



Chapter 1 SDG 1: No Poverty – Impacts of Social Protection, Tenure Security and Building Resilience on Forests

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Key Points

- The relationship between poverty reduction and forests varies across regions, decades, stage in the forest transition and degree of market access.
- Achieving the specific targets of SDG 1, such as social protection and secure land tenure, can have positive effects on forests, especially if benefits are conditional on forest conservation.
- The overall effect on forests of pursuing SDG 1 depends on which poverty reduction policies are pursued; for instance, allocating forest land to poor farmers has very different implications for land use than targeting payments for ecosystem services to poor farmers.
- Exposure and vulnerability to environmental shocks in coastal areas and near steep slopes can be mitigated by forests – if the poor retain access to forest products and ecosystem services.

1.1 Introduction

SDG 1 seeks to ‘end poverty in all its forms everywhere’. Poverty is increasingly recognised as a multidimensional concept. For example, the UN Multidimensional Poverty Index (used in the UN Human Development Reports) considers multiple deprivations that people might experience in the domains of health, education and standard of living (UNDP 2018). The World Bank’s (2001) ‘attacking poverty’ framework is another widely used multidimensional approach to poverty (see Lawlor et al. 2013 for an application to forests). Building on the work of Sen (1999), this framework focuses on how opportunities, security and empowerment interact to promote human well-being. While quantifying all of these dimensions remains a challenge, the World Bank (2018) reports multidimensional indices of poverty that encompass multiple SDGs through measures of educational achievement (SDG 4),

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access to drinking water and sanitation (SDG 6) and access to electricity (SDG 7), as well as considering whether income is sufficient to satisfy basic needs (SDG 1). Thus, the SDGs taken together embody the multidimensional approach to human development and poverty reduction.

Target 1.1 of SDG 1 focuses squarely on consumption poverty by calling for eradication of extreme poverty as defined by a monetary threshold (Table 1.1). However, SDG 1 also engages with other dimensions of poverty, recognising ‘poverty in all its dimensions according to national definitions’ (Target 1.2). Targets 1.3–1.5 specify how to reduce poverty: by ensuring that the poor are covered by social protection systems; by securing the rights of the poor to economic resources, access to basic services and property ownership; and by building their resilience to economic, social and environmental shocks.

In this chapter, we focus on the three targets under SDG 1 that specify strategies for reducing poverty, allowing us to draw on the existing evidence base about how those strategies affect forests. Specifically, we examine the potential consequences for forests of (1) implementing social protection systems that cover the poor and vulnerable (Target 1.3), (2) increasing the land tenure

Table 1.1 SDG 1 Targets

1.1 Eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day
1.2 Reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and achieve substantial coverage of the poor and the vulnerable
1.4 Ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance
1.5 Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
1.A Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation
1.B Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies
Source: Adapted from https://sustainabledevelopment.un.org/sdg1

security of the poor (Target 1.4) and (3) reducing the vulnerability of the poor and building their resilience to shocks (Target 1.5). Recognising that more than 75 per cent of the global poor live in rural areas (World Bank 2016) and that poverty and forest cover are coincident in many parts of the world (Sunderlin et al. 2008), our analysis of these three targets focuses on the rural poor and their relationships with forests.¹ These relationships are moderated by market access – e.g. through its effect on land rents and therefore incentives for deforestation (Angelsen 2010, Pfaff et al. 2007) – as well as through its effects on employment opportunities, credit availability and insurance against environmental shocks.

We set the stage for our analysis of these relationships by examining the correlation between forests and extreme poverty (defined by a global income/consumption standard) at the cross-country level (as relevant to Target 1.1) and the role of forests in national poverty reduction strategies (as relevant to Target 1.2). We conclude the chapter by relating our analysis to the means of implementation for SDG 1, suggesting that the implications for forests depend on whether national policymakers recognise the role of forests in rural livelihoods.

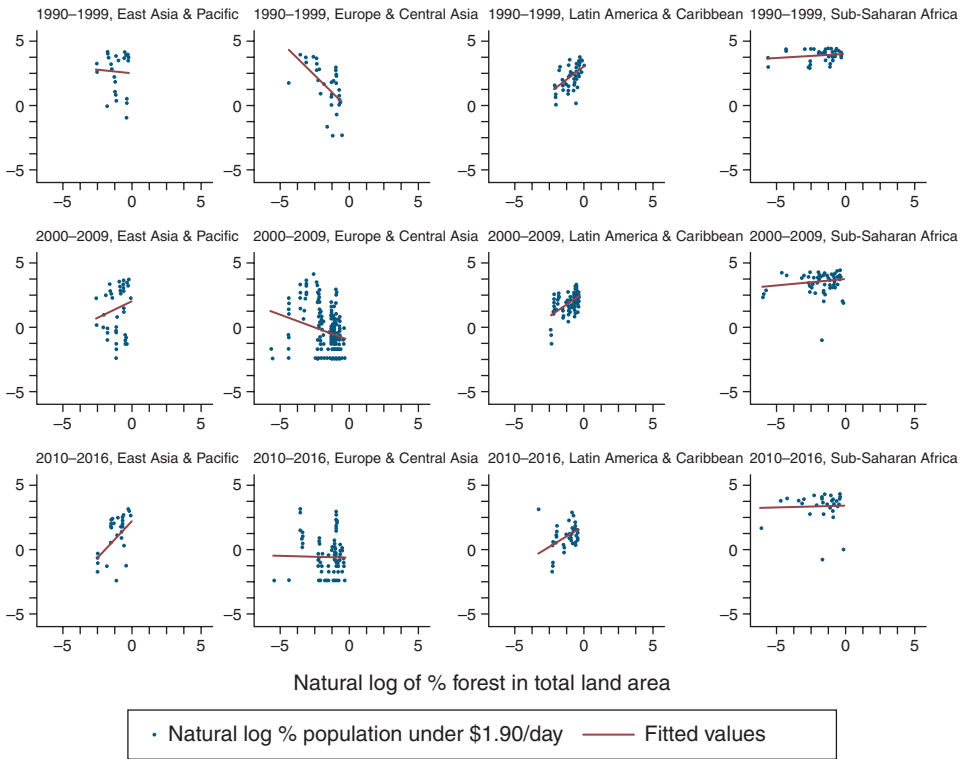
1.2 Relationship between Forests and Poverty

The relationship between poverty and forests is the subject of a large body of literature. Household-level studies have demonstrated how forests support rural livelihoods – as a source of subsistence, a safety net and a potential pathway out of poverty (Cheng et al. 2017) – through ecosystem products (Angelsen et al. 2014, Shackleton et al. 2011) and services (Daw et al. 2011). In the other direction, poverty or income level is often included as a potential driver of deforestation in models at both the micro- and macro-scale (Atmadja and Sills 2015, Busch and Ferretti-Gallon 2017). Atmadja and Sills (2015) conclude that evidence on the relationship is mixed, with studies of Latin America more likely to find an environmental Kuznet's curve (Choumert et al. 2013) or win–lose relationship (i.e. correlated poverty reduction and deforestation). The environmental Kuznet's curve is one possible explanation for the 'forest transition', or the widely observed empirical regularity that forest cover declines until a turning point or transition, after which gains in forest cover due to natural regeneration and plantations overtake losses due to deforestation (Angelsen and Rudel 2013). The mechanisms underlying this common path vary across regions and reflect the mutual effects forests and economic development have on each other (Rudel et al. 2005). The effect on

¹ Due to greater purchasing power, a poor urban family may have a greater impact on forests than a rural family living in extreme poverty. However, given that the goal is to eradicate poverty, we choose to focus on the more numerous rural poor.

forests of external aid to reduce poverty is likely to vary depending on the stage of the forest transition, possibly accelerating forest loss in early stages and encouraging the transition to forest recovery in later stages.

To provide empirical context we plot national poverty rates against forest cover across three decades and four regions. While acknowledging that trends and patterns in poverty vary depending on the dimensions considered and the thresholds applied (World Bank 2018), we consider the percentage of the population living in extreme poverty, as measured by the USD 1.90 per day threshold established by the World Bank in 2015 and consistent with SDG Target 1.1.² As shown in Figure 1.1, in East Asia and Latin America an



Graphs by Decades and Region

Figure 1.1 Relationship between forest cover and poverty, by decades and regions. Data source: World Bank.³

² See Ferreira et al. (2015) for an explanation of why, despite using different numbers, the SDG USD 1.25 per day and World Bank USD 1.90 per day poverty thresholds are consistent.

³ Total land size by country: <https://data.worldbank.org/indicator/AG.LND.TOTL.K2> Total population by country and year: <https://data.worldbank.org/indicator/SP.POP.TOTL> Poverty headcount earning less than USD 1.90/day (percentage of total population) by country and year (not all years are available for each country): <https://data.worldbank.org/indicator/SI.POV.DDAY> Forest area (sq km): <https://data.worldbank.org/indicator/AG.LND.FRST.K2>

inverse relationship between poverty and forests emerges over time: by the most recent decade, lower poverty rates are clearly associated with higher forest cover. In Europe and Central Asia, higher poverty rates are associated with a higher percentage of forest cover in earlier decades, with no apparent relationship in the most recent decade. In Africa, there is no relationship evident in any decade. While these plots only show correlations, they suggest that the effects on forests of pursuing SDG 1 are likely to vary across regions and time, and that there may not be any systematic relationship in the region with the highest levels of extreme poverty (sub-Saharan Africa). It could be that there are nonlinearities (e.g. kinks, reversed relationships) across the income continuum that are poorly characterised by this simple analysis. For example, those living far above the USD 1.90 per day threshold may have a very different relationship with forests than those living far below it.

To provide policy context we consider the role of forests in Poverty Reduction Strategy Papers (PRSPs). The International Monetary Fund (IMF) considers these policy documents to preserve national ownership of poverty reduction strategies and provide flexibility reflecting the particular circumstances of countries supported through their Poverty Reduction and Growth Trust (IMF 2018). PRSPs reveal whether national governments consider forests and poverty reduction to be ‘friends’ (i.e. synergistic relationship), ‘foes’ (i.e. competitive relationship) or completely independent of one another (i.e. no relationship). Pursuit of SDG 1 is likely to lead to better outcomes for forests in countries where conservation and sustainable management of forests are considered synergistic with poverty reduction. Of the 12 low-income or low-middle-income countries with the highest forest cover per capita, 9 have PRSPs. [Table 1.2](#) summarises these, noting both specific references to forests and the overall stance towards forests, revealing policy priorities and political realities.

The PRSPs reflect different national positions on the role of forest conservation and sustainable management in poverty reduction, which we categorise as: (1) no role – forest protection is a responsibility unrelated to poverty reduction; (2) implicit – environmental protection (including forest protection) is a cross-cutting theme but few explicit actions related to forests are included; (3) supporting – forest protection and sustainable management is expected to contribute to poverty reduction, e.g. through ecosystem services; and (4) major – better governance of forests could be a key source of economic growth and thus critical for poverty reduction. Many PRSPs suggest that forests play an implicit or supporting role in poverty reduction. In contrast, the PRSPs consistently identify transportation infrastructure and agricultural development as important means of poverty reduction, both of which are tied to deforestation. This reflects conflicting policy priorities in some countries, while in other countries (especially those with relatively abundant forests and

Table 1.2 Forests in the PRSPs in countries with high forest cover

Country, Year of publication ^a	Forest (ha) per capita	Reference to forests	Likely impact on forest	Role of forest	Poverty indicator used
Republic of Bolivia (2001)	5.3	Increase rural employment through better roads, irrigation and electrification infrastructures, and access to land for agriculture and settlement; increase export competitiveness of agricultural products; increase non-agricultural income, such as rural tourism; actions to reduce levels of risk and vulnerability to water scarcity and natural disasters include reforestation and environmental conservation through integrated, sustainable natural resource management.	Negative	Implicit – Not a major economic sector; mainly to ensure rural resilience	Income to purchase a basket of goods and services
Rep. of Congo (2012)	5.0	Improve forestry and wood industry through specialised schools and industrialisation, improved forest management, and improved utilisation of non-wood forest products; forest conservation through participatory approaches and strategies such as REDD+, PES and forest certification.	Positive	Major – Forestry a source of national wealth (5.6% of GDP, 10% of foreign trade, 16 000 jobs)	Multidimensional (employment, access to services, quality of governance, income)

Mongolia (2003)	4.6	Forests need to be protected and expanded, mainly to provide ecosystem services to support other sectors; notably, livestock forests are acknowledged for their potential to generate jobs for the poor, e.g. through tree planting and forest utilisation.	No impact	Implicit – Mainly to support livestock, avoid desertification and provide informal jobs	Income
Royal Government of Bhutan (2004)	3.6	The 2020 target includes maintaining 60% of Bhutan’s land area under forest coverage in perpetuity (from 72% forest cover in 2004), increase access to roads, increase income and employment; ‘preserving and promoting cultural heritage and environment conservation’ is one of the plan’s 5 main objectives.	Negative	Supporting – Strong baseline environmental policies and environmental conservation is 1 of 5 pillars of long-term economic development	Household expenditure
Republic of Zambia (2006)	3.3	The overall strategy of broad-based wealth and job creation through economic infrastructure and human development focuses on rural development and agriculture (irrigation, food security, roads, livestock, microfinance); forests are a part of the natural resources sectoral plan as the main provider of household energy, with untapped potential for generating income from wood industries and tourism.	Negative	Implicit – Forests contribute 3.7% of GDP via charcoal and firewood production	Income level; forest loss/ degradation an indicator and result of poverty

Table 1.2 (cont.)

Country, Year of publication ^a	Forest (ha) per capita	Reference to forests	Likely impact on forest	Role of forest	Poverty indicator used
Lao PDR (2006)	2.8	Effective poverty reduction is achieved through increased agricultural productivity and better access to markets via better roads.; sustainable and participatory forest management mentioned as a subcomponent in 1 of 5 strategies for reducing rural poverty; poverty reduction can reduce environmental degradation, and economic growth can encourage environmental conservation if accompanied by education and training and development of scientific and technological capacities.	Negative	No role – Co-location: most poverty found in remote highlands, where forests are located	Includes lack of agricultural land
Dem. Rep. of Congo (2006)	2.2	As 1 of 6 sectors with growth potential, forestry is targeted with actions to improve forest management and institutions; 1 pillar of poverty reduction is improved governance, notably in forestry and mining sectors.	Positive	Major – Better governance needed to tap into this income	Peace, access to public services and productive capital, governance and meeting basic needs

Rep. of Guinea-Bissau (2011)	1.3	Environmental management and protection is a subcomponent of promoting inclusive, sustainable economic development, which is the last of 6 core areas in poverty reduction; the focus is on building capacity to address natural disasters including forest degradation; strategy for targeting the very poor focuses on revitalising agriculture, notably cashew and rice production.	Negative	Supporting – Small part of 1 of 4 core areas for poverty reduction related to sustainable economic development	Monetary and non-monetary (housing, sanitation, safe drinking water, consumer durables)
United Rep. of Tanzania (2010)	1.0	Alleviate income poverty by focusing on identified growth areas in agriculture, tourism, manufacturing and mining, and cross-sectoral drivers (e.g. roads, energy, water); forestry and forest products are one of 7 agricultural sub-sectors targeted for growth by 2015, as part of reducing income poverty; forest is a factor of production that needs to be used more efficiently for productivity gains and value addition.	Negative	Supporting – via tourism, rural job creation	Income, well-being, and good governance
<p>^a Not included due to lack of PRSP: Solomon Islands, Vanuatu and Zimbabwe</p>					

relatively low income) it reflects the view that forest resources are a means of economic development (Maini 2003). In sum, while the PRSPs suggest a wide range of approaches to forest policy, their almost universal call to alleviate rural poverty through agricultural and infrastructural development is likely to result in forest loss.

1.3 Social Protection

Target 1.3 calls for implementing nationally appropriate social protection systems and measures for all, including floors, and achieving substantial coverage of the poor and the vulnerable. Tirivayi et al. (2017) point out that forest-dependent peoples are typically poor and vulnerable, and therefore in particular need of social protection. Social protection systems, including programmes such as unemployment insurance and pensions for the elderly, are designed to help people cope with shocks and meet their basic needs. Over the past 20 years, cash transfer programmes have become a prominent component of social protection systems throughout the developing world (Handa et al. 2017, Hulme et al. 2012).

In addition to protecting recipients' human capital, cash transfer programmes can also affect households' economic production. The intent of most cash transfer programmes is to break the intergenerational transmission of poverty to children and build their human capital by increasing their consumption of food, health services and education (Baird et al. 2014, Bastagli et al. 2016, Manley et al. 2013). But cash transfers can also affect the economic production of households, especially family farmers who are otherwise cash constrained. These changes in households' production could impact forest resources both positively and negatively. For example, infusions of cash could increase pressure on forests if they enable households to expand their agricultural operations. Or, transfers could decrease pressure on local ecosystems if they enable migration to cities or the establishment of non-farm businesses.

There are multiple other pathways through which cash transfers could affect forests. A regular cash flow could make households less vulnerable to income shocks and thus less likely to rely on forests as 'natural insurance' (Pattanayak and Sills 2001) through harvesting and selling forest products. Cash transfers can enable increased consumption, with significant effects on deforestation locally or through markets for products that drive deforestation, such as beef, milk, soy and palm oil. Tracking the associated supply responses across space and time is challenging, making it difficult to quantify the full causal impacts of social protection systems on forests.

Many studies examine the effects of cash transfers on agricultural productivity. They typically find that in addition to building children's human capital, cash transfers help households increase their agricultural output (Tirivayi et al. 2016). This empirical regularity is likely associated with the other consistent finding that transfers increase purchases of agricultural inputs, such as chemical fertiliser. This could mean transfers are promoting agricultural intensification (increases in agricultural output without corresponding increases in hectares farmed), although increases in the area farmed (i.e. extensive agriculture) are also possible. Among these studies, there are a few that directly consider impacts on land use, including forests.

Our search of the literature uncovered ten studies of how cash transfers to the rural poor affect natural resources, including one study of remittances rather than government transfers (López-Feldman and Chávez 2017). Table 1.3 summarises the nine studies that estimate impacts on land use (the tenth study – Gilliland et al. 2018 – focuses on fisheries). All of the study sites are in the early stage of the forest transition, i.e. forest loss is ongoing. The recipients of the cash transfers generally have limited market access. Two of the studies (Alix-Garcia et al. 2013, Ferraro and Simorangkir 2018) combine household survey data with geospatial data to identify impacts on forests; the remaining seven report impacts on land used for farming. Two of the studies (Lawlor 2015, López-Feldman and Chávez 2017,) also examine impacts on forest product harvesting. Finally, two of the studies (Alix-Garcia et al. 2013, Lawlor 2015) explore how variations in market access affect transfers' impacts on natural resources. Overall, this literature finds that both conditional and unconditional cash transfer programmes have significant impacts on consumption and production in the short run (e.g. after only two years of payments).

Specifically, there is evidence that cash transfers might be encouraging land intensification in Lesotho (Daidone et al. 2014) and among farmers with larger landholdings in Mexico (Gertler et al. 2012, Todd et al. 2010). Transfers are promoting agricultural expansion among smallholders and those receiving agricultural subsidies in Mexico (Todd et al. 2010), Malawi (Asfaw et al. 2016b) and Zambia (Lawlor 2015). Cash is enabling the previously landless to farm in Mexico (Gertler et al. 2012, Todd et al. 2010) and increasing the number of farmers in Ethiopia (Asfaw et al. 2016a) and in Zambia among households living more than 10 km from markets (Lawlor 2015). In Ethiopia, transfers are reducing the likelihood of leaving land fallow (Asfaw et al. 2016a). The only evidence that cash transfers can decrease the likelihood of participating in agriculture comes from the López-Feldman and Chávez (2017) study of remittances in Mexico. However, their sample

Table 1.3 Studies evaluating the effect of cash transfers on land use

Authors (year)	Country, programme	Type of income support*	Study design	Impacts of cash transfers on ...	
				Land use	Non-farm business and wage labour
Todd et al. (2010)	Mexico, <i>Oportunidades</i>	CCT for extremely poor households with children	Treatment-comparison with randomised data and matching weights	<ul style="list-style-type: none"> – Increases likelihood of farming land among previously landless – Increases per capita area farmed by smallholders; no change for large landholders – Increases in area farmed, largest for those receiving agricultural subsidies 	Not reported
Gertler et al. (2012)	Mexico, <i>Oportunidades</i>	CCT for extremely poor households with children	Randomised treatment – control	<ul style="list-style-type: none"> – Increases likelihood of farming land among previously landless – No impact on land area used among landed farmers 	– Increases likelihood of owning non-farm business
Alix-Garcia et al. (2013)	Mexico, <i>Oportunidades</i>	CCT for extremely poor households with children	Instrumental variable	<ul style="list-style-type: none"> – Increases deforestation due to increased consumption of beef and milk – Impacts appear larger in isolated communities 	Not reported
Daidone et al. (2014)	Lesotho, Child Grant Program	UCT for poor households with children	Randomised treatment – control	– No impact on the probability of growing crops or area farmed	<ul style="list-style-type: none"> – Reduces non-farm businesses for labour-constrained households – Reduces participation in wage labour

Asfaw et al. (2016a)	Ethiopia, Tigray Social Cash Transfer Pilot Programme	UCT for extremely poor, labour-constrained households	Matched treatment – comparison	<ul style="list-style-type: none"> – Increases probability of growing crops – Decreases likelihood of leaving land fallow 	<ul style="list-style-type: none"> – Reduces non-farm businesses for female-headed households – Reduces participation in wage labour
Asfaw et al. (2016b)	Malawi, Social Cash Transfer Program	UCT for extremely poor, labour-constrained households	Randomised treatment – control	<ul style="list-style-type: none"> – Increases area farmed – Increases adoption of sustainable farming practices 	<ul style="list-style-type: none"> – Reduces non-farm businesses for labour-constrained and female-headed households – Reduces charcoal/firewood businesses and increases petty trade enterprises – Increases number of days adult males spend earning wage income
López-Feldman and Chávez (2017)	Mexico	Remittances	Instrumental variable	<ul style="list-style-type: none"> – Decreases likelihood of participating in agriculture or natural resource extraction as well as reliance on environmental income 	<ul style="list-style-type: none"> – Increases likelihood of earning wage income

Table 1.3 (cont.)

Authors (year)	Country, programme	Type of income support*	Study design	Impacts of cash transfers on ...	
				Land use	Non-farm business and wage labour
Ferraro and Simorangkir (2018)	Indonesia, Program Keluarga Harapan	CCT for extremely poor households with children	Matched treatment-comparison	– Reduces village forest loss	Not reported
Lawlor (2015)	Zambia, Child Grant Programme	UCT for households with a child under age 5	Randomised treatment – control	<ul style="list-style-type: none"> – No impacts on fuelwood or bushmeat Close to markets (< 10 km) <ul style="list-style-type: none"> – increases use of charcoal – no impact on decision to farm – increases area farmed Far from markets (> 10 km) <ul style="list-style-type: none"> – no impact on charcoal use – increases likelihood of farming – increases area farmed 	– Increases likelihood of owning non-farm business

* CCT: Conditional Cash Transfer

UCT: Unconditional Cash Transfer

excludes the country's smallest villages, with perhaps the most limited market access. Across the studies there is no evidence that cash transfers promote afforestation/reforestation.

In addition to agricultural impacts, two studies estimate impacts on households' natural resource use. In Mexico, remittances decreased harvesting of natural resources (firewood, timber and wild fruits, plants and meat) as well as reliance on environmental income (López-Feldman and Chávez 2017), supporting the hypothesis that transfers can replace natural insurance. However, in Zambia, cash transfers had no impact on consumption of bushmeat or fuelwood, and for households living within 10 km of markets, transfers increased the likelihood of using charcoal by 10 percentage points (Lawlor 2015). This is especially notable because charcoal is the principal driver of forest loss in Zambia (Day et al. 2014) and many other African countries, highlighting the importance of coupling poverty reduction programmes with clean energy initiatives (see Chapter 7).

Some of the studies reviewed also estimate impacts on livelihood strategies beyond farming and natural resource use. For example, in Mexico transfers increased the number of households owning small businesses by 67 per cent (Gertler et al. 2012), and remittances increased the likelihood of earning wage income by 14 percentage points (López-Feldman and Chávez 2017). In Zambia, transfers promoted diversification into non-farm businesses, with much larger impacts on those living close to markets (increased likelihood by 23 percentage points) than those living far from markets (increased likelihood by 11 percentage points) (Lawlor 2015). The magnitude of these impacts on non-farm businesses is quite large, especially considering these impacts are estimated after only two years of cash transfers. Taken together, these results provide evidence that cash transfers can help households diversify livelihood strategies, and may decrease pressure on forests over the long run by decreasing reliance on agriculture for income.

The two studies that harness geospatial data to identify the impacts of cash transfers on forests are most relevant to the question of how reducing poverty will impact forests because they capture not only how beneficiary households respond, but also spillovers to other households. Cash transfers could have significant multiplier effects, raising non-beneficiaries' consumption and production while avoiding inflation (Handa et al. 2017, 2018). This could have implications for land use, for instance, if beneficiaries' increased demand for food is met by increased food production by their neighbours or neighbouring communities. However, the two studies provide contradictory results. Alix-Garcia et al. (2013) find that transfers increased deforestation in Mexico, whereas Ferraro and Simorangkir (2018) find that cash transfers decreased deforestation in Indonesia. Both studies examine impacts after five

years of payments. In Mexico, cash transfers increased deforestation rates by 15–33 per cent. The authors investigate how impacts vary according to market access and observe the largest impacts in isolated communities, which they conclude is because better market access diffuses the supply response across other communities. In Indonesia, on the other hand, transfers reduced village forest loss by 20 per cent (3.63 ha). The authors find some heterogeneity of impacts across forest governance institutions, with the largest reductions in forest loss in community forests, followed by concessions and protected areas. This raises the question of whether the cash transfers influence collective action, as well as household livelihood strategies. Further research is needed to understand the causal mechanisms.

Taken together, what can we say about the potential impact on forests of expanding the coverage of social protection systems? Clearly, the impacts of cash transfers vary by region due to differences in access to markets for land, labour, inputs and outputs, as well as differences in forest clearance costs and land tenure. The Indonesia study is the only one that finds clear positive impacts on forests. The remaining studies suggest that in the short run, rural households invest part of the transfers in their farms and that this results in the expansion of farmed area. Furthermore, households increase their food consumption, which elicits a supply response that increases pressure on forests. In the long run, some households living close to markets may be able to shift out of agriculture to non-farm businesses or wage labour, decreasing pressure on forests (cf. Sierra and Russman 2006). This could be encouraged by making cash transfers conditional on forest conservation, as in payments for ecosystem services (PES) (Alix-Garcia and Wolff 2014, Rodríguez et al. 2011). PES are often presented as a means to reduce both rural poverty and ecosystem degradation, although the targeting rules that maximise poverty reduction are likely to differ from the rules that maximise conservation benefits (James and Sills 2018). Both experience and field experiments have demonstrated the importance of local institutions in moderating the effects of PES, including effects on poverty (Sills and Jones 2018). The moderating effect of community tenure in the Indonesia case (Ferraro and Simorangkir 2018) suggests this may also be true of cash transfers.

1.4 Land Tenure

Target 1.4 calls for ensuring equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services. Access depends fundamentally on transportation infrastructure (SDG 9) and basic services including housing (SDG 11), water (SDG

6) and energy (SDG 7), all of which can generate demand for ecosystem products and/or services, with implications for forests. In this section we focus on ownership and control over land, in particular on the security of private and communal land tenure.

Land tenure encompasses the institutions and policies that determine how land and its resources are accessed, who can hold and use these resources, for how long and under what conditions (Robinson et al. 2014). Tenure regimes can be characterised both by *who* holds rights (an individual, a community, a private entity, the state or, in the case of open access, no one) and by the *security* of those rights (defined by degree of protection against eviction and ability to exclude others). Elbow (2014) notes that tenure security can be achieved through public recognition of customary or Indigenous rights, certificates that secure the rights to use or manage resources, or titling of community-managed land or individual property rights. This is reflected in Indicator 1.4.2, which measures both the fraction of the population with legally recognised documentation of land tenure and the fraction of the population who perceive their rights to land as secure. Land tenure security is the perception that rights will be upheld by society (Sjaastad and Bromley 2000) or the certainty ‘that a person’s rights to land will be recognised by others and protected in cases of specific challenges’ (Land Portal 2018). Securing land tenure has long been recognised as a tool for reducing poverty and enhancing economic development since it can both encourage investment and facilitate access to credit.

The security of land tenure affects forests through several channels. First, the need to secure tenure by demonstrating investment in the land may encourage deforestation in some contexts (Alston et al. 2000) and tree planting in others (Barbier and Tesfaw 2013). In many contexts, insecure tenure creates disincentives to invest in reforestation or forest management since land users have no assurance of reaping future benefits (Chazdon et al. 2016). Additionally, when forest users perceive their rights to the resource as time-limited or insecure, they are incentivised to harvest as much of the resource as fast as possible. Numerous studies have found that insecure land tenure promotes faster timber harvesting (Dorner and Thiesenhusen 1992, Puppim de Oliveira 2008, White and Martin 2002). Where the agents of deforestation are external to the customary occupants of the land, tenure insecurity for those occupants means that they do not have clear rights or incentives to defend forests from the external agents. Finally, access to technical assistance and direct conditional incentives to conserve forest (such as REDD+) may require secure tenure (Larson et al. 2013). On the other hand, increasing land tenure security can increase deforestation if it encourages investment in profitable agricultural activities that replace forest, such as plantation crops,

or sale of land to agents that plan to clear the forest (Liscow 2013). In sum, the literature reports cases of tenure security both reducing and increasing deforestation, with differences related to livelihood strategies, socio-cultural institutions, tenure type, level of inequality (in communal tenure systems) and numerous other factors.

In a recent systematic review, Robinson et al. (2014) identify 36 publications that report 118 relationships between specific forms and security of tenure and (sub)tropical deforestation. All major regions of the tropics are represented in their sample. They categorise studies based on whether tenure security has a causal relationship with positive forest outcomes (defined as slowing deforestation or maintaining/regenerating forests) or negative forest outcomes (defined as accelerating deforestation). They find that communal (but not private or customary/traditional) tenure increases the likelihood of positive forest outcomes. Tenure security is consistently associated with positive forest outcomes across all types of tenure. This contrasts with the findings of a meta-analysis of spatially explicit econometric studies of deforestation by Busch and Ferretti-Gallon (2017). Based on 27 studies that estimate the effect of tenure security (defined as land ownership, legal title or duration of occupancy), they conclude that there is no systematic relationship between tenure security and deforestation.

To update the findings of Robinson et al. (2014) and Busch and Ferretti-Gallon (2017), we searched for recent studies (published in 2014 or later) of how tenure security affects forests, focusing on private and communal tenure. Like Robinson et al. (2014), we only include studies that give some indication of the degree to which tenure rights are secure. Following Robinson et al. (2014), we define forest outcomes as either positive or negative and only include studies that give some indication of the degree to which tenure rights are secure. The results of seven recent studies are summarised in Table 1.4. All of these studies estimate the effects of circumstances or interventions that increase tenure security.

L'Roe et al. (2016) find that formalising individual land claims in the eastern Brazilian Amazon by mapping and recording them in a state-run registry decreases deforestation on medium-sized properties (100–300 ha). Registration of land claims, however, has no impact on deforestation of larger properties. Holland et al. (2017) find the titling of private lands around a reserve only reduces deforestation when accompanied by 'forest friendly' restrictions.

In Uganda, Call et al. (2017) find that households are more likely to engage in tree-planting if they have secure tenure, are educated and live in isolated communities. In China, Lin et al. (2018) find that these types of investments are more likely when households can obtain logging permits but are not affected by tenure security.

Table 1.4 Effects of securing tenure on forests across tenure type: 2014–2017 studies

	Common-Property Regime			Individual Property		
	Positive Outcome for Forests	Negative Outcome for Forests	No Impact	Positive Outcome for Forests	Negative Outcome for Forests	No Impact
Brazil			BenYishay et al. (2017)	L'Roe et al. (2016)		
China						Lin et al. (2018)
Ecuador			Buntaine et al. (2015)	Holland et al. (2017)*		
Peru	Blackman et al. (2017)					
Uganda				Call et al. (2017)		

* Holland et al. (2017) find a positive effect on forests only when tenure security is bundled with restrictions on forest clearing and subdivision of properties.

Both Buntaine et al. (2015) and BenYishay et al. (2017) find that formalising Indigenous communities' land rights in Ecuador and Brazil, respectively, has no impact on rates of forest loss. In contrast, Blackman et al. (2017) find that titling Indigenous communities' land in Peru dramatically reduced deforestation in just three years. In order to obtain titles, the Peruvian communities had to submit sustainable management plans, which Robinson et al. (2017) argue may be necessary for tenure security to have a positive effect on forests. Blackman and Veit (2018) also find that allocation of tenure rights and management by Indigenous communities reduces deforestation in Bolivia, Brazil and Colombia (but not Ecuador).

In sum, the effect of increasing land tenure security (the perception that rights to land are recognised and will be upheld) on forests is context dependent. The existing evidence base suggests that increasing tenure security rarely leads to forest loss. However, the long-term effects are relatively understudied

and hence unknown. As with direct cash transfers, there are suggestions that increasing tenure security is most likely to favour forests when accompanied by incentives or conditions that explicitly require forest conservation and sustainable management (Holland et al. 2017, Robinson et al. 2017).

1.5 Ecosystem-Based Adaptation to Climate Change

Target 1.5 is ‘to build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters’. Forests have long been recognised as a safety net or form of natural insurance, providing both cash income and subsistence goods to poor rural households living on the forest margin, thus reducing their vulnerability and increasing their adaptive capacity and livelihood resilience (Agrawal et al. 2013, Byron and Arnold 1999, Pattanayak and Sills 2001). Poor and vulnerable populations tend to concentrate in remote and environmentally fragile areas (Sunderlin et al. 2008, Watmough et al. 2016), and they rely disproportionately on natural resources and ecosystem services to support their livelihoods, for both subsistence and income generation (Barbier 2010, Barrett 2005). This implies they are both more exposed (more often affected) and more vulnerable (lose more when affected relative to their income or wealth) to environmental shocks (Hallegatte et al. 2016). It also implies the effects of environmental shocks are likely to be channelled through ecosystems and moderated by the health of those ecosystems. Thus, managing for improved ecosystem health may be an effective way to reduce the exposure and vulnerability of poor populations to shocks and disasters.

There is increasing scientific and policy consensus that natural ecosystems can contribute to climate change adaptation by reducing exposure to shocks (Doswald et al. 2014, Munang et al. 2013). The role of forests in mitigating climate change itself through REDD+ is discussed in Chapter 13. Forests are often credited with reducing the sensitivity of ecosystems to extreme rainfall events, thus buffering communities from floods (Chapter 6), and mangrove forests can reduce damage from storm surges in coastal areas (Das and Vincent 2009, Chapter 14). Thus, measures to reduce exposure and vulnerability could include reforestation of slopes to prevent landslides and restoration of mangrove shelterbelts to protect coastal settlements against storms (Pramova et al. 2012). These are examples of ecosystem-based adaptation, or the conservation or restoration of natural ecosystems to reduce the vulnerability of people facing climate change threats (Vignola et al. 2009). This may be accomplished through public works programmes that jointly provide social protection and expanded forest cover (Tirivayi 2017). Ecosystem-based

adaptation has been adopted in some National Adaptation Programmes of Action, as reflected in calls for afforestation and reforestation in Burkina Faso and Mali (to forestall desertification), Bangladesh (to stabilise the coast) and Haiti (to protect watersheds) (Locatelli et al. 2008). Thus, efforts to meet Target 1.5 could result in an expansion of forest area.

1.5.1 Sloping Land Conservation Program

The Sloping Land Conservation Program (SLCP) in China is another example of a national forest policy implemented to reduce exposure and vulnerability to environmental shocks. The SLCP is one of several programmes that China launched in response to a perceived 'national land-system sustainability emergency' in the late 1990s (Bryan et al. 2018). With rapid economic growth since the 1980s, China has experienced deforestation and land degradation (Liu and Diamond 2005). Deforestation and over-logging have exacerbated soil erosion, which is believed to threaten the safety of more than 100 million Chinese living in downstream sections of rivers in the eastern coastal region (Liu and Wu 2010). In particular, the massive floods of 1998, which resulted in more than 4000 deaths and serious economic damages, were blamed on soil erosion due to logging and deforestation in the Yangtze and Yellow River basins (Gutiérrez Rodríguez et al. 2016, Jin et al. 2017).

This perception that deforestation was to blame for the flooding led directly to the National Forest Protection Program, which banned logging, and the SLCP, which initially subsidised farmers to convert cropland to forest or grassland in the basins that had suffered flooding. In 2002, the Chinese government expanded the SLCP to cover most of the country (Liu et al. 2008). Under this programme, farmers with land prone to soil erosion and desertification are encouraged to convert agricultural fields to forest or grassland with subsidies from the government (Liu and Wu 2010). The subsidies, which many authors describe as PES, have been in the form of grain or cash. In their systematic review of the literature on the programme, Gutiérrez Rodríguez et al. (2016) find that most studies confirm the expected positive impact of the programme on forest cover and tree planting. Chen et al. (2015) concur that forest cover has increased, but note that some studies have raised questions about how much of the increase should be attributed to the SLCP and about the effects on ecosystem services.

In summary, forests have been recognised as potentially reducing both exposure and vulnerability to environmental shocks, including the extreme weather events that are expected to increase in frequency and severity with climate change. Particularly for the poorest and most vulnerable communities, investing in ecosystem services may be more effective, efficient and

sustainable than infrastructure or technological options for adaptation (Locatelli et al. 2008). Thus, Target 1.5 provides an incentive to invest in forest protection and reforestation, especially in coastal zones, on steep slopes, in areas at risk of desertification and in critical watersheds. While these investments may be more likely to happen after a disaster (e.g. SLCP implementation in the wake of catastrophic floods), there are increasing calls to proactively implement ecosystem-based adaptation, including through afforestation and reforestation.

1.6 Conclusion and Means of Implementation

As with most SDGs, the suggested means of implementation for SDG 1 are mobilisation of resources and investment. For SDG 1, these are indicated by the proportion of government spending and international aid (grants and non-debt-creating inflows) allocated to three priorities: (1) poverty reduction; (2) education, health and social protection; and (3) sectors that disproportionately benefit women, the poor and vulnerable groups. While international aid to a country is not strictly a zero-sum game, clearly all governments operate under budget constraints. In this context, increasing the proportions of government spending and international aid on the priorities identified for SDG 1 could reduce the proportions of spending and aid allocated to forests (also a prominent concern for biodiversity; see Roe et al. 2013, Sanderson and Redford 2003). This could exacerbate the underfunding of the forest sector (Agrawal et al. 2013). Furthermore, as illustrated by the PRSPs, most governments prioritise infrastructure and agricultural development to alleviate rural poverty, with likely negative impacts on forests.

These trade-offs can be avoided if forests are understood to be fundamental to poverty reduction and hence included either as a means of poverty reduction (e.g. as part of ecosystem-based adaptation) or as a condition of poverty-reduction policies (e.g. social protection or titling policies that require commitments to forest conservation). Given the concentration of poverty in Africa, this is particularly important for the future of forests on that continent. There is some evidence that donors and governments are increasingly recognising the potential synergies between forest conservation and poverty reduction (Leisher et al. 2013). For example, Ethiopia's climate-resilient green economy strategy includes forest protection and restoration as one of the four pillars of economic development (FDRE 2011). Bilateral donors have invested resources in understanding forest–poverty relationships – for example, through the Ecosystem Services for Poverty Alleviation programme (Schreckenberget al. 2018). This programme was funded by the UK's Department for International Development, along with the Economic

and Social Research Council and Natural Environment Research Council. Likewise, CIFORs ⁴ Poverty and Environment Network attracted funding from international donors for rigorous research that carefully quantified the contribution of forest products to local livelihoods (Wunder et al. 2014).

While the importance of ecosystem goods and services to the rural poor has been established by this line of research, there is much less evidence on the types of interventions that can successfully achieve both forest conservation and poverty reduction (cf. Adams et al. 2004). For example, reviews of integrated conservation and development projects have generally concluded that most fail to achieve their goals (Naughton-Treves et al. 2005), and even that those goals are fundamentally contradictory (Miller et al. 2011). Likewise, the literature on PES has been cautious about its potential to simultaneously achieve forest conservation and poverty reduction, in part because these two goals may require different spatial targeting (Alix-Garcia et al. 2013, 2015; James and Sills 2018). Systematic reviews of the literature have found no evidence that PES harms recipients, but little evidence of benefits (Sills and Jones 2018).

Forest conservation is often pursued through reallocation of property rights to forests, either to government agencies to manage as protected areas or to communities to manage under sustainability requirements enforced by the government. Intuition suggests that restricting access to forest in protected areas should have a negative effect on local incomes, while decentralisation of forest management should increase incomes. However, recent research using rigorous quasi-experimental methods has found that protected areas can help alleviate poverty, with tourism as the likely mechanism (den Braber et al. 2018, Ferraro and Hanauer 2014, Pullin et al. 2013, Robalino and Villalobos-Fiatt 2015, Sims 2010). In a systematic review of impact evaluations of decentralisation, Samii et al. (2014) find three studies that report a positive effect on participants' household income (from forests or in total), suggesting a fairly thin evidence base. Further research into how impacts are moderated by institutions and other contextual factors is needed to understand the potential to achieve SDG 1 through forest initiatives (Sills and Jones 2018). Research that differentiates impacts on women, the poor and vulnerable groups may identify windows of opportunity or challenges. For example, Duchelle et al. (2018) report that REDD+ initiatives that limit deforestation have generally not negatively impacted local incomes. In sites where there have been negative impacts, they are concentrated among the highest-income households, resulting in greater equality of income. In the same sample, Larson et al. (2018) find negative impacts of REDD+ on women except

⁴ Centre for International Forestry Research.

in sites where there were explicit strategies to address their priorities (also see Chapter 5). Thus, opportunities for win–wins may be fairly narrowly defined and require detailed analysis and tailored policies.

In sum, the specific targets for SDG 1 include social protection, secure land tenure and reducing exposure and vulnerability to environmental shocks. The empirical literature shows that cash transfers as well as more secure property rights – especially for community land – can be conducive to forest conservation, given the right context and conditionalities. As demonstrated by programmes to reforest hillsides and protect mangroves, initiatives to reduce vulnerability to environmental shocks can adopt an ecosystem-based adaptation approach, thereby promoting an expansion of forest cover. This approach is consistent with the scientific evidence that forests are both a mainstay of rural livelihoods and a source of natural insurance. However, there is relatively little evidence that this scientific knowledge is shaping poverty reduction and national development strategies. To the extent that those strategies are based on infrastructure and agricultural development, they are likely to remain in conflict with forest conservation and sustainable management.

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