, 2011). Thus, institutional reform, within and outside the forestry sector, may be required to enable market-based value addition through forest uses, as discussed in the next section that reviews the World Bank's forestry portfolio.

Although the usefulness of the "I" in PRIME for poverty reduction in forest landscapes is generally clear, forest safeguard issues are a consideration, particularly because they can damage ecosystem services (E). A principal worry with investments such as roads, for instance, is that they can contribute to deforestation by increasing access to logging, bringing in secondary settlements or attracting migrants (Angelsen, 2010; Chomitz, 2007). Furthermore, the responsibility for economic development in forest landscapes often falls outside the mandate of forestry agencies, making it difficult to develop appropriate policies.

2.4. Improving market access (M)

Creating access to markets (M) is a well-established conduit for jobs and income generation in rural areas. In recent years, devolution of forest management to local communities has opened timber and non-timber markets to poor households (see Sam & Shepard, 2011 and the case study in Section 3), technological changes in the plywood and paper industry and the introduction of portable sawmills have made small-scale producers and plantations more competitive (Scherr et al., 2004; Angelsen & Wunder, 2003); and carpentry and woodworking enterprises have provided important off-farm employment and income (Humphries et al., 2018).²

A growing market for certified timber offers possibilities for achieving both poverty reduction and sustainability (Romero, Putz, & Guariguata, 2013; Rametsteiner & Simula, 2003). For instance, the area under international forest certification has risen from 14 to 438 million ha from 2000 to 2014 (FAO, 2015). However, certification of small and medium enterprises (SMEs) often requires external support and the development of community forestry enterprises (CFEs) (Harada, 2014; Antinori & Bray, 2005; FSC, 2004) because of challenges related to the scale, quality and sustainability of timber management and high transaction costs (Burivalova, Hua, Koh, Garcia, & Putz, 2016; Wiersum, Humphries, & van Bommel, 2011; Molnar, 2004).

Many poor households rely on the production and marketing of NTFPs such as medicinal plants, bush meat, nuts, and honey (Angelsen et al., 2014; Tincani, 2013; Shackleton et al., 2011; Maiga & Kologo, 2010). Yet, commercially successful NTFPs are relatively rare because they require a high value-weight ratio, low product adulteration and a stable resource base and market

² This may also require forest safeguards, particularly for natural forests, and promotion of other sources of timber, for example through smallholder forest plantations (Angelsen & Wunder, 2003) and outgrower schemes with the private sector (Mayers, 2000, Desmond & Race, 2001).

(Belcher, Ruiz-Perez, & Achdiawan, 2005; Angelsen & Wunder, 2003). Moreover, poor households – and women in particular – often obtain only a small share of the final benefits due to high regulatory burden and weak bargaining power (Sunderland & Ndoye, 2004) and exploitative market chains (Ingram, Haverhals, Petersen, Elias, Basnett, & Phosiso, 2017; Shackleton & Gumbo, 2010). One strategy to expand market access for NTFPs would be to register them under Geographical Indication, an intellectual property recognized by the World Trade Organization (Chabrol, Mariani, & Sautier, 2017; Egelyng et al., 2017). Such ‘origin’ markets, like certification schemes, will need support, particularly in terms of rights and institutional arrangements, to be successful.

Lastly, wood-based fuels offer another opportunity to increase market access for the poor, as they require few skills or technology to enter the market (Angelsen & Wunder, 2003). The employment potential through small-scale wood collection, charcoal production, transportation, and last-mile retail is substantial, with the charcoal sector in Sub-Saharan Africa alone employing some seven million people (World Bank, 2011). Legalizing informal markets can make them more pro-poor (Gautier, Hautdidier, & Gazull, 2005), but can also increase unsustainable harvesting from forests (Zulu & Richardson, 2013; Makonda & Gillah, 2007), making sustainable sourcing of fuelwood and charcoal, through tree planting on farms, an important consideration (Angelsen & Wunder, 2003).

In all the markets discussed above, the poor clearly face challenges both in entering the market and extracting sufficient rent from the sale of forest products, suggesting that other PRIME components may be pre-requisites for some markets to flourish. A strategy to surpass some of these barriers is for smallholders to organize themselves into self-governing, inclusive forest producer and/or marketing organizations (Macqueen et al. this issue, Macqueen, 2013). These offer members political and economic services, including lobbying for policy changes, economies of scale, information on prices and quality requirements, capacity building, and better linkages to government institutions, the private sector, financial institutions and development agencies (Hajjar & Kozak, 2017). Increasingly, these organizations are ensuring active membership and leadership roles for those who traditionally were excluded from forest landscape management decisions (Macqueen et al. this issue, Gurung et al., 2011).

2.5. Ecosystem services for poverty reduction (E)

A final opportunity is to strengthen the flow of benefits from forest ecosystem services (E) to the forest-reliant poor. Forests’ regulatory services help maintain productivity in agriculture, agroforestry, hydropower and other sectors, supporting the long-term sustainability of many forest-dependent livelihoods (Cohn et al., in this issue; MEA, 2005). One well-known market-driven approach that is used to capture some of these economic benefits is nature-based tourism, which is a driver of growth in several developing economies (Narain & Orfei, 2012; Hall, 2007). There is some evidence to show that protected areas, an associated policy instrument, may have poverty reduction benefits (Canavire-Bacarreza & Hanauer, 2013; Andam, Ferraro, Sims, Healy, & Holland, 2010).

Another increasingly common strategy is to construct markets by paying local communities to protect ecosystems (Alix-Garcia & Wolff, 2014; Bulte, Lipper, Stringer, & Zilberman, 2008) (see also the Mexican case study in Section 3). Payments for environmental services (PES) are potentially a mechanism for managing both natural areas and rural poverty; however, evidence of the widespread presence of win-win solutions is limited (Samii, Lisecki, Kulkarni, Paler, & Chavis, 2014; Alix-Garcia & Wolff, 2014; Milder, Scherr, & Bracer, 2010; Wunder, Engel, & Pagiola, 2008). This is, at least partly, because PES programs may be able to meet forest protection

goals cost-effectively by either targeting a few large landowners or areas where the poor may not live (Robalino, Sandoval, Villalobos, & Alpizar, 2014; Ferraro, 2008). A case in point is China’s Grain for Green program, which increased soil organic carbon (Song, Peng, Zhou, Jiang, & Wang, 2014), but with moderate impacts on poverty, possibly because the selection criteria prioritized off-site soil erosion rather than poverty reduction (Uchida, Xu, Xu, & Rozelle, 2007). In addition to such design issues, PES participation and the benefits accruing to the poor depend on household characteristics and the opportunity and transaction costs that households face (Bulte et al., 2008; Wunder, 2008).

Still, how PES can meet both environmental and poverty reduction goals is important, particularly in the context of global-scale carbon payments such as the Reduction of Emissions from Deforestation and forest Degradation mechanism (REDD+). In the context of REDD+, there is an increasing recognition of the need for disaggregated analyses – by factors such as gender, age and ethnicity – to determine who derives which benefits from different ecosystems (Daw et al., 2015; Daw, Brown, Rosendo, & Pomeroy, 2011). A recent review of 22 REDD+ initiatives in six countries, for instance, found that women’s perceptions of well-being decreased in REDD+ intervention villages compared to control sites, suggesting insufficient attention to gender equality and women’s rights (Larson et al., 2018). Forward-looking participatory approaches that explore social complexity and lead to inclusive, integrated landscape management plans are showing more positive results (Dawson & Martin, 2015; Daw et al., 2015).

2.6. Synergies across interventions

We show in the previous discussions that PRIME pathways share strong synergies. Productivity improvements are a pathway out of poverty if households have access to expanded markets to sell their products. Similarly, for markets to enable income generation, households need security over resource use and the skills to create marketable goods. Additionally, without public infrastructure and enabling institutions that reduce transaction costs, forest goods or ecosystem services cannot serve the needs of poor households beyond subsistence requirements. Furthermore, a sustainable resource base is essential. Thus, the PRIME framework emphasizes the need for a broad approach to poverty reduction that heeds the different ways in which individual strategies build on each other.

This co-dependence of the five PRIME strategies and their role within a larger set of economic development approaches is illustrated in Fig. 1. For deep poverty reduction in forest landscapes, it will require more than the five PRIME approaches. For instance, ‘off-farm’ and ‘off-forest’ job creation may be essential, and may be indirectly triggered from PRIME interventions over the long-run. However, our focus in this paper is on forestry investments and their impacts on poverty in the short to medium term. Thus, our proposition is that forest-related projects that aim to reduce, or at least not deepen, poverty, need to be comprehensive and attend to all five PRIME pathways and their interconnectedness. The portfolio review and case studies in the next section strengthen this proposition and showcase which pathways are most commonly jointly pursued in the World Bank’s forestry portfolio.

3. Examining interconnections across PRIME strategies through the World Bank Group’s forestry portfolio

To better understand the potential utility of the PRIME framework, we apply the framework to the World Bank Group’s forestry investments. We use a portfolio review approach to assess the extent to which PRIME strategies, and combinations thereof, are

found in WBG forestry projects during the 2002–2015 period. We choose these projects because they were designed and implemented under the 2002 WBG Forest Strategy (World Bank, 2004), which was launched to increase the WBG's engagement in the forest sector (World Bank, 2016a).

Between 2002 and 2015, the WBG funded forestry investments in 309 projects, which were designed, implemented and often co-funded by the governments of the client countries. Of these, 88 projects had completed a full project cycle, i.e. they were approved, fully implemented and brought to closure. The portfolio review focused on a subset of these completed projects, using the following criteria: a) the project was approved in 2002 or later; b) the project was completed prior to 2015 and a results assessment publicly available; c) at least 20 percent of the project was focused on the forestry sector, ensuring the project's relevance for the sector; and d) WBG funding for the forestry-related components amounted to at least USD 0.5 million, i.e. was large enough to include multiple action items. Thirty-six projects met these inclusion criteria (see Fig. 2 and Appendix Table A1). Project-level data for the review comes from a comprehensive database created for the WBG's Forest Action Plan FY16–20, Project Appraisal Documents, which outline project design and implementation arrangements, and Implementation Completion and Results Reports, which assess the extent to which the project has achieved its objectives. If these documents were not available, substitute project documentation capturing similar information were included.

A set of inclusion and exclusion criteria, listed in Table 1, was applied to each project activity to determine whether they aligned with one or more PRIME strategies. For example, interventions that boosted productivity through enhancements to forestry land, machinery or labor were included under "P", while interventions that focus on enhancing agricultural or other non-forest sector productivity were excluded. Similarly, project activities that strengthen rights over forest and/or land either through formal or informal mechanisms were included under "R". Here, projects that focused on participation only, e.g. of community members in the design, implementation or monitoring of a project component, were excluded. Project interventions were included under "I" if: a) they supported people's livelihoods in forest landscapes, e.g. through investments in telecommunication or transport services that improved access to forest product markets (while interventions aimed at enhancing market access through marketing and logistics support or value addition were included under "M"); or

b) institutional reforms that provided some type of livelihood or social security support or lowered the regulatory burden on small-scale forest enterprises. Interventions that focused on macro-level reforms, such as the development of a national forest sector strategy or land use plan, were excluded as they may or may not focus on poverty reduction. Likewise, interventions were only included under "E" if ecosystem services specifically supported livelihoods and income generation, i.e. by creating payments, additional jobs or commercial opportunities, but not activities with a conservation and no poverty focus.

The sample of 36 projects assessed had an overall investment value of USD 1.19 billion, with the average value of these projects being USD 33.14 million (ranging from USD 108 million – 0.91 million), including both grants and loans (Table A1). As Fig. 2 shows, the number of projects is geographically spread across East Asia and the Pacific (31%), Sub-Saharan Africa (22%), Latin America (19%) and Eastern Europe and Central Asia (19%) (see also Table A1 and Fig. 3B). Some 41% of the value of these investments is made in the East Asia and Pacific (EAP) region, driven by the large portfolios in China and Vietnam. In contrast, the portfolios of Sub-Saharan Africa and Eastern Europe and Central Asia are largely made up of several small projects. Only one of the 36 projects are in South Asia, but it is also has the largest budget in the sample.

The distribution of projects is tied to the recipient country's level of development. Nearly 90% of project recipients are "lower middle" and "upper middle" income countries, based on the WBG's income status criteria (Table A1). Thus, at a macro level, forestry investments, at least those made by the World Bank, are not reaching the poorest countries. Moreover, the extent to which countries with large forest areas receive significant funding also varies widely. For example, countries with more than half of their total land area covered in forest, such as Costa Rica, Indonesia, Lao PDR, Peru and Gabon, receive relatively small investments compared to the largest recipient China.

Fig. 3 identifies multiple aspects of the PRIME framework across the World Bank portfolio. Fig. 3A presents the percentage of projects that includes each PRIME strategy. Fifty three percent of projects provide technical support and training to improve the management of community forestry and/or smallholder plantation forests as well as nurseries and small-scale forest businesses (P). Nearly a third of projects focus on strengthening rights both through formal as well as informal mechanisms (R). The most common theme addressed was regional complementary investments

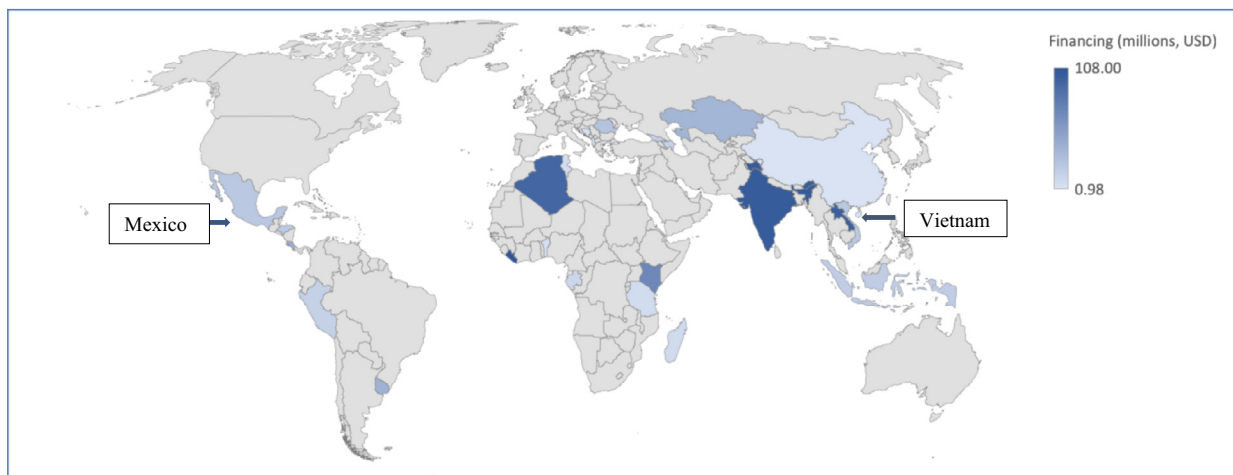


Fig. 2. Subset of completed World Bank Group forestry project financing (2002–2015) examined for PRIME strategies ($n = 36$). Source: Project-level database created for the WBG's Forest Action Plan FY16–20. Note: The total portfolio (2002–2015) included 309 projects, of which 88 had completed a full project cycle and 36 meet inclusion criteria for further analyses (Table 1). Mexico and Vietnam were reviewed as case study countries.

Table 1
Decision Criteria for applying PRIME criteria to WB Forestry portfolio.

Theme	Description of included interventions
Productivity	Decision criteria: <ul style="list-style-type: none"> • Include if the intervention boosts productivity through enhancements to forestry land, machinery or labor • Exclude if the intervention focuses on enhancing agricultural or other non-forest sector productivity Examples: <ul style="list-style-type: none"> • Training individuals or communities in forest management (e.g. planting, harvesting, monitoring), management of non-timber forest products and/or agroforestry production • Providing machinery and/or technology to enhance productivity, such as portable saw mills, seedlings, or fertilizer
Rights	Decision criteria: <ul style="list-style-type: none"> • Include if the intervention strengthens formal or informal rights (including decision-making processes) over forests/land • Exclude if the intervention only includes participatory component in project design, implementation and/or monitoring Examples: <ul style="list-style-type: none"> • Granting individuals and/or communities forest and tree ownership and/or use rights • Strengthening community-based forest user groups
Regional complementary Investments	Decision criteria: <ul style="list-style-type: none"> • Include if the intervention provides complementary investments in institutions, infrastructure and public services at the regional level that support the forestry sector • Exclude if the intervention supports broad-based institutional reform, such as the development of a national forest sector strategy or land use plan Examples: <ul style="list-style-type: none"> • Institutional reforms to reduce bureaucratic/legal hindrances and streamlining of regulatory processes for small-scale forest enterprises or creating institutional mechanisms to enhance forest economic activities • Introducing safety net programs tied to remote forest landscapes • Improving rural connectivity, including transport and IT infrastructure to enhance forest livelihoods • Increasing access to credit to support forest management, agroforestry or the production of NTFPs • Increasing capacity of forest agency staff to support livelihood programs
Market access	Decision criteria: <ul style="list-style-type: none"> • Include if the intervention enhances market access through marketing and logistics support or value addition • Exclude if the intervention improves infrastructure access to markets, such as through roads, as this is included in "I" Examples: <ul style="list-style-type: none"> • Introducing certification schemes for timber or origin products for NTFPs • Formalizing markets for sustainable charcoal and fuelwood production • Developing new/additional forest products and /or adding value to existing products • Creation of producer networks and cooperatives
Ecosystem services	Decision criteria: <ul style="list-style-type: none"> • Include if the intervention enhances the returns from ecosystem services in an equitable manner, including monetary, such as REDD or other carbon sequestration payments, as well as non-monetary income from ecosystem asset or services • Exclude if the intervention is not livelihoods-oriented, i.e. if it has a conservation focus Examples: <ul style="list-style-type: none"> • Introducing payment for ecosystem services, such as REDD+ • Developing nature tourism initiatives that benefit local poor • Training on managing forest ecosystem services and ecotourism

(I), which featured in 69% of projects in the sample. This usually came in the form of support for forest department reform, participatory forest land use management and zoning, investment in village infrastructure and community building, and monitoring and evaluation efforts to measure both forest and livelihood outcomes. However, because it was not always possible to separate institutional support focused on improving livelihood outcomes from broader support for other forestry activities, 69% may be an over-estimation. Access to markets was less targeted (14%), which suggests that WBG forestry investments during the 2002–2015 period did not prioritize the role of timber and NTFP markets for the poor and primarily supported the production end of the value chain. Lastly, 33% of the projects had a focus on ecosystem services (E), largely through PES schemes or nature-based tourism. Fig. 3B presents the geographic distribution of these projects. As the Figure shows, the largest subset of forestry projects in the World Bank portfolio (11) were in East Asia, of which a third of the projects had three or more PRIME components. The projects from the Latin American region also had a focus on poverty strategies. We examine two countries from these regions (Vietnam and Mexico) in greater detail below.

Even though all five PRIME strategies do not feature in any WBG forestry projects, several are addressed simultaneously. Seventy five percent of the projects in the World Bank's forestry portfolio

included at least two PRIME strategies, while a third of the projects covered three or four PRIME strategies (Fig. 3C). The combination of Productivity and Investments (P and I) together dominates, followed by strategies that include P, I and R (Rights) or I and E (Ecosystems) (Fig. 3D). Investments in institutional reforms and infrastructure appear to be the bedrock of activities that seek to improve productivity, rights and ecosystem benefits. The results support the notion that reforms in forest landscapes require a broad focus; and, the gaps in the review intimate that there is scope for a more comprehensive PRIME type approach.

In terms of the scale at which interventions are made, activities to boost productivity, support access to markets and reap economic benefits from managing ecosystem services are often geography-specific, while institutional and regulatory changes can be broader to get to regional or national considerations. The majority of the interventions in the WBG portfolio review, regardless of pathway, were at the local or regional scale. This is probably in part due to the limited life span of the projects and the focus of the Ministry or Department that benefited from the WBG's forestry loan.

To further explore the synergies among different PRIME strategies and illustrate the applicability of the framework in different contexts, we examine World Bank forest interventions in two cases. The two countries were purposively chosen based on a) their

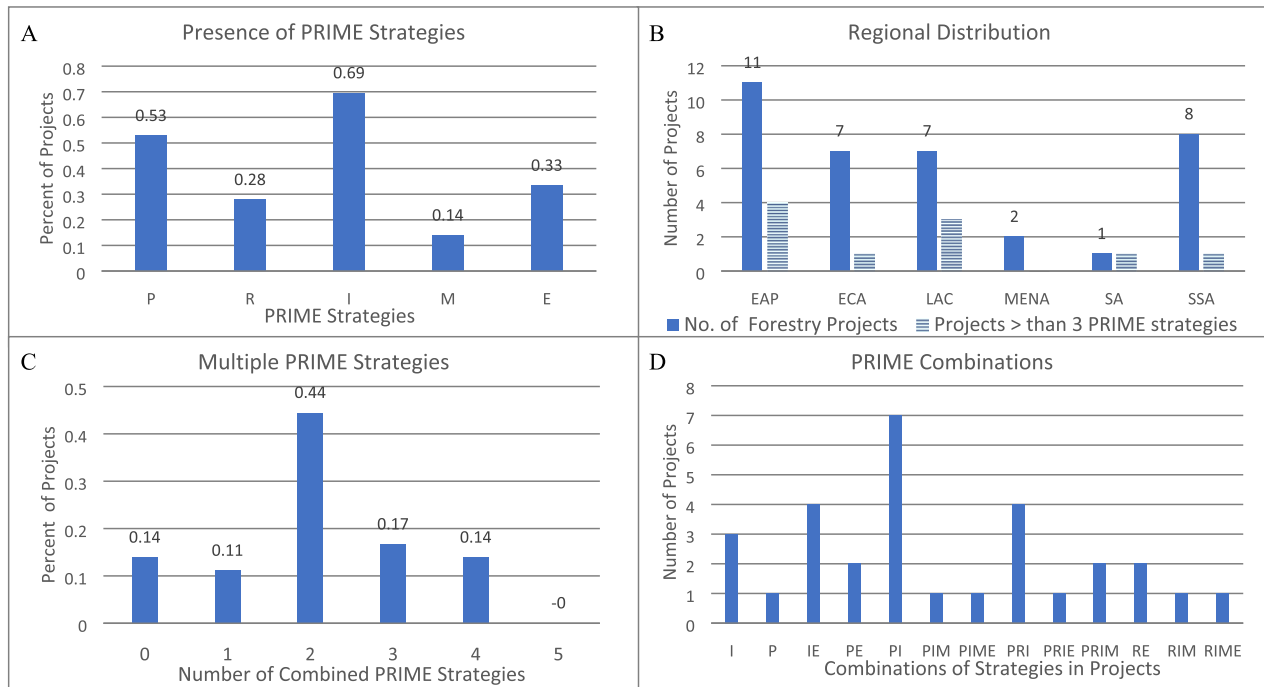


Fig. 3. WBG Forestry Projects (2002–2015) with different PRIME Strategies (n = 36), identifying the extent of each strategy in the portfolio (A), regional distribution (B), projects that undertook multiple strategies (C), and the types of combinations of strategies present (D). Source: Project-level database created for the WBG's Forest Action Plan FY16-20 Note: PRIME strategies refer to P = Productivity, R = Rights, I = complementary Investments, M = Markets, E = Ecosystem services. Regional country classifications in the World Bank portfolio are EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MENA = Middle East and North Africa, SA = South Asia, SSA = Sub-Saharan Africa.

inclusion in the portfolio review; b) variation in geography, income and poverty levels; c) the forest land size, and d) the availability of evidence on project and program impacts.³ These criteria were met in two important forest countries: Vietnam, an emerging economy with growth in the plantation sector, and Mexico, which has a long history in decentralized forestry management (see Appendix Table A2).

Vietnam. Poverty in Vietnam has been on a dramatic decline since 2010, with the poverty headcount (at \$5.50 a day (2011 PPP)) decreasing from 48% in 2010 to less than 29% in 2016 (World Bank, 2019). Forest cover in Vietnam, which makes up 48% of land area (Table A2), has also experienced some encouraging trends (Cochard, Ngo, Waeber, Kull, 2017; FAO, 2015). While the country has seen significant loss in primary forests, Vietnam may be in 'forest transition', with the northern mountain provinces seeing regrowth in natural forests and plantations emerging in the mid-elevation areas (Cochard et al., 2017). Between 1990 and 2010, plantation forests in Vietnam increased by 270%, with plantation forests covering some 25% of forested lands (FAO & JRC, 2012).

Densely populated, around 25 million people in Vietnam live in and around forests (Auer, 2012) and some 60% of productive forests in Vietnam are under household management (FAO, 2006). Over the last decade or so, Vietnam has developed a flourishing timber-based processing industry (Putzel, Dermawan, Moeliono, & Trung, 2012; Auer, 2012)⁴ and many household plantations supply wood to an export-oriented wood-chip industry and the furni-

ture industry. Recognizing these characteristics, the Government's National Forest Development Strategy envisions an expanding forest sector through investments in better forest management, protection and forest product processing and trade (Socialist Republic of Vietnam, 2007).

In support of the Government's strategy, the WBG invested USD 78.5 million from 2005 to 2015 in the Vietnam Forest Sector Development Project (World Bank, 2015). The project sought to establish new forest plantations as well as improving the productivity of existing, but poorly performing, plantations to close the growing gap between demand and supply of wood products. The project identified the main reasons for low productivity to be inadequate incentives, insufficient market orientation, weak planning, management and extension capacity, inadequate investment and insecure forest land tenure (World Bank, 2015). These challenges were addressed by enhancing seed quality and forest management (P), accelerating the process for issuing Land Use Rights Certificates (LURCs) (R), revising policies and regulations related to forest management and improving access to credit to smallholders through a new funding mechanism (I) and promoting plantation forest certification to ensure sustainability and access to new markets (M).

Through these investments, some 40,000 poor and medium income households (more than double the number at project appraisal stage) developed 76,571 ha of plantations, with some 36,000 household receiving land use rights. The Vietnam Bank for Social Policy issued low-interest loans to smallholder plantation forest investors based on the availability of land use certificates. Input supply chains were strengthened through nurseries and the creation of farmer user groups. While nearly three-fourths of these plantations met international sustainable forestry certification standards, they were only slowly being certified when the project closed. Overall, the World Bank's Independent Evaluation Group rated the outcomes achieved by the small holder forestry component of the larger project as 'substantial' (World Bank, 2018a, 2018b).

³ We use peer-reviewed articles where available (e.g. Alix-Garcia et al. (2015, 2018) and Sims and Alix-Garcia (2017) in the Mexico case, and Frey et al. (2016, 2018) in Vietnam) to assess forest-poverty linkages. In addition, we use evidence provided in publicly available World Bank documents (Implementation Completion and Results (ICR) reports and the Independent Evaluation Group (IEG) assessments). However, these documents do not always note confounding factors in their evaluations, since their focus is on assessing implementation design, operational performance and achievement of project objectives rather than poverty impacts per se.

⁴ By 2008, the processing sector was already one of Vietnam's top five export sectors (Putzel et al., 2012).

Post-project surveys indicate that the financial rates of return to forest smallholders were on average 24% (average net present values of USD 3000 per ha), mainly due to good timber yields, moderate costs and high stumpage prices (Frey, Ha, Quoc, Dzung, Carle, & Davis, 2016). By increasing land and labor productivity (P) through forest plantations and new skills, smallholder forestry in Vietnam appears to offer households a commercial opportunity to meet both short- and long-term economic needs (Sandewall et al., 2015). Smallholder plantations showed robust returns under prevailing market conditions (Frey et al., 2018).

The prevalence of markets (M) for wood products enabled small holders in Vietnam to take advantage of productivity (P) improvements and institutional (I) reforms that were initiated through the World Bank project. Further, the government's commitment to land rights (R) aided longer term investments. Policy reforms, including changes in forest sector policy and banking institutions (I), led to a conducive environment for forest-based entrepreneurship. Thus, forestry as an economic development strategy, at least for some households in Vietnam, was facilitated by multiple complementary factors, some of which go beyond the synergies of project-implemented PRIME interventions.

Mexico. Forests make up 34% of the total land area in Mexico (see Table A2) and much of this land is owned and managed by indigenous communities (*comunidades*) or groups of formerly landless rural people (*ejidos*) (Barsinmantov & Kendall, 2012), who are among the poorest in the country. To address the twin challenges of rural poverty and a degrading resource base, the Government of Mexico has initiated several forest-related initiatives to help mobilize communities to sustainably manage their own forest resources.

The World Bank has had a long and deep involvement with Mexico's environmental, forest and climate-related programs and strategies, including Mexico's national PES program (E). Between 2003 and 2011, with WBG support, Mexico's National Forestry Commission allocated USD 489 million for PES activities, supporting conservation in 3.4 million ha (5.2%) of forests and targeting some 5,967 *ejidos*, communities and smallholders (Shapiro-Garza, 2013; CONAFOR, 2011). PES activities in Mexico began as straightforward, market-based payment programs. However, through interactions with social movements and national and local politics, they were 'hybridized' in implementation and developed a strong poverty reduction focus (Shapiro-Garza, 2013). The program continues to be one of the world's largest national payment-based conservation programs (Alix-Garcia et al., 2018).

Mexico's national PES program pays landowners for the environmental services provided by their forested lands, whilst prioritizing municipalities with high levels of rural poverty. Payments are made for communally and privately held forests, with the payment varying, depending on the relative deforestation risk faced by a parcel of land, local poverty levels and the share of indigenous populations (Alix-Garcia, Sims, & Yanez-Pagans, 2015). Households associated with community forests tend to be poorer and more dependent on agriculture, making PES an important source of income. Payments are significant and, on average, amount to USD 3050 per year per household (12% of household income) for private owners and USD 130 per year per capita in common property areas (about one month of work at minimum wages) (Alix-Garcia et al., 2015). In exchange for the funds, landowners pledge to maintain and manage existing forests or natural land cover by undertaking activities such as building fences, controlling pests, or patrolling for illegal activity (Alix-Garcia et al., 2018).

Evaluations of the environmental and socioeconomic impacts of Mexico's National PES program show that it reduced land cover loss from deforestation or degradation by 40–51% compared to rates in the absence of the program (Alix-Garcia et al., 2015); had an approximately equivalent effect on conservation relative

to protected areas (Sims & Alix-Garcia, 2017); and increased community based activities (patrolling, building fire breaks, controlling pests, or promoting soil conservation) by approximately 50%, without crowding out prosocial efforts (Alix-Garcia et al., 2018). However, the program only slightly reduced poverty at the local level (Alix-Garcia et al., 2015; Sims & Alix-Garcia, 2017). The authors argue that this is because: a) there is generally a trade-off between conservation in forest-rich areas and poverty, with a stronger overlap between deforestation risk and poverty in community forestry areas relative to private forests; and b) the participation costs of actively managing natural forests (fire and pest management and patrols) are high enough to make payments less profitable at the household level.

Forest programs in Mexico also offer lessons regarding how gender-responsive actions can be incorporated to empower marginalized groups. A recent gender analysis identified that women are not participating in Mexico's forest-related programs because of gender bias in traditions, norms and customary rights. Using a behavioral science approach, researchers found that women need more time, resources, and accessible information to engage in forest landscape programs aimed at benefitting them (World Bank, 2018a, 2018b). Building on these findings, a new grant program for indigenous people and local communities will incorporate gender-responsive actions, such as targeted communication channels and feedback mechanisms to engage female program applicants and enhance program access.

The experience of Mexico shows that there can be trade-offs in achieving both poverty reduction and conservation objectives, especially in forest-rich areas with high degrees of poverty. The relative success of the PES program in reaching the poor is partly attributable to Mexico's decentralized forest structure, where local communities have rights (R) over forest lands. The Government's responsiveness to local demands and strong support for forest sector reform (I) were also major enabling factors. However, Mexico's experience also highlights the need for additional steps to ensure that the most vulnerable groups, including the landless, indigenous people and women, can share the benefits from ecosystem-based payments.

4. Discussion and conclusions

The PRIME framework highlights five complementary strategies for reducing poverty among people living in and around forests. The framework can be applied as a tool for thinking through key relationships and forest-based poverty reduction pathways and be modified by researchers, program designers or practitioners, based on their particular forestry situation. In each case, the framework can be used for developing a theory of change as well as determining the sequence of interventions based on local contexts, scale of the intervention and available forest resources. It can also serve to motivate policy-focused multidisciplinary research in the context of forest landscapes to address many of the knowledge gaps identified here and in the other articles in this issue.

Distinguishing between five pathways to illustrate the importance of different components was not easy to do, either conceptually or during the portfolio review, as the pathways are clearly interconnected. In fact, the literature and project reviews, coupled with field experience of the authors across many countries strongly support the notion that effective poverty reduction in forest landscapes will be conditional on multiple PRIME strategies being implemented, either simultaneously or sequentially. Capacity development is integral to improving productivity, stronger and equitable forest and land rights are required to strengthen agency, and inclusive institutions and services are needed if investments in forest landscapes are to provide pathways out of poverty.

Gender-responsive interventions and institutional arrangements are equally critical, as women are key players necessary for achieving sustainable forest management (Kristjanson et al., 2019). Conceptual models such as PRIME are useful precisely because they can be used as an easily remembered checklist, but also force us to think about synergies across pathways.

The examples from Mexico and Vietnam show how the different pathways are interconnected, support each other and how poverty-related outcomes are facilitated by synergies among different strategies. Success in Vietnam, for example, built upon government policy changes that granted long-term forest tenure to households, the provision of training to improve people's forest management skills, and initiatives that increased poor household's access to credit and other regional complementary investments. Even if all five PRIME pathways are not present, an incremental approach can be useful. But, there may be some path-dependencies. Without secure rights over resource extraction, for instance, interventions that support the supply of forest products to markets may fail. In the case of Mexico, introducing PES was possible because the forestry institutions in the country were decentralized. Gender-responsive forest program interventions are now being implemented, in part due to the disappointing results of REDD+ efforts to enhance women's, as well as men's, perceived well-being to date (Larson et al., 2018).

Over time, poverty reduction in forest areas will likely be no different than what is seen in agricultural areas: 'off-forest' jobs and migration (Hecht, Yang, Sijapati Basnett, Padoch, & Peluso, 2015) will play a significant role in changing the relationship between forests and people. We see this trend in forest villages in middle-income countries such as Turkey and Albania (World Bank, 2016b; IOM, 2016). This implies that communities need to be supported to seek off-forest jobs, while simultaneously strengthening their ability to benefit from forest resources in a sustainable manner. The PRIME framework is useful precisely because it stresses both direct forest-income generation strategies and complementary regional investments that may provide new opportunities.

While PRIME offers a comprehensive view on poverty reduction, it will still be important to carefully evaluate the forest-related outcomes of any specific intervention. There may be trade-offs between the socioeconomic and environmental effects of poverty-reducing interventions, as some aspects of the Mexico case study suggest. Social and environmental safeguards that development agencies and governments develop and enforce can help ensure that potential negative impacts on forests or poverty are effectively addressed. Within each country context, it may be useful to match specific PRIME strategies with a parallel set of forest safeguards and to track both poverty and forest indicators over time.

The dearth of strong evidence on the poverty impacts of specific forest-related interventions (Miller and Hajjar, current issue) would caution us to use PRIME as a conceptual approach for thinking through pathways and for analyzing complex interventions, rather than as a tool to measure the relative contribution of each type of investment to reduce poverty. Its practical utility is currently being further tested at the WBG, where project leaders have been asked by the Program on Forests (PROFOR) to consider this framework, including guidance on incorporating gender, at the earliest stages of project and program design and in the development of forest sector strategy papers jointly developed with governments. However, any individual intervention within a specific country context will need to be rigorously evaluated to ascertain welfare outcomes.

In terms of future research directions, the framework and our application of it in this analysis demonstrate a need for better program evaluation of different forest landscape interventions and standard instruments to measure forest uses, benefits and costs (Cheng et al., 2017, 2019), including poverty impacts. Both these actions will strengthen the evidence on different PRIME strategies and synergies among them. Here, FAO, CIFOR, IFRI and the WBG recently launched a standard survey instrument, called the Forestry Living Standards Measurement Survey (Food and Agriculture Organization (FAO), Center for International Forestry Research (CIFOR), International Forestry Resources and Institutions Research Network (IFRI), & World Bank., 2016). Combining such field-based surveys with participatory gender-disaggregated approaches and, ideally, satellite (forest/tree cover) data, offers exciting opportunities for measuring and monitoring forest sustainability and poverty simultaneously. It is only when more countries implement such approaches that we will begin to see more convincing evidence on the complex role and contributions forest landscapes can play for the diverse communities and people that depend on them.

Declaration of Competing Interest

None.

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Appendix A

Table A1
Information on the projects covered in the World Bank forestry portfolio.

Country	Region	Country Income Level	Year Approved	Financing (millions, USD)	P	R	I	M	E	Number of PRIME Strategies
1	China	EAC	Upper middle income	2006	100.00		1	1	1	3
2	Indonesia	EAP	Lower middle income	2005	0.98			1	1	2
3	Indonesia	EAP	Lower middle income	2006	17.53	1			1	2
4	Lao PDR	EAP	Lower middle income	2005	0.91					0
5	Lao PDR	EAP	Lower middle income	2003	20.40	1	1	1		3
6	China	EAP	Upper middle income	2002	93.90	1	1			2
7	China	EAP	Upper middle income	2007	105.25	1	1	1	1	4
8	Vietnam	EAP	Lower middle income	2005	0.97					0
9	China	EAP	Upper middle income	2010	60.00	1			1	2
10	Vietnam	EAP	Lower middle income	2005	78.50	1	1	1	1	4
11	Lao PDR	EAP	Lower middle income	2005	7.00					0
12	Romania	ECA	Upper middle income	2003	25.00	1	1			2
13	Bosnia and Herzegovina	ECA	Upper middle income	2008	3.40			1		1
14	Bosnia and Herzegovina	ECA	Upper middle income	2003	3.40			1		1
15	Albania	ECA	Upper middle income	2005	7.86	1	1	1		3
16	Azerbaijan	ECA	Upper middle income	2005	13.00	1	1			2
17	Kazakhstan	ECA	Upper middle income	2006	35.00	1	1	1		3
18	Georgia	ECA	Upper middle income	2003	15.67	1	1	1		2
19	Mexico	LAC	Upper middle income	2004	21.30	1	1	1	1	4
20	Mexico	LAC	Upper middle income	2002	31.10			1		1
21	Honduras	LAC	Lower middle income	2004	20.00	1	1	1	1	4
22	Uruguay	LAC	High income	2005	37.00			1	1	2
23	Central America – Nicaragua and Honduras	LAC	Lower middle income	2006	12.00	1	1			2
24	Costa Rica	LAC	Upper middle income	2006	40.00		1	1	1	4
25	Peru	LAC	Upper middle income	2003	14.80	1				1
26	Tunisia	MENA	Lower middle income	2002	5.30		1		1	2
27	Algeria	MENA	Upper middle income	2003	95.00	1	1			2
28	India	SA	Lower middle income	2003	108.00	1	1	1		3
29	Madagascar	SSA	Low income	2004	102.90		1		1	2
30	Tanzania	SSA	Low income	2004	7.00	1	1			2
31	Ivory Coast	SSA	Lower middle income	2009	2.54					0
32	Gabon	SSA	Upper middle income	2006	10.00			1	1	2
33	Nigeria	SSA	Lower middle income	2006	10.03					0
34	Liberia	SSA	Low income	2007	3.55	1	1			2
35	South Africa (and Lesotho)	SSA	Upper middle income (Lower middle income)	2002	15.30			1	1	2
36	Kenya	SSA	Lower middle income	2007	68.50	1	1	1		3

Source: Project-level database created for the WBG's Forest Action Plan FY16–20.

Note: Region refers to World Bank country classifications with EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MENA = Middle East and North Africa, SA = South Asia, SSA = Sub-Saharan Africa.

Table A2
Forest Poverty Indicators (Mexico and Vietnam).

Indicator	Mexico	Vietnam	Source	
1	Forest Area (% of land area) (2015)	34	48	FAO (2015)
2	Other wooded land (% of land area) (2015)	10	2	FAO (2015)
3	Deforestation rate (annual % change 2010–2015)	–0.1	0.9	FAO (2015)
4	Tree cover loss (2001–2017) as % of 2000 land area	6.4	15	Global Forests Watch
5	Rural Population (% of total) in 2015	21	66	World Development Indicators
6	Adjusted net national income per capita (constant 2010 US\$) in 2015	7894	1399	World Development Indicators
7	Rural Poverty Headcount ratio (% of rural population) in 2014	62	19	World Development Indicators
8	Poverty headcount ratio at \$5.50 a day (2011 PPP) (% of population) in 2014	41	36	World Development Indicators
9	WB Forestry projects	17	7	World Bank (2016a)

Source: World Development Indicators – <https://datacatalog.worldbank.org/dataset/world-development-indicators>, Global Forest Watch – <https://www.globalforestwatch.org/>, FAO (2015) – <http://www.fao.org/3/a-i4793e.pdf>.

Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.worlddev.2019.104622>.

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