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Forests, Trees and the Eradication of Poverty: Potential and Limitations

A Global Assessment Report

Editors: Daniel C. Miller, Stephanie Mansourian and Christoph Wildburger

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Tel +43 (0)1 877 01 51-0
E-mail office@iufro.org
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Preface

Since its establishment in the year 2007, the Global Forest Expert Panels (GFEP) initiative of the Collaborative Partnership on Forests (CPF) has been effectively linking scientific knowledge with political decision-making on forests. GFEP responds directly to key forest-related policy questions by consolidating available scientific knowledge and expertise on these questions at a global level. It provides decision-makers with the most relevant, objective and accurate information, and thus makes an essential contribution to increasing the quality and effectiveness of international forest governance.

This report, titled "Forests, Trees and the Eradication of Poverty: Potential and Limitations", presents the results of the seventh global scientific assessment undertaken so far within the framework of GFEP. All assessment reports are prepared by internationally recognised scientists from a variety of biophysical and social science disciplines. The publications are presented to stakeholders across relevant international policy fora. In this way, GFEP supports a more coherent policy dialogue about the role of forests in addressing the broader environmental, social and economic challenges reflected in the United Nations Sustainable Development Goals (SDGs).

Poverty is one of the greatest challenges facing humanity. Globally, one out of every 10 people lives in extreme poverty. Poverty eradication has therefore found a place at the top of the United Nations 2030 Agenda for Sustainable Development. "End poverty in all its forms everywhere" is the first Goal of this Agenda, which is supported by all 193 UN member states. The international community is now stepping up efforts to achieve this goal, especially in response to the severe setback caused by the Covid-19 pandemic. The zoonotic nature of the Covid-19 virus has also illustrated the urgency to reduce human pressure on nature.

One way to relieve this pressure and alleviate poverty is to recognize and further optimize the critical role of forests and trees as allies in the fight against poverty. This report consolidates available scientific evidence on the wide range of contributions which forests and trees outside forests make to curbing poverty, and on the effectiveness of diverse forest management policies, programs, technologies and strategies. It does so based on an understanding of poverty not only in terms of monetary values, but also as an obstacle that keeps people from attaining a certain level of well-being and participating fully in society.

Poor and vulnerable people often depend on the use of natural resources and, in many regions, they are able to harness forest goods and services to manage and mitigate risk, especially in the face of crises. It is therefore essential to take into account the role that forests play in development in general, and in achieving poverty eradication, in particular. Scientific reports like the one in hand are important tools for supporting policy-makers and stakeholders in their ambition to ensure sustainable development and to advance the implementation of the United Nations 2030 Agenda.

I would like to thank the Chair of the Global Forest Expert Panel on Forests and Poverty, Daniel C. Miller, GFEP Coordinator Christoph Wildburger, GFEP Editor Stephanie Mansourian, and the GFEP Team for their excellent work in guiding the assessment process and in leading the development of this publication. It is my sincere hope that those with a responsibility for implementing the SDGs at all levels will find this report, and its accompanying policy brief, a useful source of information and inspiration.

Alexander Buck
IUFRO Executive Director

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This publication is the product of the collaborative work of scientific experts within the framework of the Global Forest Expert Panel (GFEP) assessment on Forests and Poverty, who served in different capacities as panel members and authors. We express our sincere gratitude to all of them:

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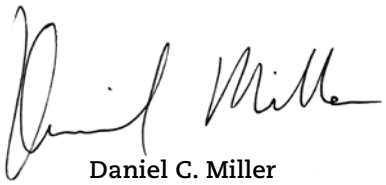

Daniel C. Miller
Chair

Stephanie Mansourian
Content Editor

Christoph Wildburger
GFEP Coordinator

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List of Acronyms and Abbreviations

ACOFOP	Association of Forest Communities of Petén
AI	Artificial Intelligence
CBD	UN Convention on Biological Diversity
CCB	Climate, Community and Biodiversity
CCP	Company-Community Partnership
CFE	Community Forest Enterprise
CFM	Community Forest Management
CFUG	Community Forest User Group
CGIAR	Consultative Group on International Agricultural Research
CIFOR	Center for International Forestry Research
CIS	Commonwealth of Independent States
CLIP	Community Life Improvement Programme
CPF	Collaborative Partnership on Forests
DHS	Demographic and Health Survey
DRC	Democratic Republic of the Congo
ECOSOC	United Nations Economic and Social Council
EID	Emerging Infectious Disease
ES	Ecosystem Service
EU	European Union
EUTR	European Union Timber Regulation
FAO	Food and Agriculture Organization of the United Nations
FLEGT	Forest Law Enforcement, Governance and Trade
FLR	Forest Landscape Restoration
FLU	Forest and other Land Use
FMNR	Farmer Managed Natural Regeneration
FOE	Friends Of the Earth
FPIC	Free, Prior and Informed Consent
FPO	Forest Producer Organisation
FSC	Forest Stewardship Council
FTA	Forests, Trees and Agroforestry
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFEP	Global Forest Expert Panel
GIIN	Global Impact Investing Network
GIS	Geographic Information System
GNI	Gross National Income
ha	Hectare
HIC	High-Income Country
HIV	Human Immunodeficiency Virus
HLPE	High Level Panel of Experts on Food Security and Nutrition

IFRI	International Forest Resources and Institutions
Int$	International dollar
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUFRO	International Union of Forest Research Organizations
LAPSSET	Lamu Port and Lamu-Southern Sudan-Ethiopia Transport Corridor
LCF	Locally-Controlled Forestry
LEB	Log Export Ban
LMIC	Low- and Middle-Income Country
LSMS	Living Standards Measurement Surveys
LULUCF	Land Use, Land-Use Change, and Forestry
MEA	Millennium Ecosystem Assessment
MPI	Multidimensional Poverty Index
MRL	Mountain-River-Lake
MT	Metric Tonnes
NCMM	National Commission for Museums and Monuments
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Product
ODA	Overseas Development Assistance
OECD	Organisation for Economic Cooperation and Development
PA	Protected Area
PEFC	Programme for the Endorsement of Forest Certification
PEN	Poverty Environment Network
PES	Payments for Ecosystem Services
PPF	Plan Piloto Forestal (Forestry Pilot Plan)
PPP	Purchasing Power Parity
PRIME	Productivity, Rights, complementary Investments, Markets and Ecosystem services
PROFOR	Program on Forests
RAFI	The Rural Advancement Foundation International
RCT	Randomised Control Trial
REDD+	Reducing Emissions from Deforestation and forest Degradation, and fostering conservation, sustainable management of forests and enhancement of forest carbon stocks
RRI	Rights and Resources Initiative
RSPO	Roundtable on Sustainable Palm Oil
SAN	Sustainable Agriculture Network
SDG	Sustainable Development Goal
SER	Society for Ecological Restoration
SLCP	Sloping Land Conversion Programme
SME	Small and Medium Enterprise
SMFE	Small and Medium Forest Enterprise
SVLK	Sistem Verificasi Legalitas Kayu (Indonesia's national timber legality assurance system)
SWIFT	Survey of Well-being via Instant and Frequent Tracking
TNC	The Nature Conservancy
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
USD	United States Dollars
VCS	Voluntary Carbon Standard
VPA	Voluntary Partnership Agreement
WEF	World Economic Forum
WHO	World Health Organization
WTTC	World Travel & Tourism Council
WWII	Second World War
WWF	World Wide Fund for Nature
ZDC	Zero Deforestation Commitment

1

Chapter 1

Introduction: Forests, Trees and Poverty

Coordinating Lead Author: *Daniel C. Miller*
Lead Authors: *Jennifer Zavaleta Cheek, Peter Newton, Christoph Wildburger, Terry Sunderland and Pamela A. Jagger*

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1.1 Problem Statement: Can forests and tree-based systems contribute to poverty alleviation?

Poverty[1] is one of the greatest challenges facing humanity. The poorest around the world often go hungry, lack adequate shelter, suffer from poor health, live with the threat of violence, and worry about their immediate future and that of their families. Despite major reductions in recent decades (McArthur and Rasmussen, 2018; World Bank, 2018), poverty remains stubbornly persistent. Globally, one out of every 10 people lives in extreme poverty, defined as less than 1.90 international dollars (Int$)[2] per day (World Bank, 2019). About two-thirds of the world's population still lives on less than Int$ 10 per day (Figure 1.1), the threshold (or *poverty line*) associated with a more permanent move out of poverty (Edward and Sumner, 2019). Poverty has not spared individuals in even some of the world's wealthiest countries, with the poverty rate exceeding 10% in many European countries and 15% in the United States (OECD, 2020a). Across the globe, millions more people make a living at levels just above national and international poverty lines and are at significant risk of moving into poverty (Krishna, 2011; World Bank, 2018). Poverty disproportionately affects marginalised groups and has stubbornly persisted across generations (UNDP, 2019).

Poverty has often been perceived using a monetary lens. More refined understandings of poverty emerged in the 1990s that consider the multiple dimensions making up *human well-being*, including health, safety, food and education, amongst others. These multidimensional definitions of poverty understand it as a state of deprivation or disadvantage that prevents an individual or group from attaining a certain level of well-being and participating fully in society (World Bank, 2001; Smeeding, 2016). Such definitions encompass not only commonly used income or consumption measures of poverty but also a range of non-monetary attributes that directly affect people's capabilities and overall well-being and allow human capabilities to go unrealised (Sen, 1993; 1999; Alkire, 2002; World Bank, 2018).

Given the persistence of poverty in many corners of the world, addressing this problem stands as one of the most urgent global priorities. *Poverty eradication* has therefore found a place at the top of the United Nations 2030 Agenda for Sustainable Development: "End poverty in all its forms everywhere" is the first of the 17 Sustainable Development Goals (SDGs) agreed upon by all 193 Member States of the United Nations (UN, 2015). This SDG includes five main targets covering many aspects of poverty, from a focus on extreme poverty measured in monetary terms to nationally-determined definitions of multi-dimensional poverty (Box 1.1). The natural environment is embedded explicitly in two of these targets, which concern the rights to land and natural resources (target 4) and the resilience of the poor in the face of different kinds of shocks and disasters (target 5).

Poor and vulnerable populations often rely heavily on natural resources and *ecosystem services* to support their livelihoods, both for subsistence and income generation (Sunderlin *et al.*, 2005; Angelsen *et al.* 2014). Evidence shows that *forests and tree-based systems* can support rural livelihoods, have a buffer function in maintaining livelihoods, and represent natural insurance (Wunder *et al.*, 2014; Rasmussen *et al.*, 2017). A large body of literature also specifically examines the role that forests (Agrawal *et al.*, 2018; Cheng *et al.*, 2019; Miller and Hajjar, 2020) and trees outside forests (Waldron *et al.*, 2017; Miller *et al.*, 2020) can play in *poverty alleviation*.

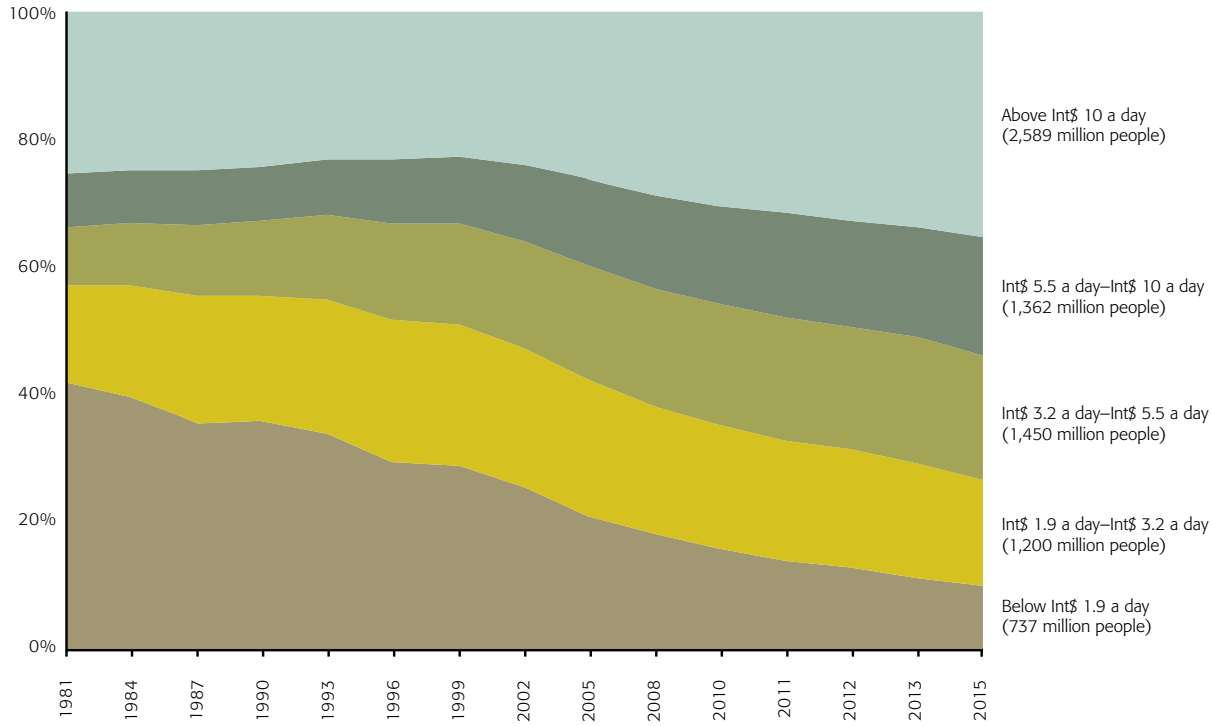
An indigenous Kichwa family make a 4-hour journey on the Payamino River to see a doctor in the town of Coca, Ecuadorian Amazon
Photo © Johan Oldekop

1 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

2 An 'international dollar' is a hypothetical currency used to enable comparisons across country contexts. This currency could buy in a given country a comparable amount of goods and services that a US dollar would buy in the United States. In other words, it has the same purchasing power parity that the US dollars has at a given point in time.

Figure **1.1**

Global population distributed according to different poverty thresholds



Note: Poverty thresholds in 'international dollars' (Int$) at constant 2011 purchasing power parity (PPP) prices to account for inflation and cross-country differences in price levels. Data: World Bank, 2019.

Forests and trees are important assets in virtually all countries of the world, including those where forests cover vast tracts of land like Brazil, Gabon, Papua New Guinea and Russia, and countries where forests are sparse but trees are scattered across portions of the landscape such as Mongolia, Niger and Yemen (Hansen *et al.*, 2013; Zomer *et al.*, 2016). Worldwide, more than a billion people (often referred to as *forest-reliant people*), many living below the international poverty line, derive direct and indirect benefits from forests (Angelsen *et al.*, 2014; FAO, 2014). These benefits include forest-related employment and income, use of timber and *non-timber forest products*, and a wide range of ecosystem services. Recent figures suggest that the forest sector contributes at least USD 539 billion directly to the world Gross Domestic Product (GDP), with a total contribution (accounting for direct, indirect and induced effects) of some USD 1.2 trillion (Li *et al.*, 2019). For comparison, this amount is roughly the equivalent of the GDP of Australia, the world's fourteenth largest economy (World Bank, 2020a). These figures are likely significant underestimates given that they do not capture inputs from the informal use of forests nor many other values of forests (e.g. provision of ecosystem services to support agriculture and nature tourism, and recreation related to forests).

Trees outside forests also provide important benefits to millions of people around the world. In 2010, some 43% of all agricultural land globally had at least 10% tree cover, and this percentage has increased over the last decade (Zomer *et al.*, 2016). *Agroforestry* – the integration of trees or other woody perennials with crops or livestock in production systems – can offer subsistence and income opportunities (Garrity *et al.*, 2010; Miller *et al.*, 2017), enhance the productivity and resilience of agricultural lands (Reed *et al.*, 2017; Blaser *et al.*, 2018; Amadu *et al.*, 2020; Hughes *et al.*, 2020) and improve food and *nutrition security* (Vira *et al.*, 2015; HLPE, 2017; Rosenstock *et al.*, 2019), among other benefits.

Box **1.1**

Targets for Sustainable Development Goal 1: "End poverty in all its forms everywhere"

- **1.1** Eradicate extreme poverty for all people, everywhere.
- **1.2** Reduce at least by half the proportion of all people living in poverty in all its dimensions, by national definitions.
- **1.3** Implement nationally appropriate social protection systems and measures for all with substantial coverage for the poor and vulnerable.
- **1.4** Ensure that all people, particularly the poor and the vulnerable, have equal rights to economic resources, and 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.

Source: UN, 2015.

But what do we know about the potential for forests and tree-based systems to contribute to achieving SDG 1? This is the central question that this report seeks to answer. The report synthesises and presents available scientific evidence on the role of forests and tree-based systems to alleviate and, ultimately, eradicate poverty. The scope is global, covering countries classified as *low- and middle-income* (LMIC) and *high income* (HIC) by the World Bank (2020b). Although the literature on the relationship between forests and tree-based systems and poverty has grown markedly over the past two decades (Cheng *et al.*, 2019), important knowledge gaps remain. This report summarises current understanding while highlighting areas where further research is needed. In so doing, we seek to describe how forests and trees outside forests have contributed to poverty alleviation – and might do so in the future – and make these connections more visible for decision-makers across the globe.

This global assessment of forests and poverty comes at a critical time. The implementation period for the SDGs is well underway, with less than a decade remaining to reach the goals and targets set (UN, 2015). Even as poverty remains a widespread problem in many parts of the world, significant progress has been made to reduce poverty over the past several decades (World Bank 2018; Figure 1.1). With a growing middle class in many countries, more people are economically prosperous than ever before in human history. However, coronavirus disease 2019 (COVID-19) spread across the globe in 2020, causing not only major health problems and hundreds of thousands of deaths but also a massive economic slowdown that threatens to further impoverish millions of people around the world (OECD, 2020b; Sommer *et al.*, 2020). The UN estimates that at least 71 million people will have been pushed into extreme poverty in 2020 (UN, 2020b). The pandemic has also exacerbated the yawning gap between the richest and the poorest globally and within countries (UN, 2020a; Collins *et al.*, 2020) For these and other reasons, COVID-19 as well as potential other infectious diseases in the future pose a major threat to progress towards the SDGs (Di Marco *et al.*, 2020).

As questions about global prosperity mount, so do pressures on the world's forests and ecosystems that sustain life on earth. For example, 14 of the 18 categories of contributions identified by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) that nature makes to human well-being – including a range of regulating, material, and non-material contributions - have declined over the past three decades (IPBES, 2019). Many species have gone extinct during this period and a further one million species are estimated to face extinction within decades (IPBES, 2019). In a recent study, not even one out of 150 countries was able to meet the basic needs for its citizens at a globally sustainable level of resource use (O'Neill *et al.*, 2018).

Forested landscape in Malawi
Photo © Jennifer Zavaleta Cheek

Although the rate of deforestation has slowed in the decade since 2010, net deforestation has increased across much of the tropics, leading to a net reduction in tree cover of 8% (~9,500,000 ha) in the tropical dry forest and 2% (~8,400,000 ha) in the tropical moist deciduous forest biomes since 1982 (Song *et al.,* 2018). Intact, old-growth forests have seen major declines across the globe (Potapov *et al.*, 2017; Watson *et al.*, 2018), with losses especially acute in biodiversity 'hotspots' in Australia, Brazil, Central America, Madagascar, Southeast Asia and West Africa (Hill *et al.*, 2019). Forests have returned in a number of (mainly temperate) regions, but the world's forest estate is, on average, younger with stands having a faster turnover as old-growth forests, characterised by stable dynamics, decline (McDowell *et al.*, 2020). These trends have meant that the international community will fall well short of the goal of halving tropical deforestation by 2020 and faces a steep challenge in ending it by 2030, as agreed in the 2014 New York Declaration on Forests.

Major drivers of deforestation include the production of commodities (soy, cattle, palm oil), logging, *shifting agriculture* and fire (Curtis *et al.*, 2018), each of which is affected or exacerbated by climate change. In fact, climate change not only jeopardises gains made in addressing global poverty but also threatens some of the world's poorest and most vulnerable people whose basic necessities and livelihoods often derive directly from forests and tree-based systems (Althor *et al.*, 2016; Hallegatte and Rozenberg, 2017). Human-induced changes to the earth's climate, including increases in frequency and intensity of extreme events, such as floods and fires, have already adversely affected *food security* and terrestrial ecosystems in many regions (IPCC, 2019). Climate change threatens both the total area covered by forests and forest integrity (Trumbore *et al.*, 2015) which, in turn, imperils the livelihoods of forest-dependent people (Newton *et al.*, 2016). Given that forests are also key to mitigating climate change through avoided deforestation and carbon sequestration, policies that promote sustainable forest management, conservation and restoration while recognising the rights and stewardship of *forest-dependent people*, promise to help advance multiple sustainable development objectives (Seymour and Busch, 2016; Mansourian, 2018; Katila *et al.*, 2019). However, such policies will have to navigate potential trade-offs between climate mitigation and *forest-based livelihoods*.

Together, climate change, biodiversity loss and other environmental issues push planetary boundaries (Rockström *et al.*, 2009; Steffen *et al.*, 2015) and threaten the sustainability of progress made to alleviate poverty globally. They also challenge efforts to ensure the social foundations of sustainability are sound, including extending gains made to populations that remain marginalised in countries around the world (Raworth, 2017). In this context, forests take on particular importance for not only expanding human well-being to reduce poverty and bring more widespread *prosperity* but to do so in a way that is sustained over time.

Children in Takamanda, Cameroon, peeling the seed of njansang (Ricinodendron heudelotii), a spice commonly used in local cuisine
Photo © Terry Sunderland

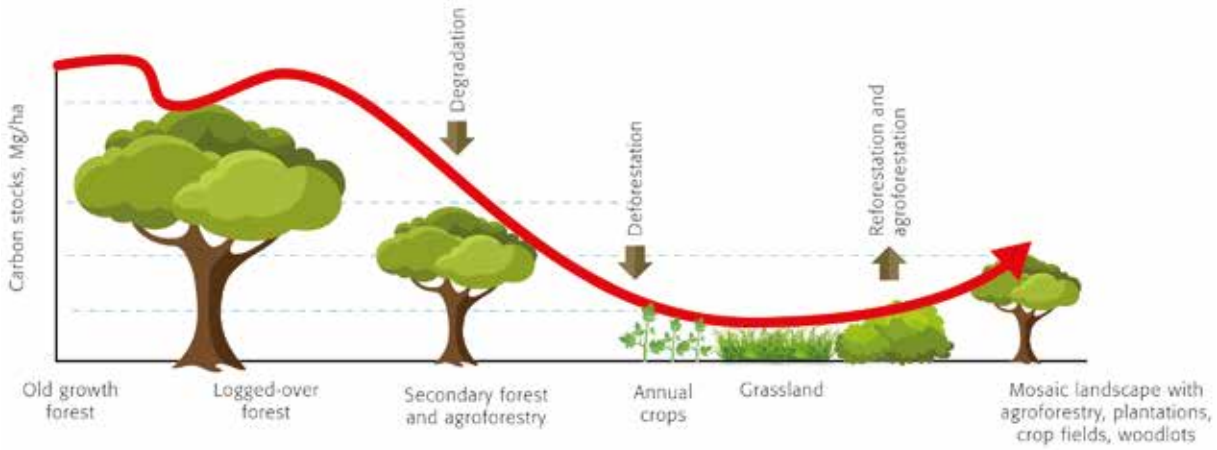
1.2 Conceptualising Forests, Trees and Poverty

1.2.1 Forests and tree-based systems

This report examines the relationship of both forests and trees outside of forests to poverty alleviation. Throughout the report we use the term forests and tree-based systems, which encompasses a wide array of different types of land use involving trees along a forest transition curve (Figure 1.2), from intact old growth forests to planted forests, to agroforestry systems, and single species tree crop production. We include different types of forests from tropical dry and wet forests to temperate and boreal forests. Mangroves fall within our definition of forests but oil palm does not as it is considered an agricultural crop (FAO, 2014). We highlight that we do not assume teleological forest change from pristine primary forest to land dominated by agriculture, but seek evidence on the dynamics of diverse forests and tree-based systems and poverty alleviation in different parts of the world.

Figure 1.2

Forest transition curve



1.2.2 Poverty

Poverty has multiple dimensions, but it is often measured as material income or consumption and in terms of being below a given income threshold. For example, the World Bank defines poverty at USD 1.90 per day in 2011 purchasing power parity (World Bank, 2018). Income levels associated with absolute poverty are often used to measure poverty because they are quantifiable and allow for comparison across different geographical contexts. This approach has limitations, however. Income levels are indirect measurements of poverty, which assume that if people have a high enough income, they will be able to provide for basic needs. However, differences in consumption patterns and prices based on a given individual's demographic characteristics and location pose a major challenge to identifying a precise, universal poverty line (Alkire and Santos, 2014). Moreover, the experience of poverty is more than having a low level of consumption or income; it is better understood by the inability to satisfy a set of basic needs, rights or functionings.

The *capabilities* approach developed by Sen (1999) and Nussbaum (2000) provides an alternative conception of poverty where wealth is understood as the expansion of citizens' capabilities and ability to pursue what they value. In this conception, wealth is only useful in so far as it translates into a reduction of suffering and increase in substantive freedoms like economic opportunity, political choice, security and health. Since wealth should not be an end in and of itself, another, more direct way to assess poverty is to measure the indicators associated with meeting minimum standards related to core human functionings. One example of doing so is the Multidimensional Poverty Index (MPI), which attempts to assess the magnitude of poverty in a comparable way across countries by directly measuring three dimensions of poverty: education, health and living standards (Alkire and Santos, 2014). Use of this indicator implies that the share of the world's poor is about 50% higher than when monetary measures for extreme poverty are used, suggesting that poverty is an even more widespread and deeply entrenched global problem than previously thought (World Bank, 2018). Research based on the perspectives of people actually experiencing poverty (Bray *et al.*, 2020) extends the dimensions of poverty (to include, e.g. disempowerment, suffering in body, mind and heart, and institutional maltreatment) and further suggests the expansive and stubborn reach of poverty.

Several other conceptual issues relating to poverty merit brief discussion here to orient the reader to the remainder of this report. First is the distinction between *absolute* and *relative poverty*. Most countries use an absolute threshold to measure their poverty in which a fixed amount of money needed to meet basic needs such as food, clothing and shelter is specified. Some countries use a relative threshold that defines poverty in relation to the economic status of other members of society using a cutoff point. For example, the

European Union typically defines the poor as those whose per capita income falls below 50% of the median (Haughton and Khandker, 2009).

Second, both absolute and relative measures of poverty can be used to describe the incidence of poverty – the number of people who are poor in a given context. However, these 'headcount' approaches are silent on the intensity of poverty (how poor the people below the poverty line are) and on inequalities among the poor and between the poor and the rich (Agrawal and Redford, 2006). The poverty gap index – an estimate of how far on average the poor are from the poverty line – and the Gini coefficient – a measure of income or wealth distribution – are two common approaches used to shed light on poverty intensity and *inequality*.

Third, poverty also has an important temporal dimension. The literature distinguishes between chronic (or persistent) poverty and transient poverty (Haughton and Khandker, 2009). Those who are chronically poor experience deprivation over long periods of time, even their entire lives, and often pass poverty along to their children. The transitory poor are those who are sometimes in poverty but at other times are able to move out of it such that, on average, they are not classified as poor.

Fourth, there are a number of ways to conceptualise a lessening of poverty. Poverty alleviation refers to a lessening of deprivation or disadvantage such that well-being is improved. This lessening may include movement above a certain income or consumption threshold, such as international or country-specific poverty lines (termed *poverty reduction* or *poverty elimination*). It may also include a lessening in the degree of poverty experienced or avoiding falling into poverty (termed *poverty mitigation*) (World Bank, 2001; Sunderlin *et al.*, 2005). The term 'poverty reduction' can also be used to refer to a lessening of the number of people who are considered to be poor based on measures of other dimensions of poverty (World Bank, 2001). This term is frequently used in national poverty strategies and is often understood as a situation in which the poverty rate falls, more or less permanently, based on economic growth (World Bank, 2018). *Poverty eradication* refers to the complete or near absence of people or households under the international poverty line in a given context. It implies permanent movement out of poverty by addressing the root causes of why people are impoverished (UN, 2020a). 'Poverty alleviation' is the most encompassing of the foregoing terms and, for this reason, it is the main one used in this report when refering to a lessening of poverty. Other terms, notably 'poverty eradication', are used when more specific meaning is required.

Finally, we emphasize that understanding and acting to address poverty requires a relational perspective that recognises and addresses heterogeneity across different social groups (Beck *et al.*, 2020). Particular emphasis must be placed on addressing the needs and aspirations of vulnerable groups, including children, youth, persons with disabilities, people living with HIV, older persons, indigenous peoples, minority populations, refugees, internally displaced persons and migrants (UN, 2016). It is important to note that individuals can be part of several different groups, which can present multiple disadvantages in terms of the assets and capabilities that a person has and the services and opportunities they can access. For example, a poor elderly woman from an indigenous group may face more marginalisation than someone else that has one or fewer of her traits. Additionally, inequality can exist across geospatial scales, including within the urban to rural spectrum as well as across sub-regions within a country and between countries. (Kochendorfer-Lucius and Pleskovic, 2006).

1.3 Policy Context for this Report

The role of forests in sustainable land use approaches that balance poverty alleviation with other management goals is important for the implementation of existing international commitments.

In addition to the 2030 Agenda and the SDGs, the international policy framework related to sustainable development, poverty alleviation and forests is largely based on Agenda 21 and the three Rio Conventions – the UN Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD) and the UN Convention to Combat Desertification (UNCCD) – adopted following the 1992 Earth Summit. The relationship between forests and poverty also intersects with the implementation of the UN Declaration on the Rights of Indigenous Peoples and the ILO Indigenous and Tribal Peoples Convention (1989) No. 169.

The UN Strategic Plan for Forests (ECOSOC Resolution 2017/4) was agreed as part of the follow-up process to Agenda 21 in the UN Forum on Forests (UNFF). The second of the Plan's six goals – "enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people" – is especially relevant to the subject of this report. Notably, it includes target 2.1 that "extreme poverty for all forest-dependent people is eradicated" (UN, 2017).

The Convention on Biological Diversity represents another international instrument relevant for this assessment. In 2010, the signatories to

the CBD adopted a Strategic Plan for Biodiversity 2011-2020, which included the 20 Aichi Biodiversity Targets. Targets 5 and 7 explicitly refer to forests and aim at halting deforestation and sustainably managing forests. Target 2 addresses the need to integrate biodiversity values in poverty reduction strategies (UNEP, 2010). Negotiations for a global Post-2020 Biodiversity Framework are underway, with a 'Zero Draft' version released in early 2020 and a final version expected to be adopted in late 2020 or early 2021. The contribution that forests and biodiversity make to people, as per the IPBES report, is likely to be central to the Post-2020 Biodiversity Framework.

The parties to the UNFCCC responded to the significant role of forests in *climate change mitigation and adaptation* with decisions on land use, land-use change and forestry activities (LULUCF). These included establishing the *REDD+* scheme (Reducing Emissions from Deforestation and Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries). Within the framework of the Paris Agreement (2015) the role of forests for sustainable development was further emphasised.

The UNCCD 2018-2030 Strategic Framework aims at restoring the productivity of degraded lands, improving the livelihoods of people, and reducing the impacts of drought on vulnerable populations (UNCCD, 2017). National Action Programmes are the key instruments for realising these goals, and parties to the Convention are requested to include measures in them to conserve natural resources, such as the sustainable management of forests (Wildburger, 2009). The UNCCD emphasises 'land degradation neutrality' as a pathway to sustainable development, within which forests (particularly forest restoration and rehabilitation) play a substantial role.

All of these international commitments are interrelated and form an important basis for the SDGs and their implementation. The SDGs themselves are rooted in the eight Millennium Development Goals (MDGs), which were adopted in the Millennium Declaration in 2000 as the international framework for development policy until 2015. Under this earlier agenda, countries committed to reduce extreme poverty and made major progress toward that goal (Figure 1.1; McArthur and Rasmussen, 2018). The SDG framework has now broadened the scope for addressing poverty to cover most aspects of economic, social and environmental sustainability (Timko *et al.*, 2018; Katila *et al.*, 2019). This framework is also global as opposed to the MDGs, which were mainly relevant for LMICs.

The 17 SDGs and their associated 169 targets cover a wide range of social, economic and environmental issues, and address essential global challenges, including poverty alleviation, food security and nutrition, and the protection, restoration and sustainable use of forests. Given its focus on poverty, SDG 1 is most relevant to this report. Two SDGs explicitly address forests: SDG 15 (Life on Land) aims at the protection, restoration and sustainable use of terrestrial ecosystems and halting the loss of biodiversity, and refers to forests in several targets; SDG 6 (Clean Water and Sanitation) calls for the protection and restoration of forests in one of its targets. However, forests and tree-based systems can be directly or indirectly linked to each of the SDGs (Figure 1.3). A range of scientific assessments have explored the different contributions forests and trees can make to realising the SDGs (Vira *et al.*, 2015; Seymour and Busch, 2016; Creed and van Noordwijk, 2018) while related work has considered how efforts to achieve the SDGs may affect forests and people who rely on them (Katila *et al.*, 2019).

Nepali woman cutting firewood
Photo © Conghe Song

Figure **1.3**

A stylised multi-functional landscape illustrating how different SDGs may be inter-linked in a single landscape

Source: Landscapes for People, Food and Nature Initiative, 2015.

Governmental policies to alleviate poverty tend to focus on agriculture, infrastructure and cash transfers while neglecting the roles of forests. This approach is likely to undermine efforts to restore, sustainably manage and conserve forests as well as to sustain gains made in alleviating poverty. At the same time, government actions to protect forests have excluded the poor in many cases (Peluso, 1992; Adams and Hutton, 2007) and people living in or near forests are often politically weak such that they are ignored in the development of relevant policies (Larson and Ribot, 2007).

Effective implementation of the 2030 Agenda for Sustainable Development requires prioritising such marginalised communities and the development of cross-sectoral measures that take into account the role of forests and trees in poverty alleviation (Stafford-Smith *et al.*, 2017; Timko *et al.*, 2018; van Noordwijk et al., 2018). Such a nexus approach holds promise for improved outcomes for people and forests, although in practice it faces political economy challenges, including the historic separation of key government agencies relating to agriculture, forestry and wildlife (Gibson, 1999; Larson and Ribot, 2007; Miller *et al.*, 2017). Growing consensus among policymakers, the business community and the public about the importance and interlinked nature of environment and development issues (Fisher *et al.*, 2020; WEF 2020) may enable the collective action necessary to overcome such challenges.

The outbreak of the COVID-19 global pandemic and the rise of diverse social movements to tackle issues like climate change and racial discrimination are also shaping the international policy arena. Box 1.2 introduces these phenomena, briefly discusses their implications for forests and tree-based systems and poverty, and highlights ways in which they are covered in this report.

Box **1.2**

COVID-19, social movements and forest-poverty dynamics

The coronavirus outbreak (COVID-19) in 2020 has become the first global pandemic in more than a century. At the same time, major social movements seeking urgent action on climate change and to address systemic racism have also gained momentum in countries around the world. These two contemporary phenomena have potentially profound implications for understanding and action relating to forests, trees and poverty.

The COVID-19 pandemic is likely to affect forest-poverty dynamics in multiple ways (FAO, 2020; Wunder, 2020). First, illness and death within households are a major cause of poverty (Krishna, 2011) and this is the most direct way in which COVID-19 is likely to exacerbate poverty worldwide. Many thousands have lingering health effects due to the disease. Second, the COVID-19 pandemic has triggered the most severe global recession in nearly a century, with the global economy expected to contract by more than 6% in 2020 (OECD, 2020b). Current estimates suggest COVID-19 will push up to 71 million people into extreme poverty, and income-based poverty is expected to increase for the first time since 1990 (Sumner *et al.*, 2020; UN, 2020b). Third, unemployment and concerns about contagion in cities is leading to migration to rural areas in many countries, which is beginning to have major environmental impacts as land will be required for agriculture and other uses (Rondeau *et al.*, 2020). Migration, together with more limited enforcement in forest areas, is leading to deforestation in many countries, with Brazil a particularly well-documented case (Londoño *et al.*, 2020). Forest destruction, in turn, increases the likelihood that viruses and other pathogens will transfer from wild animals to humans, in a vicious zoonotic circle (Bloomfield *et al.*, 2020). Illegal activity in forests has also risen with reduced access for enforcement agencies, and governments' attention turned to addressing the pandemic and its immediate impacts on society. Forest exploitation (both legal and illegal) at the expense of local communities dependent on them, is also likely to increase as powerful actors (both public and private) seek to expand their income base. Finally, development aid is likely to be reduced as governments spend substantial amounts propping up their own economies.

Concurrent with the COVID-19 pandemic is increasing social pressure across the globe to address climate change and other environmental issues and to reckon with racism and discrimination. The student-led climate movement is reshaping politics, policies and investments in many countries (Marris, 2019) while a major international social movement has arisen to address institutionalised racism across many sectors. The forestry and environmental field is no exception (e.g., Merchant, 2003; Taylor, 2016; Baker *et al.*, 2019). These movements are spurring reflection on how forest conservation and management might become more inclusive and just, notably, by directly grappling with legacies of colonialism and dispossession that have disproportionately affected indigenous people and people of colour.

The COVID-19 pandemic and current pro-environment, anti-racist social movements are distinct, but they have intertwined to create both enormous uncertainty and considerable opportunity. Each is already having far-reaching impacts that bear on forest-poverty dynamics and possibilities. The possibility of transformational change to more equitable, just and sustainable ways of steering society and the environment is now on the table in a way it has not been before. Detailed discussion of these two issues is beyond the scope of this report, but we do touch on both of them in several chapters. For example, Chapter 3 considers social differences, including class, gender and race[3], in the poverty effects of forests and trees. Chapter 6 discusses COVID-19 and human infectious disease, more broadly, as critical trends bearing on forests, trees, and poverty alleviation. Chapter 7 offers concluding reflections on the implications of the current pandemic and movements against systematic racism for the findings and policy recommendations of this report.

3 This term is used here as per the Universal Declaration of Human Rights.

1.4 Assessment Objectives, Scope and Approach

To better understand and recognise the contributions of forests and tree-based systems to the overall 2030 Agenda goals of poverty eradication and sustainable development, government representatives and other policymakers need reliable, policy-relevant scientific information. In turn, this information can help decision-makers identify synergies and navigate potential trade-offs concerning poverty alleviation and forests, trees and land use worldwide.

Recognising this need, IUFRO on behalf of the Collaborative Partnership on Forests (CPF) tasked the Global Forest Expert Panel (GFEP) on Forests and Poverty to carry out a comprehensive global assessment of available scientific evidence about the interactions between forests and poverty. The results are compiled in this report, which seeks to inform relevant international policy processes related to the 2030 Agenda for Sustainable Development, particularly SDG 1.

The overall ambition of this report is to make the contributions of forests and tree-based systems to poverty alleviation more visible while highlighting key *equity* issues relating to the distribution of the costs and benefits of forest-related interventions. In so doing, we seek to provide a strong and accessible scientific basis for more effective decision-making by policymakers, donors, practitioners and other relevant stakeholders. We recognise that forests and tree-based systems have a wide range of benefits beyond their potential role in poverty alleviation, including biodiversity conservation and reducing greenhouse gas emissions. However, the explicit focus of this report is to understand the extent to which conservation and management of forests and tree-based systems can contribute to poverty alleviation while also maintaining their biophysical benefits. We explore the considerable variation that exists within our broad definition of forests and tree-based systems with regard to this challenge.

The scope of this report is global. We collate and analyse evidence on the relationships between forests and tree-based systems and poverty across a wide range of economic and agro-ecological and economic contexts. This report considers poverty in relation to forests and trees in any country where such resources are prevalent nationally or in particular subnational regions. However, we devote particular attention to LMICs as they are home to the majority of the world's poorest people, many of whom live in forests and tree-based landscapes.

This scientific assessment has been carried out by the members of the GFEP on Forests and Poverty, twenty-one scientists from diverse geographical and cultural backgrounds with established expertise on this topic. More than twenty contributing authors also supported the development of this study. In reviewing the evidence, we have relied primarily on peer-reviewed literature. We have also used relevant published work from a variety of organisations recognised as reliable sources of data, particularly UN institutions. This assessment has revealed important gaps in knowledge on the relationship between forests, trees and poverty, and we identify these, while also pointing out where the evidence base is relatively strong. We also discuss the level of consistency in the literature, and address the degree of certainty regarding conclusions that can be drawn from the evidence.

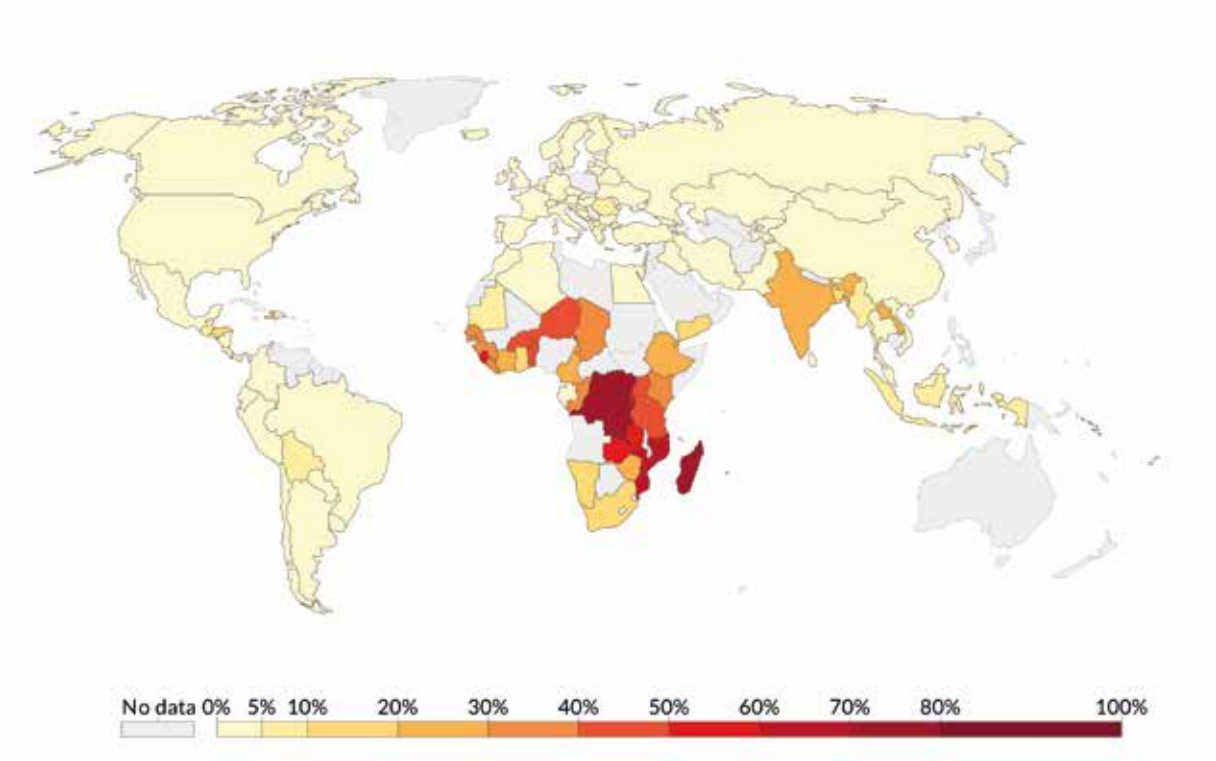
Villagers who rely on nearby forests take a rest to meet researchers in Rhamechhap District, Nepal
Photo © Johan Oldekop

1.5 An Overview of Forest-Poverty Linkages

Approximately 737 million people were estimated to be living in extreme poverty in 2015 (World Bank, 2019). Most of these people live in Africa and Asia (Figure 1.4), with half in just five countries: Bangladesh, Democratic Republic of the Congo,

Figure **1.4**

Share of the world's population living in extreme poverty in 2017



Data: World Bank, 2019

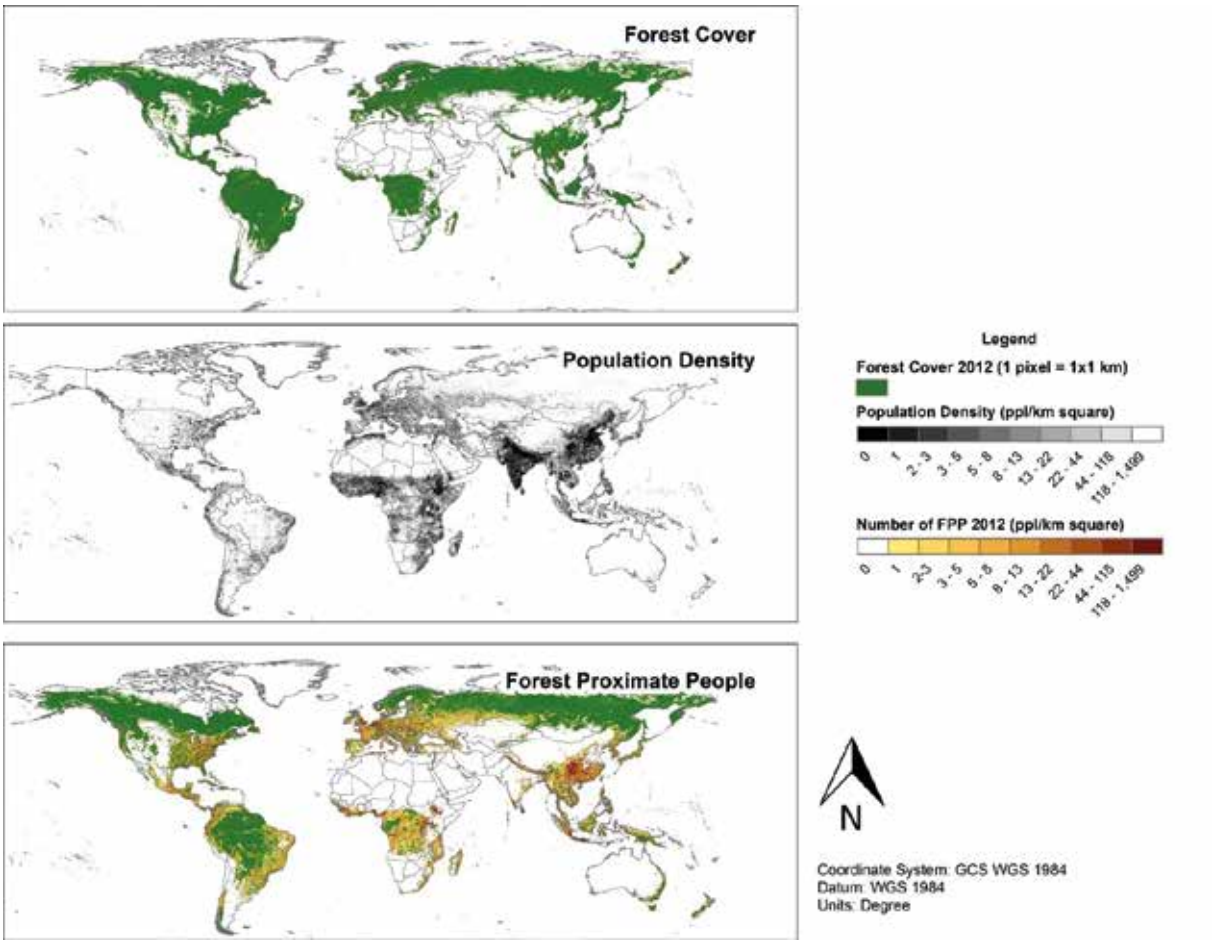
Ethiopia, India and Nigeria (World Bank, 2018). Forests comprise a vital resource in each of these countries. The Democratic Republic of the Congo and India are among the top ten countries in terms of forested area globally, while Bangladesh is home to the largest mangrove forest in the world (FAO and UNEP, 2020). Forest dependence is high and coincides with poverty in different areas of each country. In India, for example, about 27% of the population, or 275 million people, were found to depend on forest resources for subsistence and income generation (Milne, 2006) and, for the poorest in some states, forests provide about 30% of total income, an amount greater than that from agriculture (Damania *et al.*, 2020).

Globally, around 40% of the extreme rural poor – some 250 million people – are estimated to live in forest and savannah areas (FAO and UNEP, 2020). However, further research is needed to confirm and update these numbers. Recent work mapping 'forest proximate people' worldwide (Newton *et al.*, 2020; Figure 1.5) provides information on the possible universe of people who reside in or near forests, many of whom may be poor. Further, research suggests that rural areas with the world's poorest often have high tree cover and high levels of biodiversity (Fisher and Christopher, 2007; Sachs *et al.*, 2009). Country-scale studies also shed important light on patterns of forest-poverty overlap (e.g., Sunderlin *et al.*, 2008), but these have not yet been scaled up to provide a comprehensive global portrait. We know that millions of people rely on trees on farms for their livelihoods around the world (Garrity *et al.*, 2010; Miller *et al.*, 2017) and data are available on tree cover on agricultural land globally (Zomer *et al.*, 2016). However, detailed global estimates of the imbrication of poverty with trees on farms remains elusive.

The relationship between forests, trees and poverty is dynamic, not just spatially but also temporally and contextually. Chapter 2 presents an in-depth analysis of these dynamics and their implications for poverty alleviation, particularly the specific targets articulated under SDG 1. Here, we underscore that different kinds of forests and tree-based systems may have different capacity to address poverty at different times – and that they may have different effects for different social

Figure **1.5**

Global distribution of forest proximate people (rural people living within 5 km of a forest, 2012)



Source: Newton et al., 2020

groups. This capacity will depend on a series of social, economic, political and biophysical factors (see Chapter 4). A comprehensive assessment of the potential of forests and tree-based systems to alleviate poverty must attend to these dynamics.

For example, given that being lifted out of and descending into poverty may entail different dynamics (Krishna, 2011), forests and trees may play different roles for those seeking a *pathway out of poverty* compared to those who may be at risk of becoming poor due to forest degradation or destruction. Without attending to such distinctions, forests risk being seen as inferior to other forms of rural poverty reduction strategies that imply forest conversion to agriculture or other more extractive approaches, which may deliver results in the near term, but have less certain long-term impacts. More holistic analysis of the role of forests and tree-based systems in poverty alleviation over time, across space, and in different biophysical and socio-economic contexts is critical for enhancing synergies between sustainability goals and effectively addressing trade-offs.

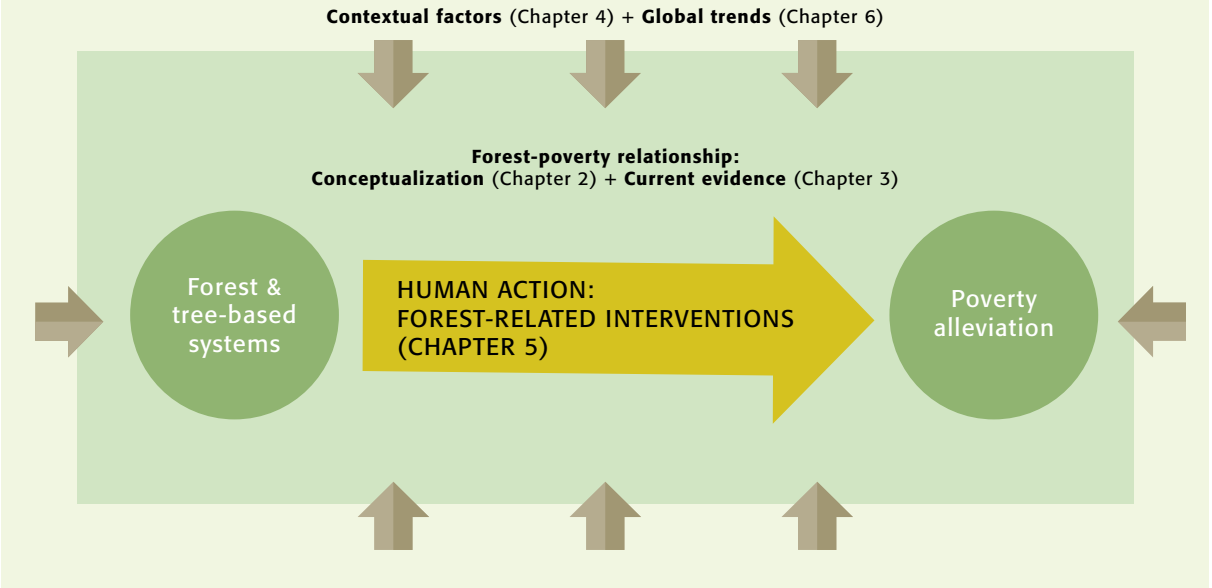
1.6 Structure of this Report

This report comprises seven chapters, including this introduction. Figure 1.6 presents a conceptual overview of how the different chapters fit together to form a comprehensive global assessment of current knowledge on the relationships between forests, trees and poverty.

Chapter 2 reviews existing poverty frameworks, discusses the specific targets and indicators under SDG 1, and presents the framing for how we analyse forest-poverty dynamics and human well-being throughout this report. Chapter 3 synthesises current knowledge on the role of forests and tree-based systems in affecting poverty alleviation and the well-being of the poor. It considers forest con-

Figure **1.6**

Conceptual overview of the report structure and linkages



tributions to income, broader human well-being and to reducing risk, and compiles evidence on the socially differentiated effects of conservation, management, and restoration of forests and tree-based systems.

Chapter 4 examines a set of key social, economic, political and environmental factors affecting forests and tree-based systems and their ability to alleviate poverty. Chapter 5 identifies and describes a set of 21 potential levers (e.g. policies, programmes, technologies, strategies) used in the forest sector that could plausibly reduce poverty. The chapter then reviews evidence on the effect that each lever has had on alleviating poverty. Chapter 6 identifies six major global trends that are expected to affect poverty in forests and tree-based systems. The chapter concludes by discussing how the enabling conditions described in Chapter 4 and policy levers reviewed in Chapter 5 may interact with these global changes to shape the future of forests, trees and poverty. Chapter 7 concludes by summarising the key messages of this report for decision-makers, including those in local and national governments, intergovernmental organisations, the business sector, civil society groups and the research community.

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Chapter 2

Key Concepts for Understanding Forest-Poverty Dynamics

Coordinating Lead Authors: Pamela A. Jagger and Jennifer Zavaleta Cheek
Lead Authors: Daniel C. Miller, Casey Ryan, Onja H. Razafindratsima, Priya Shyamsundar and Erin O. Sills

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Abstract
In this chapter we review existing poverty and forest-poverty frameworks and present the framing for how we analyse forest-poverty dynamics and human well-being throughout this report. We highlight four ways that forests and tree-based systems can shape poverty outcomes: 1) as a resource that allows people to move out of poverty; 2) supporting livelihoods and thus helping people avoid moving into, or further into, poverty; 3) mitigating risk; and 4) negatively affecting livelihood opportunities. We connect these four roles for forests and tree-based systems with the targets and indicators under SDG1. Existing conceptual frameworks for forest-poverty dynamics primarily focus on the role that forests play in supporting human well-being over relatively short time frames (temporal dynamics). This is a critical dimension that merits further attention as we continue to build the evidence base surrounding forest-poverty dynamics over longer time frames (>2-5 years). Forest-poverty dynamics also have two other important dimensions: spatial and contextual. We highlight the importance of considering temporal, spatial and contextual dimensions of forest-poverty relationships as part of systems frameworks for building our knowledge base.

2.1 Introduction

Poverty[4] and its converse, *well-being*, are conceptualised, measured and interpreted in many different ways, which in turn influence our understanding of the role of *forests and tree-based systems* in *poverty alleviation*. This chapter provides a framework for reviewing the dynamic relationship between forests and tree-based systems and poverty. Our emphasis is on forest-poverty dynamics, explicitly focusing on the role that forests play in reducing the prevalence and impact of poverty. We focus on how forests contribute to poverty alleviation rather than how poverty alleviation affect forests (see Lawlor *et al.*, 2019 for an extensive review of this relationship). Our review and framework development covers three related, but conceptually distinct dimensions of forest-poverty dynamics – temporal, spatial and contextual – which we view as critical for building a case for policy and practice that leverages the full potential of forests and tree-based systems for poverty alleviation.

2.2 Poverty Dynamics and Human Well-being

Global efforts to track progress towards poverty alleviation have brought to the fore questions about how we conceptualise, measure and interpret poverty and poverty dynamics. Multi- and bi-lateral donors and governments historically focused analysis of poverty on monetary measures including dollar a day metrics such as the current USD 1.90/day *poverty line* (World Bank, 2018a). The approach to monitoring progress towards poverty alleviation, which remains an important component of poverty analytics, involves aggregating poverty data at country level, and using static poverty rates (e.g. snapshots at a given point in time using cross-sectional data for households or individuals), across multiple years to describe broad trends observed over time (Yaqab, 2000). The most robust static poverty analysis uses multiple waves of population representative data to establish trends over time. Analysis of poverty dynamics is different from static poverty analysis in that it uses longitudinal or panel data to track the same households or individuals over time.

Measures of dynamic poverty allow us to understand transient poverty (e.g. oscillation above and below the poverty line) and the factors that catalyse movement into or out of poverty for households and individuals. In their path-breaking work to advance the analytical study of poverty dynamics Addison, Hulme and Kanbur (2008) advocate for research that considers poverty dynamics over the life-course of individuals, across generations and between different social groups. They argue that without consideration of changes in poverty status over time we cannot understand transient poverty, or factors that hold people in chronic poverty. They advocate for the use of panel data, carefully selected measures that can provide information about poverty status over time (e.g. objective indicators of nutritional status such as stunting) and use of retrospective data about past circumstances.

Several poverty scholars have proposed frameworks to extend our conception of changes in poverty status beyond monetary poverty and static approaches to data collection and analysis. The overall tenor of these frameworks is movement

4 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

away from measures of monetary poverty at single points in time, and towards recognition that a host of factors at the household, community and broader institutional levels (e.g. markets, regulatory frameworks, institutions, etc.) influence movement into and out of poverty, and that change occurs across time, space and context. Chambers and Conway (1992) proposed a livelihoods approach where economic units (e.g. individuals or households) have a portfolio of *capabilities*, assets and activities required for a means of living. This framing is dynamic in that it captures changes fundamental to sustaining *livelihoods* over time. Scoones (1998) developed the idea of the five capitals: human, economic or financial, physical, social and natural as endowments that determine *human well-being*. Each of the five capitals is a potential lever of change affecting the trajectory of movement in and out of poverty. Livelihoods are sustainable when they can cope and recover from stresses and shocks, maintain or enhance capabilities and assets, while not undermining the resource base. An important contribution of Scoones (1998) is to consider scale in the study of livelihood strategies, noting that the net effect of different strategies may accrue differently at the household-level than in aggregate at a coarser scale unit of analysis, for example district or sub-regional-level.

Other scholars take a broader approach to conceptualising poverty dynamics and *inequality*. Sen (1985) focused normative arguments on missing dimensions of poverty analysis including longevity and education, extending to capabilities inherent in physical and mental characteristics, and social opportunity and influence. The capabilities approach he developed in collaboration with Martha Nussbaum emphasises the opportunities people have (or lack) to fulfil needs including being adequately nourished, receiving appropriate medical care in times of need, and pursuing educational interests (Sen, 1999; Nussbaum 2000). Building on core concepts developed by Sen and Nussbaum, Alkire (2007) further developed the concept of multidimensional poverty, which complements traditional income-based poverty measures focusing on individual deprivations in the areas of employment quality, empowerment, physical safety, the ability to go without shame, and psychological and subjective well-being. Alkire (2007) argues for inclusion of high quality indicators in all of these areas to advance our understanding of poverty and poverty dynamics.

In addition to broader conceptualisations of poverty, the dynamics of inequality have emerged as important to understand and monitor over time. Krishna (2004) in the 'Stages of Progress' method emphasises that the benchmarking of households within communities is critical to understanding poverty trajectories that are often only considered at aggregate scales, and acknowledges that both micro- and macro-level processes are fundamental to understanding poverty trajectories. The Stages of Progress method uses life histories and retrospectives of community events and their impacts gained through participatory approaches. This approach yields rich site-specific contextual information about past and present trajectories as well as expectations about the future. People may be mired in poverty, find ways to move out of poverty, fall into poverty again, or find themselves in poverty for the first time (Krishna, 2006). Krishna and Shariff (2011) note that panel data collection as an approach to understanding poverty dynamics is costly and requires time to establish a period long enough to generate meaningful insights into factors influencing movement into and out of poverty.

Integration of the aggregate effect of changes in poverty status are embodied in the World Bank's (2015) 'twin goals' which frame the majority of the Bank's current lending and policy programming: an end to extreme poverty by 2030; and improvements in metrics of shared *prosperity*, or reduced inequality, in every society. These broad objectives emphasise reducing the number of people living below the global poverty line (as measured by income), supporting countries in setting poverty thresholds that are relevant to particular contexts, and monitoring what share of total income goes to the poorest 40% of people.

Throughout this report we use human well-being as the orienting concept for our discussion of forest-poverty dynamics, with poverty being the converse of well-being (Fisher *et al.*, 2014). Human well-being encompasses many of the contributions of the poverty scholars cited above, the objective material circumstances of people's lives including health, housing, *food security* and income; social aspects such as community relations and trust; and inclusive of subjective assessments related to how individuals view their own circumstances (McKinnon *et al.*, 2016; OECD, 2017). Following the broad literature on poverty and poverty dynamics, well-being (and thus poverty) are multidimensional, with important dimensions beyond commonly measured economic aspects of poverty (Alkire and Santos, 2013). The concept of multi-dimensional poverty is widely accepted in policy discussion and is consistent with the SDG 1 targets. These targets (Box 1.1; Chapter 1) consider poverty in unidimensional framings focused on cash income (Target 1.1) but also allow scope for

multi-dimensional poverty through consideration of nationally defined indicators (Target 1.2) and access to social protection programmes (Target 1.3), equitable resource access and rights (Target 1.4); and building *resilience* and reducing vulnerability to climate-related and other shocks (Target 1.5).

Figure 2.1 conceptualises the ways that well-being and poverty status, broadly conceived, can change over time. In this stylised framework, people are classified as non-poor, poor, transient poor and extremely poor. The last of these categories is important because the poorest are often most reliant on forest-related products for meeting basic needs and smoothing consumption (Angelsen *et al.*, 2014). A given household may find itself within different groups at different times based on the season, the household 'life cycle', or after experiencing a shock.

Trajectories of well-being over time (Figure 2.1) can be described as:

- Durable improvements in well-being (shifts out of poor or extreme poor status) (Ai, Aii)
- Maintenance of the status quo (any horizontal trajectory)
- Transience around poor or extreme poor status (oscillation within yellow or red bands)
- Durable declines in well-being (into poor or extremely poor status) (Bi, Bii)

2.2.1 Durable shift out of poor or extreme poor status

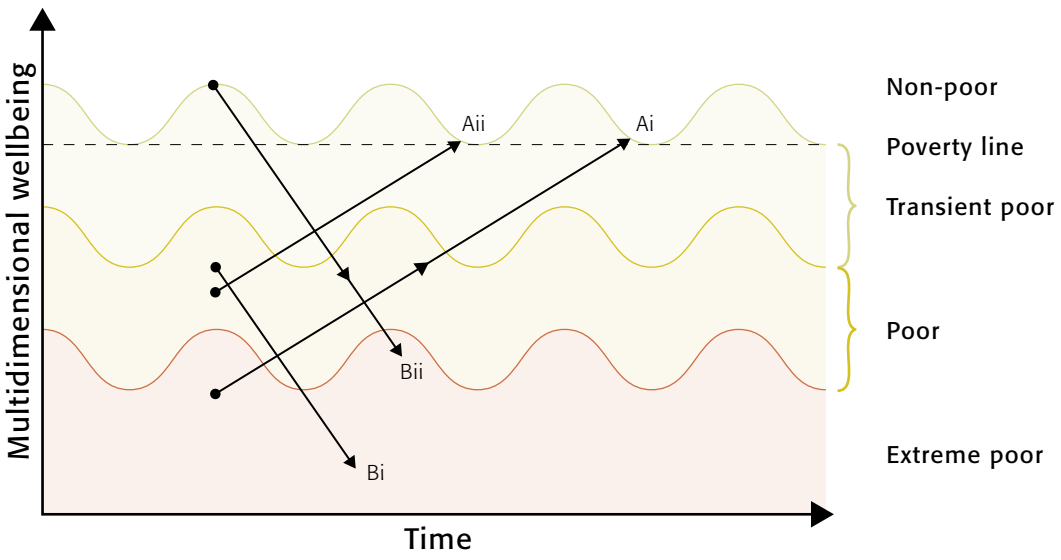
People are considered to have moved out of poverty when they surpass a certain level of income or consumption (World Bank, 2018b) or move beyond a locally defined state of poverty (Krishna, 2006). Movement up and out of extreme poverty (Ai), or poverty (Aii) typically requires major changes in income earning strategies and/or ability to accumulate assets and capacity to leverage social, human and natural capital in ways that dramatically alter well-being (Brockington, 2019). Given the human capital limitations to dramatically changing income earning strategies, and the pervasiveness of intergenerational transmission of poverty, shifts out of poor and extreme poor status may happen across generations, especially after higher investments in childcare and education (Moran, 2003).

2.2.2 Maintaining the status quo

People could also remain at the same level of poverty or maintain the status quo. Even though the ultimate goal is for households and individuals to move out of poverty permanently, other trajectories include maintaining the status quo and not falling into poverty or from 'poor' to 'extreme poor' status, especially in the face of shocks (see below).

Figure **2.1**

Conceptualising poverty dynamics



Ai Aii = Moving out of poverty
Bi Bii = Moving into poverty

2.2.3 Transience around poor or extreme poor status

Several potential stressors and shocks contribute to transience for the poor and extremely poor groups (e.g. climate change related shocks, morbidity or mortality of a productive household member, etc.) (Dercon and Hoddinott, 2004). Transitory or stochastic poverty can occur due to short-term, adverse labour, price and environmental shocks that can decrease incomes or increase prices of goods (Carter and May, 2001). Studies of household income dynamics find that most households experiencing poverty move in and out of poverty over time (Baulch and Hoddinott, 2000).

Woman collecting fodder from the forest in Nepal
Photo © Conghe Song

2.2.4 Durable shift into poor or extreme poor status

Households or individuals can shift from a state of being poor to being extremely poor (Bi) or fall into poverty from non-poor status (Bii). Poverty dynamics of this scale are typically the result of extreme events that have a major impact on livelihood strategies. Typical causes of movement into poverty include health crises of productive aged adults, death in families (Krishna, 2010), loss of access to assets and resources, major disasters or weather events that alter income and consumption streams in the long term (Krishna and Shariff, 2011; Klasen and Waibel, 2015). Political upheaval can also lead to extreme poverty (Goodhand 2001). Given the high frequency of transience among the poor, it is primarily those in the non-poor category and those in *poverty traps* who are likely to maintain their position over time. We address the special case of forest and poverty traps in Box 2.1.

Box **2.1**

Forests and poverty traps

A poverty trap is a self-reinforcing mechanism that causes poverty to persist (Azariadis and Stachurski, 2005). Even though most poverty in low-income countries is transitory, meaning that poor households move in and out of poverty over relatively short periods of time, poverty traps exist when poverty persists indefinitely with no promise of movement out. Despite a growing literature on poverty traps, largely emerging from the availability of household-level panel datasets, relatively little attention has been given to conditions under which forests serve as poverty traps (Angelsen *et al.*, 2014). The poverty trap literature considers various measures of well-being including flows of income or expenditures as well as stock measures of assets and human capital, health and *nutrition* (Barrett *et al.*, 2016). At the macro scale, human populations in remote forest landscapes far from markets may find themselves in a poverty trap by virtue of the lack of income and asset accumulation opportunities. This macro-level relationship highlights a potential correlation between people living at the forest frontier and poverty traps, but does not establish a causal link between forests and poverty. Given the high overlap between the extreme poor and those living in marginal or remote areas often dominated by forests and woodland, *forest-dependent* people may be at risk of facing poverty traps (Barbier, 2019). For example, depletion of community resources resulting from coordination failures, overexploitation of natural resources, and *degradation* below recoverable thresholds can lead to a poverty trap (Ostrom, 1990; Baland and Platteau, 1996; Toth, 2015). Overall, there is good evidence that poverty is higher in forested areas, but no evidence that this correlation is caused by the negative impacts of forests on well-being.

2.3 Conceptual Framing for Forest-Poverty Dynamics

The study of forest-poverty dynamics has evolved at the same time as the conceptualisation of poverty by the global community has broadened to include multidimensional aspects of poverty, and as data and analytical tools for monitoring poverty and inequality over time have improved. However, most foundational work on poverty dynamics (c.f. Scoones, 1998) largely fails to give explicit attention to natural resources and environmental sustainability as central to supporting well-being (Miller and Hajjar, 2020). Early conceptual framing of the role of forests and trees in poverty dynamics emerged primarily out of a small number of high quality, mostly static analyses conducted in disparate settings. Seminal efforts include Cavendish (2000) who analysed high frequency household panel survey data with detailed questions on environmental income finding that environmental resources contribute on average to 40% of the income (cash plus subsistence) for poor households in Zimbabwe. Studies by Pattanayak and Sills (2001), McSweeney (2004; 2005) and Shackleton *et al.* (2007) illustrated that forests play an important role as a safety net, providing not only opportunities for income diversification but also serving as a form of natural insurance against shocks ranging from disruptions in agricultural and livestock production to illness and death related to HIV/AIDS.

These early empirical examples highlighted the 'hidden harvest' of forests and tree-based systems functionally absent from standard analyses of rural livelihoods and poverty dynamics (Campbell and Luckert, 2002). They led Angelsen and Wunder (2003) to conceptualise three ways that forests contribute to rural livelihoods and poverty alleviation: supporting current consumption (e.g. providing fuel, food, fodder, medicine, building materials needed to meet everyday consumption needs); acting as a safety-net or natural insurance against shocks; and serving as a *pathway out of poverty*. Numerous studies (see Chapter 3 of this volume) review findings related to current consumption and safety-net functions of forests and trees in a range of settings.

Angelsen and Wunder (2003) give considerable attention to forest-poverty dynamics by discussing the hypothesised limitations of relying on forests as a poverty alleviation strategy highlighting three issues. First, the most common ways in which the majority of rural households in *low and middle-income countries* rely on forests are the production and sale of *non-timber forest products* (NTFPs) and trade in low value products (e.g. firewood and low value timber). Both of these activities have relatively low return on investment relative to the labour input required. Second, they point out the trade-off inherent in forest based poverty alleviation strategies and forest conservation, suggesting that relying on forest-based strategies other than *sustainable forest management* for carbon, *bio-*

Clear-cut in a Chilean forest
Photo © Jennifer Zavaleta Cheek

diversity, water or tourism values is not a viable pathway. Third, they flag the need for considerable financial and human capital to engage in most high-value forest sector activities (e.g., extraction of valuable timber species) implying that policies that support forests as a pathway out of poverty might bypass the poorest due to their own lack of capital and elite capture. Sunderlin *et al.* (2005) add nuance to the discussion by considering the geographic overlap of rural poverty and forests, and suggesting that remoteness plays a fundamental role in forest-poverty dynamics. Forest cover, population density, scarcity of forest products and proximity to markets all play an important role in determining the economic viability of forest based economic strategies. These contributions suggest that understanding the complex relationship between forests and tree-based systems and poverty requires attention to spatial and contextual heterogeneity.

While Angelsen and Wunder (2003) and Sunderlin *et al.* (2005) provided important new ways of thinking about the role of forests and environmental goods in rural livelihoods, their conceptualisation is limited to the role of subsistence (e.g., the monetised value of goods produced and consumed by households) and cash income, and the contributions of that income to defining poverty status. The first two dimensions of the Angelsen and Wunder (2003) framework were explored across a wide range of settings in the low-income tropics with data from the Poverty Environment Network (PEN) led by CIFOR. Analysis of the PEN data provided confirmation that forests and trees are critical in supporting the current consumption and income needs of households and for reducing income inequality within communities (Angelsen *et al.*, 2014; Lopez-Feldman *et al.* 2007), but did not confirm the use of forests as safety nets in a wide range of settings (Wunder *et al.*, 2014b). Several of the institutional barriers hypothesised by Angelsen and Wunder (2003) as important mediators in the ability of households and communities to access resources were analysed using the PEN dataset, including *tenure* rights (Jagger *et al.*, 2014) and gender roles (Sunderland *et al.*, 2014). Notably, the PEN Project was not designed, nor were the data appropriate, for testing theories about forests as a pathway out of poverty.

Two recent frameworks add new dimensions to our conception of forest-poverty dynamics including the indirect effects of forest management on *poverty reduction* (Miller and Hajjar, 2020) and the multidimensional framing of how forests can reduce poverty (Shyamsundar *et al.*, 2020). Following the framing of the twin goals of the World Bank (2015), Miller and Hajjar (2020) describe how forests contribute to prosperity. They emphasise human well-being beyond economic and material dimensions, and suggest a societal movement towards prosperity (e.g., a reduction in inequality), both significant departures from earlier conceptualisations that largely focused on income poverty. The main mechanisms or pathways to prosperity focus on forest-based income diversification through the sale of timber and non-timber forest products, *payments for ecosystem services (PES)*, tourism and the contribution of forest *ecosystem services* to agricultural productivity. They highlight that the inclusion of indirect pathways through which forest management might influence poverty (e.g. by enhancing agriculture) have not been explored in the literature. The PRIME framework (Shyamsundar *et al.*, 2020) describes five ways through which policy and programmatic interventions can facilitate the contribution of forests to poverty alleviation: improving productivity of forest and labour; strengthening community, household and women's rights; strengthening institutions, infrastructure and public service provision; increasing access to markets; and enhancing ecosystem services. They test the utility of this framework by examining forestry projects within the World Bank's portfolio.

Drawing on this literature, we identify four roles that forests and tree-based systems play in affecting poverty and human well-being: 1) helping people move out of poverty through direct and indirect contributions to income; 2) supporting well-being through subsistence, food security, and cultural and spiritual values; 3) mitigating risks through seasonal gap filling and mitigation of shocks; and 4) decreasing well-being through poverty traps or experiences due to negative externalities related to the presence of forests and trees.

2.3.1 Moving out of poverty

A substantial change in income directly or indirectly derived from forest can catalyse movement out of poverty. Forests and trees outside forests help people move out of poverty by providing a range of goods and services that directly or indirectly enable households to earn income. The former includes goods such as timber, energy and bushmeat; the latter includes the ways in which forests support agriculture income or ecotourism-based livelihoods. Such income and oth-

er benefits from forests and trees can lead to asset accumulation for households such that they are able to move out of poverty. Benefits may derive from sustainable or unsustainable exploitation of forests and trees as well as through their conservation, *restoration* and sustainable management.

Households derive income from extracting timber and non-timber products. Timber collection, which is the most common commercially viable and lucrative forest product (FAO, 2014) often requires large economies of scale and high initial investments in technology (Wunder, 2001; Angelsen and Wunder, 2003; Belcher and Kusters, 2004). Economic opportunity for forest extraction lies primarily in tropical countries, with more than two-thirds of the people living in or near forests residing in such countries (Newton *et al.*, 2020). However, comparatively few people live in or near large tracts of tropical rainforest (many live in or near dry forests), so income generation from timber extraction may be limited for the poorest forest-dependent households. Further, elite capture, corruption and unsustainable practices and other political economy challenges frequently hinder the business for commodities with high rents (e.g. Sundström, 2016). Nevertheless, locally-controlled forestry businesses and cooperatives exist in contexts around the world that can contribute to poverty reduction and broader notions of prosperity (Macqueen *et al.*, 2020; Humphries *et al.*, 2020).

Additionally, households earn income from converting forests into agricultural land, but the sustainability of this strategy depends on soil quality, input availability and a host of other factors. Over time, the costs associated with any loss and degradation of ecosystem services may outweigh livelihood benefits (see discussion and evidence in Chapter 3). At the same time, a wide diversity of *agroforestry* systems exist that may provide income and other benefits that enable more sustainable movement out of poverty (Miller *et al.*, 2020a).

Collection of NTFPs typically requires little specialised skill or technology, but it does require proximity and access to the forest and to markets for NTFPs (Neumann and Hirsch, 2000; Shackleton *et al.*, 2011; Angelsen *et al.*, 2014). Often the poorest are the most likely to collect NTFPs (Neumann and Hirsch, 2000; Shackleton *et al.*, 2011; Tincani, 2012; Angelsen *et al.*, 2014), perhaps because they lack better alternatives (Wunder, 2001). Whether NTFPs are a pathway out of poverty is debated (Wunder *et al.*, 2014a; Shyamsundar *et al.*, 2020), given the limited potential to scale-up production and in many cases limited markets for NTFPs. However, extraction of specialised products for urban markets (e.g. rubber, honey, resins, nuts, etc.) has potential to increase incomes (Kusters *et al.*, 2006; IUCN, 2012).

Other ways in which people earn income from forests include PES, ecotourism, and via indirect contributions to agricultural yields. Households can receive payment to keep their forest intact or even reforest through PES, an increasingly widespread policy for supporting forests and livelihoods globally (Salzman *et al.*, 2018). This includes mechanisms such as REDD+ promoted under the UNFCCC (Parrotta *et al.*, 2012). However, land ownership and social capital are often prerequisites for successful engagement in PES programmes (Wunder *et al.*, 2018), acting as a barrier to entry or success in these schemes (Wells *et al.*, 2020). Ecotourism can also increase incomes by providing more job opportunities within the tourism sector, and catalysing the construction of infrastructure like roads, health clinics and schools (den Braber *et al.*, 2018). In Costa Rica, Ferraro and Hanauer (2014) found that revenue from ecotourism was the main mechanism for reducing poverty. Last, forests could additionally contribute to incomes indirectly by providing ecosystem services like regulating water cycles and filtration, weed and pest control, limiting erosion, and pest and disease control that improve yields (MEA, 2005; Gamfeldt *et al.*, 2013).

2.3.2 Support well-being

Forests support well-being because they provide subsistence goods, improve food security, offer cultural and spiritual goods and services, and provide a means for formalising rights and strengthening democratic processes.

Forests provide a wide range of goods in support of subsistence such as food, fuel, fodder and building materials (Sunderlin *et al.*, 2005; Angelsen *et al.*, 2014). Resources collected from forests can support consumption to meet basic needs, which can reduce pressure on stretched incomes and make households less vulnerable to price changes of fuel and other critical consumption goods in the market. Subsistence income is not typically captured in standard measures of poverty, but it does play a critical role in smoothing incomes and mitigating risk, which relates to SDG 1 Target 5, and to multidimensional poverty (Target 1.2).

Forests also support well-being by improving food security and dietary diversity (Vira *et al.*, 2015). Tree cover (Ickowitz *et al.*, 2014), proximity to forests (Golden *et al.*, 2011; Tata *et al.*, 2019), and composition of forests (Rasmussen *et al.*, 2019) are associated with higher quality diets, including higher dietary diversity of fruits, vegetables and meats. In many contexts, the contribution of forests to

Mother and children on the border of W National Park, Benin
Photo © Daniel C. Miller

dietary diversity is not easily replaced by higher incomes. Paradoxically, in places where forests were converted to commodity crops leading to increased incomes, there were negative consequences for nutrition and dietary diversity (Ickowitz *et al.*, 2016). For example, after over thirty years of oil palm development in Indonesia, the incidence of child stunting remains very high (Beal *et al.*, 2018; Tiominar, 2011; Santika *et al.*, 2019).

Forests also provide non-material benefits that contribute to culture and spirituality, feelings of empowerment, individual happiness and social relations (Raymond *et al.*, 2009). Forests and trees can be central to the identity of forest-dependent communities (Oteng-Yeboah *et al.*, 2012; Daniel *et al.*, 2016), and forest knowledge is intimately embedded in indigenous knowledge systems (Asselin, 2015). For some indigenous communities, the forest is a sacred place where they perform cultural and religious ceremonies and collect products for traditional ceremonies (Munyi and Mutta, 2007; Rutte, 2011; Ngoufo *et al.*, 2014). Even though non-material benefits are unlikely to influence economic measures of well-being or income and asset poverty, non-material benefits from forests contribute to the broader multi-dimensional understandings of well-being and may contribute to fulfilment of SDG1 targets focused on rights (1.4) and *resilience* (1.5), in a supporting role in the overall well-being of households.

2.3.3 Mitigate risk

Forests can play a critical role in risk management and coping with shocks by providing a safety net or 'natural insurance' function and through serving as seasonal gap fillers. In the face of shocks, households can turn to forests to increase their income or improve subsistence by collecting forest goods (Pattanayak and Sills, 2001; Sunderlin *et al.*, 2005; Wunder *et al.*, 2018). Households may start harvesting timber and non-timber forest products when they have lost other income earning opportunities, or increase their frequency of visits to collect more timber and NTFPs. Given the barriers to entry for timber production and limited potential to scale up NTFP collection, forests seem most useful in making up shortfalls and providing basic survival for the poor (Neumann and Hirsch, 2000). Often income- and asset-poor (Wunder *et al.*, 2014b) and male-headed households (McSweeny, 2004; Fisher and Shively, 2005) rely more on forests to cope with shocks as compared to more asset-rich households who have other response options. Households with greater access to forest (Fisher and Shively, 2005; Fisher *et al.*, 2010) or that are remote and lack market-based coping options (Godoy *et al.*, 1998) are more likely to use the forest as a safety net. Depending on the availability of other coping strategies, households chose responses other

Figure **2.2**

Relationship between forests and tree-based systems and SDG1 targets and indicators

Source: United Nations, 2020

than forests first to respond to shock (Wunder *et al.*, 2014b). Nevertheless, forests can be particularly important when households face multiple, interacting shocks such as economic collapse and drought (Pritchard *et al.,* 2020).

There is evidence that forests and trees play an important role as seasonal gap fillers allowing households to smooth income and consumption (Pattanayak and Sills, 2001; Sunderlin *et al.*, 2005) over the course of the year. Forests provide a variety of non-seasonal products (e.g. fuelwood, building materials) suitable for collection between agricultural seasons (Byron and Arnold, 1999). However, most NTFPs are seasonally available (Ngane, 2012), suggesting that there may be limitations for NTFPs to support incomes. Logically, more diverse forests provide a wider range of goods at different times throughout the year (Pritchard *et al.* 2019). When forests act as safety nets, households are not likely to shift out of poverty in a durable way, but they can smooth income and consumption in the short- to medium-term, which relates to SDG 1 target 5 on risk mitigation.

2.3.4 Movement into poverty

Even though the scope of this report is to discuss the potential for forests to alleviate poverty, it is worth noting that forests may be associated with negative consequences for poverty alleviation. Events associated with living in proximity to trees and forests can negatively impact well-being, sometimes in very extreme ways. Examples include forest fires, crop-raiding by wildlife (Naugton-Treves *et al.,* 1998; Hill, 2018; Chen *et al.*, 2019) and prevalence of zoonotic disease (Kilpatrick and Randolph, 2012; Paige *et al.*, 2014). These events are largely a function of living at the forest frontier, or where forest and agricultural systems merge. Forests have also occasionally been referred to as a 'poverty trap', but the causal mechanisms for how forests can keep people in poverty may be more related to their association with remoteness than to the forest itself (Box 2.1).

Policies affecting actions in forest landscapes where human populations reside, particularly those that create incentives to change access to forests and contribute to land use change, have the potential to reduce well-being. Examples include forest policies related to establishment of strict protected area (Brockington and Wilkie, 2015) and other exclusionary land use policies that limit rights of access to forest goods and services like projects that establish large-scale monoculture commercial *plantations* or land grabs that establish long-term access rights for foreign entities (Fairhead *et al.*, 2012). Additionally, policies that convert forests to agricultural lands or for mining practices may have short-term rewards, but may have medium- or long-term implications for forest derived goods and ecosystem services (Rodrigues *et al.*, 2009). We also note that actions or absence of enforcement of policies and laws can foster and sustain elite capture, support rent seeking behaviour, and or support corrupt practices, all of which undermine opportunities for the poor to move up and out of poverty through forest-based pathways.

2.4 Towards a Deeper Knowledge Base for Understanding Forest-Poverty Dynamics

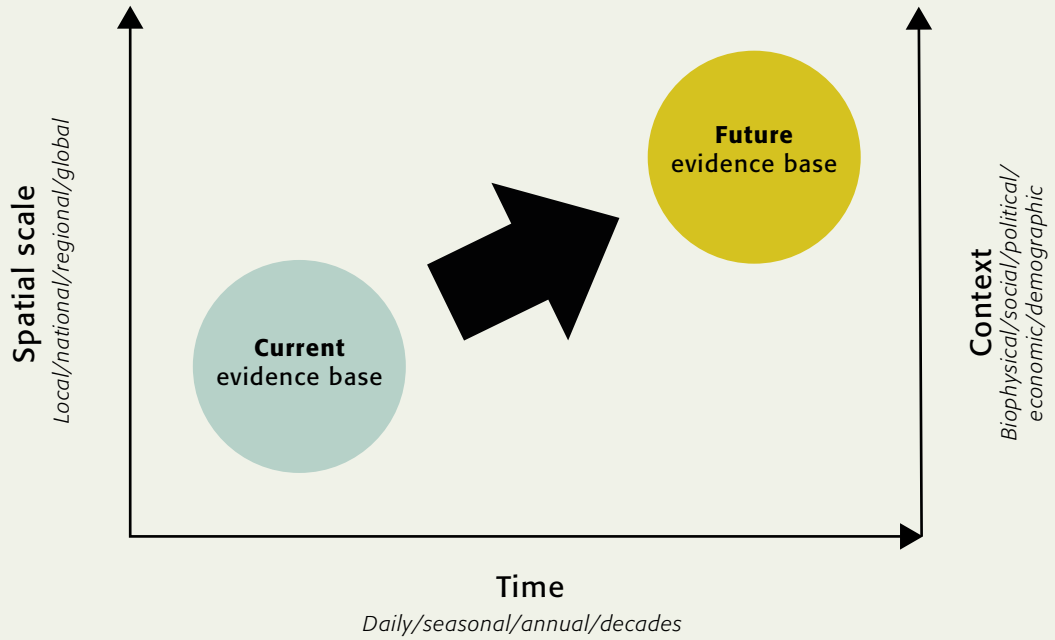
In this section, we consider the extent that existing frameworks for understanding forest-poverty dynamics address temporal, spatial and contextual dimensions of change. Incomplete knowledge about these three dimensions of forest-poverty dynamics limits our understanding of the relationship between forests and poverty, and serves as a barrier to policymakers and other key stakeholders as they weigh the relative effectiveness of relying on forests and trees to support poverty alleviation efforts (Figure 2.2).

2.4.1 Forest-poverty dynamics across time

The conceptual framing of forest-poverty dynamics to date has primarily focused on the role that forests play in supporting human well-being over time (temporal dynamics) (Figure 2.3, x-axis). For example, the concept of the forest transition (Figure 1.2, Chapter 1) provides a framework for understanding the relationship between economic development and forest cover at large spatial and temporal scales (Duchelle *et al.*, 2014; Mather, 1992; Mather and Needle, 1998; Rudel *et al.* 2005), but provides only very general insights into the temporal dimension of forest-poverty dynamics. Time is a critical dimension of the forest-poverty dynamics framework that merits further attention as we continue to build the evidence base, allowing us to build on knowledge gained from the dominant cross-sectional or static approach of inquiry. A recent review by Miller and Hajjar (2020) found that less than 17% of 150 studies on forests and poverty had an explicit temporal dimension, and that most covered a relatively short time frame (e.g. 1-5 years). More research is needed that involves repeated measures on the same units of analysis over time, acknowledging that there are a range of temporal units with relevance to understanding forest-poverty dynamics. Analysis involving repeated measures of the

Figure **2.3**

Current and needed future evidence on three dimensions of forest poverty dynamics



same units over short time periods sheds light on within year seasonal variation, which is important to understanding well-being and risk mitigation functions (Wunder *et al.*, 2014a; Wunder *et al.*, 2018), whereas analysis involving data collected over decades is more appropriate for understanding the impact of major changes in land use and land cover and implications for the role of forests in poverty alleviation. In the absence of such efforts to collect this type of data, forests and trees are often seen as inferior to other poverty alleviation strategies, which may deliver results in the near term, but have less certain long-term impacts.

In recent years the emergence of evidence-based policymaking has motivated an increase in experimental and quasi-experimental programme evaluations that use data collected over relatively short time frames (1-5 years), frequently for the same households or other relevant units of analysis. While the conservation and natural resource management sectors lag behind efforts in the health, education and social protection sectors (Ferraro and Pattanayak, 2006; Caplow *et al.*, 2011; Baylis *et al.*, 2016), calls to assess the impact on poverty of protected area management and forest carbon projects using data over time have been addressed (Andam *et al.*, 2010; Sims, 2010; Clements *et al.*, 2015; Sills *et al.*, 2017). Similarly, the use of regularly collected household survey data, including the World Bank Living Standards Measurement Surveys (LSMS) and the Demographic and Health Survey (DHS) data has made it easier to consider analysing changes in forest and tree use and poverty for representative populations over time (e.g. Jagger and Perez-Heydrich, 2016; Miller *et al.*, 2020b). Despite their potential, however, to date, these datasets have had serious limitations with regard to the attention given to forest goods and services (Wunder *et al.*, 2014a; Bakkegaard *et al.*, 2017; Box 3.2 in Chapter 3). Perhaps most challenging, but also most important for understanding the role of forests and trees in movement out of and into poverty, is the use of temporal data on the decadal scale.

2.4.2 Forest-poverty dynamics across space

We consider three dimensions of spatial analysis as highly relevant for further development of our understanding of forest-poverty dynam-

ics (Figure 2.3, left y-axis). The first is to strive to set studies from relatively small or homogeneous geographies in broader context. The majority of studies focused on forests and poverty take a micro-level approach focusing on data collected from a specific community or communities. Even research programmes focused on forests and people that are global in scope, including PEN (Angelsen *et al.*, 2014; Wunder *et al., 2014a)* and the International Forest Resources and Institutions (IFRI) (Wollenberg *et al.* 2007; Poteete and Ostrom, 2008) research programmes, rely on study sites opportunistically selected by partners and collaborators. Framing information on the relationship between forests and poverty in the context of the spatial location of the study site along the forest transition curve is one strategy for assisting policymakers with judgements about the relevance of findings. The framework permits researchers to move beyond general 'context matters' statements, to locate sites along a reference measure, the forest transition curve, and test hypotheses related to their location on the curve (Duchelle *et al.*, 2014). Second, outcomes often accrue at different scales. Impacts observed at highly localised scale may not be observable or easily aggregated to broader scale, or conversely, impacts may only be observed and measured at coarser scales. Lastly, whatever limited knowledge of forest-poverty dynamics exists, it is for rural sites. Trends in reliance on forests and trees as urbanisation expands have received limited attention in the literature, apart from studies focused on biomass energy use in growing urban centres (Zulu, 2010) and use of NTFPs (Schlesinger *et al.*, 2014). Increased attention to urban settings is warranted given population projections for sub-Saharan Africa and South Asia, and the poverty dynamics within Africa's growing cities.

2.4.3 Forest-poverty dynamics across contexts

Last, recognising heterogeneity of context (Figure 2.3., right y-axis) is important for acknowledging and understanding the complexity within and between sites. Within social-ecological systems there are a large number of context variables that influence outcomes (Senge, 1990; Ostrom 2007). Context dynamics refers to the unpredictable ways in which this large number of variables interact with one another shaping outcomes (Salafsky *et al.*, 2002). Context includes biophysical characteristics, market access, social, political, economic and demographic factors. It allows us to address critical questions about who benefits and under what circumstances they benefit from access to forest and tree-based goods and services. Angelsen and Wunder (2003) note that rural populations tend to be heterogeneous exhibiting a range of different interactions with forest resources. Hence, proposals for interventions should take into account multiple scales, providing reference to particular forest and socio-economic and political conditions. Further, relevant demographic and social dynamics need to be unravelled: how do differing gender, class, ethnicity and other dimensions of social differentiation influence forest uses, dependency, and rules and norms over access to and control of forests (Hecht *et al.*, 2015)?

A woman passes an axe to another community member in the Ecuadorian Amazon
Photo © Johan Oldekop

Again, the forest transition curve provides a useful analytical tool for situating evidence of the relationship between forests and poverty in broader context. In addition to variation in forest cover, rates of land use change and broad trends in economic development (e.g. the core of the forest transition), variation in infrastructure, market access, property rights, migration patterns, rule enforcement, etc. are critical to building our understanding of the enabling conditions for movement out of or into poverty via a pathway involving forest-based goods and services. How contextual factors vary along and within stages of the forest transition is important to understand. Whether a given household can move out of poverty depends on a coalescence of enabling conditions, which need to be sustained over time. Even though any one of these pathways could lead to poverty alleviation, pronounced and enduring impacts may require engaging with multiple pathways at the same time (Shyamsundar *et al.*, 2020). However, when and where these pathways are best suited to achieve poverty reduction requires empirical evaluation of impacts (Cheng *et al.*, 2019). Situating in-depth and site-specific knowledge in broader context should be an explicit objective of future work on forest-poverty dynamics.

In Table 2.1 we connect the four roles for forests and trees and poverty trajectories with our discussion of temporal, spatial and contextual heterogeneity summarising the key considerations for generation of a robust evidence base on the topic of forest-poverty dynamics. Research employing space for time substitution (e.g. using data from different geographic and social-ecological contexts to provide insights into temporal dynamics) is potentially a fruitful tool for both research and policy in the near term (Sunderland *et al.*, 2017). Emphasising use of the forest transition curve as a guiding stylised framework for spatially locating and contextualising sites provides a mechanism through which policymakers can situate findings relative to the geographic distribution of the population across different stages of economic development and land use change.

Our framing here lays out the path for the analysis that follows in Chapters 3, 4 and 5.

Table **2.1**

Charting a path operationalising evidence of forest-poverty dynamics

	FOREST AND TREE ROLES	WELL-BEING TRAJECTORY	TEMPORAL	SPATIAL	CONTEXTUAL
1	Moving out of poverty	Up and out of poverty	Annual/decadal	Within and between landscapes	Enabling conditions
2	Support well-being	Status quo	Seasonal/annual	Within landscape	Who benefits under what circumstances
3	Mitigate risk	Transient poverty	Seasonal/annual	Within landscape	Who benefits under what circumstances
4	Increase poverty	(Further) into poverty	Seasonal/annual/ decadal	Within and between landscapes	Enabling conditions

2.5 Conclusion

There is abundant evidence that forests and trees make crucial contributions to poverty alleviation and human well-being. While the role of forests in moving people permanently out of poverty is likely limited, it requires further exploration with more robust data that takes into account temporal, spatial and contextual heterogeneity. Strong support does exist for the role that forests play in supporting current consumption, gap filling and managing risk. A more broadly conceived definition of well-being allows for greater consideration of the role of forests in poverty reduction and allows for greater recognition of the role of forests in meeting SDG 1 targets and indicators. To date, the theoretical work on poverty dynamics does not give much attention to natural resource endowments, including forests and trees, and the relationship of forests to poverty reduction. One of our main observations is that the conceptual framing of forest-poverty dynamics primarily focuses on the role that forests play in supporting human well-being over time (temporal dynamics). This is a critical dimension of the dynamics framework that merits further attention as we continue to build the evidence base surrounding forest-poverty dynamics. However, we note that forest-poverty dynamics have two other important dimensions: spatial and contextual. In this chapter we provided framing for considering temporal, spatial and contextual dimensions of forest-poverty relationships as part of systems frameworks for building our knowledge base.

Handmade cart used for wood transport in Chile
Photo © Jennifer Zavaleta Cheek

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Chapter 3

Forest-Poverty Dynamics: Current State of Knowledge

Coordinating Lead Authors: Onja H. Razafindratsima, Judith Kamoto
Lead Authors: Erin Sills, Doris N. Mutta, Conghe Song, Terry Sunderland, Gillian Kabwe and Casey Ryan
Contributing Authors: Sarah E. Brown, Patricia M. Kristjanson, Maria Brockhaus, Patrice Bigombe Logo, Blaise-Pascal Ntirumenyerwa Mihigo, Symphorien Ongolo, Jianmin Xiao and Yue Zhao

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Abstract
This chapter reports on evidence about the role of forests and trees in alleviating poverty and supporting wider human well-being. It considers how, whether, where, when and for whom forests and trees are important in forest-poverty dynamics. We organise the evidence according to four possible relationships between forest products and ecosystem services and poverty: 1) helping households move out of poverty; 2) supporting well-being through subsistence, food security and cultural and spiritual values; 3) mitigating risks; and 4) decreasing well-being by generating negative externalities that could significantly contribute to trapping or moving households into poverty. The evidence shows that these relationships are strongly context-dependent, varying with geography and social, economic and political contexts. However, across contexts, we most commonly observe that forest and tree products and services help the poor to secure and stabilise their livelihoods, rather than either helping them exit poverty or driving them into poverty.

3.1 Introduction

Forests and tree-based systems[5] are vital resources for sustaining human populations around the world (Sjaastad *et al.*, 2005; Ali, 2018; Cheng *et al.*, 2019). In tropical countries, forests contribute an average of 22% of household income in communities near forests (Angelsen *et al.*, 2014), which generally have high poverty rates (Sunderlin *et al.*, 2008). *Agroforestry* systems are also commonly used by poor farmers and have the potential to increase their incomes, especially with improved genetics and markets (Leakey *et al.*, 2005). Thus, both *sustainable forest management* and agroforestry are widely claimed to be important for achieving the first SDG (Griggs *et al.*, 2013; Lawlor *et al.*, 2019). In this chapter, we assess the available evidence for these claims. To set the stage, we first review some of the central narratives and myths about poverty and forests.

One of these central narratives is that rural populations who rely on *shifting cultivation* and pastoralism, including many *forest-proximate* populations, need to be 'settled' in fixed communities to develop. This is rooted in the idea that their traditional grazing and small-scale cultivation systems trap them in poverty and are responsible for *deforestation*, despite evidence to the contrary (Curtis *et al.*, 2018; Thu *et al.*, 2018; Dressler *et al.*, 2020). This framing of smallholders as responsible for deforestation has persisted since colonial rule and has been used to justify claims on forests for large-scale production of global commodities such as timber, at the expense of local forest stewards (Dove, 1983; Doolittle, 2007). This discourse remains common in debates over climate change (Weatherley-Singh and Gupta, 2015; Skutsch and Turnhout, 2020). The potential of shifting cultivation systems to generate joint benefits for *livelihoods* and climate change *mitigation*, e.g. in building below-ground carbon stocks, has been largely ignored (Ickowitz, 2006; van Vliet *et al.*, 2012; Bruun *et al.*, 2017; Dressler *et al.*, 2017; Bruun *et al.*, 2018).

In contrast, agroforestry has been widely accepted as a way to achieve the 2030 development agenda (Garrity, 2004; Waldron *et al.*, 2017; Agroforestry Network, 2018). Agroforestry systems are appealing because they provide a suite of products and services that contribute to *poverty alleviation* and improved *human well-being*. However, agroforestry is just one of a whole spectrum of trees on farms and in landscapes that can make these contributions.

Another theme in the literature has been the potential for harvest and sale of diverse *non-timber forest products* (NTFPs) to both conserve forests and alleviate poverty. As we summarise below, there is substantial evidence that poor households use NTFPs to maintain their socio-economic and cultural status, but less evidence that they can leverage them to move out of poverty. And while forest products have been shown to help smooth income and consumption, it is not clear whether and when they are the preferred insurance mechanism. In many settings, forests may be more important for *ecosystem services* that are inputs to quality of life and agricultural production, rather than as sources of forest products.

This chapter summarises current knowledge of the role of forests and trees in poverty dynamics, considering the full range of products and services that are sold, consumed, or used as production inputs. Other than the formal timber sector (Box 3.1), most contributions of forests are either excluded or not attributed to forests in the official economic statistics that are the basis for national poverty

5 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

rates (Box 3.2). Thus, we draw on the scientific literature for evidence on how, whether, where, when and for whom forests and trees play the four possible roles in poverty dynamics posited in Chapter 2: (1) helping people move out of poverty; (2) supporting well-being through subsistence, *food security* and cultural and spiritual values; (3) mitigating risks, and (4) decreasing well-being by generating negative externalities that could significantly contribute to trapping or moving households into poverty. For this fourth role, we focus on evidence regarding whether the forest itself has negative effects on local communities (Lyytimäki, 2015), distinct from the negative effects associated with the process of deforestation (reviewed briefly in Section 3.6) and with the imposition of strict forest protection rules that exclude local people (Byg *et al.*, 2017; Poudyal *et al.*, 2018), which are addressed in the context of protected areas in Chapter 5.

We find ample evidence that *forest ecosystem* goods and services affect poverty dynamics, with some evidence on how such dynamics vary with geography and socio-demographics. We focus on differences in how the dynamics play out for men and women. There is relatively more evidence on forest products as part of the second and third roles and relatively less evidence both on services and on the first and fourth roles. This is reflected in the varying lengths of the following sections on the four forest-poverty dynamics. In each section, we synthesise the existing literature, with emphasis on regions with the highest poverty rates (sub-Saharan Africa), the highest poverty headcounts (South Asia), and the most dramatic reductions in poverty in recent decades (China).

Firewood is a critical resource for rural households in many countries
Photo © Nelson Grima

Box **3.1**

Formal timber sector

Focusing on the region with the highest poverty rates, FAO estimates that 79 million m^3 of wood was harvested as industrial timber in Africa in 2018 (FAO, 2019), but this is widely recognised as a substantial underestimate due to large-scale illegal felling and trade of logs in many countries. The formal forest sector contributed less than 1% of the total GDP of sub-Saharan Africa in 2011, rising above 10% in only one country (Liberia) (FAO, 2014). These industrial wood harvests are destined both for growing regional markets and for export, largely to China. In 2009, 78% of Africa's timber exports were bound for the Chinese market, having risen from 35% in 2000 (IIED, 2014). In turn, estimates for the extent of illegal logging are high, but difficult to quantify and confirm by its very nature (Kleinschmit *et al.*, 2016).

During the decade from 1990 to 2000, about half a million people were directly employed in the formal, primary wood production and wood industry sector in Africa (Lebedys and Yanshu, 2014). This represented a small (<1%) and declining fraction of the labour force (FAO, 2005; Whiteman and Lebedys, 2006; FAO, 2014). However, the FAO also estimates that at least three times more people are employed in the informal sector, mainly related to fuelwood and charcoal, than in the formal forestry sector (FAO, 2014). In particular, the charcoal trade accounts for a large share of incomes within the informal forest products sector (Mwampamba *et al.*, 2013; FAO, 2014; Jones *et al.*, 2016; Chiteculo *et al.*, 2018) and may provide jobs for millions of people.

3.2 Movement Out of Poverty

Forests and trees in the landscape could help reduce the proportion of people living in poverty, by enabling households to increase their incomes through sales of forest and tree products (Belcher, 2005). It is difficult to evaluate whether, where and for whom this has occurred without longitudinal data. Angelsen *et al.* (2014) and Miller and Hajjar (2020) point to panel survey data as

particularly valuable for understanding this role of forests, trees and agroforestry. Lacking long term panel data, researchers typically examine contributions to household income, expenditures or assets, rather than the role of forests in lifting people out of poverty over time (Miller *et al.*, 2017). Based on this largely cross-sectional and descriptive literature, the consensus view that emerged in the 2000s was that fundamental structural barriers generally prevent poor people from using forest and tree products to exit poverty (Wunder, 2001; Belcher *et al.*, 2005; Pérez, 2005). This is consistent with a recent literature review (Miller and Hajjar, 2020), which found only 12 studies that "described a social group (e.g., household, community or region) as moving out of poverty due at least in part to forests," i.e. through sales of timber or non-timber forest products. In the context of this pessimism about the potential for substantial numbers of people to use forests and trees to exit poverty, we seek to identify conditions that have allowed poor people to leverage tree and forest products to climb out of poverty. In these case studies, we give careful consideration to who has participated, i.e., who has benefitted. Ongoing policy changes discussed in Chapter 5 are also creating new conditions and offering new ways that the poor can leverage forests to raise their incomes above the *poverty line*, such as payments for ecosystem services (see Box 5.2 on the Conversion of Cropland to Forest Programme in China).

Harvesting bush mango (Irvingia gabonensis) for local consumption and trade, Ekuri, Nigeria
Photo © Terry Sunderland

Box **3.2**

Collecting national information on the socio-economic dimensions of forests and trees

National statistical offices in most countries conduct household surveys to inform national decision-making on poverty and livelihood issues, but these usually collect little to no information on the use and benefits of forests and trees (FAO *et al.*, 2016; Miller *et al.*, 2017). This absence of information means that the contribution of forests and trees outside forests to households' welfare, and their role in *poverty reduction* often remain hidden (Scoones *et al.*, 1992; Luckert and Campbell, 2012).

Recognition of the need for national information on the socio-economic dimensions of forest and tree resources has spurred the development of multiple new tools in recent years. Building from foundational work on measuring forest livelihoods (Cavendish, 2000; Wollenberg *et al.*, 2007; Angelsen *et al.*, 2012), a team of experts from FAO, CIFOR, IFRI (International Forestry Resources and Institutions) and PROFOR (Program on Forests) and the LSMS-ISA (Living Standards Measurement Study – Integrated Surveys on Agriculture) initiative at the World Bank has now published a set of forestry modules and guidebooks on their use (FAO *et al.*, 2016). The Forestry Modules were piloted in Indonesia, Nepal and Tanzania with national-scale implementation completed in Turkey. These modules are now complemented by a parallel effort to develop a set of modules to capture the socio-economic values of trees on farms, which was piloted in Mali (Miller *et al.*, 2019). They have also informed related tools, such as Forest-SWIFT (Survey of Well-being via Instant and Frequent Tracking) (World Bank, 2019a) and LivWell (FLARE, 2019), capable of more rapidly capturing focused data on forest reliance and poverty.

The main goal of these modules and the guidebooks describing their use is to provide a mechanism for national statistical offices to collect forest- and tree-related information in regular national-level household socio-economic surveys, thereby filling key information gaps on the contribution of

forests and other environmental resources to income, welfare and livelihoods. The modules are adaptable to different scales from local communities through to a whole country. Therefore, they are also relevant to a range of other potential users, including researchers, donors, other government agencies (e.g. forestry departments) and non-governmental organisations (NGOs) interested in improved information on the socio-economic dimensions of forests and trees in broader landscapes.

In one of the earliest reviews that concluded forests have a limited role to play in lifting people out of income poverty, Wunder (2001) argued that timber is the product most likely to generate enough profits to reduce poverty, but that those profits are largely captured by capital intensive and politically powerful actors. In Box 3.5, we describe a unique case in which poor communities have profited from timber, partly because they hold secure collective *tenure* rights. This points to the decentralisation of forest ownership and management rights as one way to enhance the role of forests in poverty alleviation, consistent with systematic reviews that have found decentralisation effectively increased local incomes in the few cases where it has been rigorously evaluated (Samii *et al.*, 2014). While acknowledging that "forest-based development success stories … are rare, especially among the developing countries," Palo *et al.* (1999) pointed to Finland where timber exports "played a vital role in economic development." In fact, the timber sector contributed to the economic development of many countries in northern Europe and North America that now have among the highest incomes in the world. These same countries continue to benefit from the trade in timber harvested in the Global South, thus contributing to the structural barriers that limit the ability of the poor in the Global South to leverage timber resources to exit poverty (Box 3.6).

Non-timber forest products are generally more accessible to poor households but offer only low returns to their labour (Wunder, 2001). López-Feldman and Wilen (2008) developed a theoretical model and examined a case study in Mexico showing that the poorest households, with the lowest opportunity costs of time and fewest alternative income-generating opportunities, are the most likely to be engaged in collection and sale of NTFPs. While this means that NTFP income flows disproportionately to the poor, it does not necessarily lift those households out of poverty, especially when forest resources are open access (and therefore susceptible to overexploitation and dissipation of rents) and when access to transportation, markets and other public services are limited (Belcher *et al.*, 2005). As Shackleton *et al.* (2008) concluded, "while key in enhancing the livelihood security of the poorest households, these products were unlikely to provide a route out of poverty for most, although there were exceptions." These exceptions can be created by more equitable forest policy (Larson and Ribot, 2007) or better market access (Scherr *et al.*, 2003). Market access is in turn shaped by consumer demand, globalisation, demographic trends, and expansion of communications or road infrastructure, which therefore can open windows of opportunity for poor people to harness forest products as a way to exit poverty, as illustrated by shea butter in Box 3.7.

As with forests, the rural poor face structural barriers to harnessing agroforestry to exit poverty. Russell and Franzel (2004) point to the need to expand market opportunities for smallholders, including for high-value products such as vanilla, as described in Box 3.8.

3.3 Role of Forests in Maintaining Human Well-being

This section reviews the evidence on how the poor secure their well-being by drawing on the multiple benefits of forests and trees, including both final and intermediate goods and services, both traded in markets and consumed. Standard measures of income and poverty as reflected in official statistics only credit forests for income from final goods and services traded legally in markets (Box 3.1). However, forests and trees also provide both tangible and intangible inputs to production and to household well-being (e.g. fodder, pollination, food and sacred places), which do not pass through markets and therefore are excluded from national income accounts.

3.3.1 Wood products

The harvest and processing of timber provide employment and income to millions of people worldwide. Exact numbers are difficult to obtain because this mostly occurs through the informal sector. FAO (2014) estimated that there were 54.2 million people employed in forestry, logging, and secondary manufacturing (sawn wood, panels, and paper) worldwide in 2010. In a report for the FAO Farm and Forest Facility, Verdone (2018) estimated that smallholders produced USD 2-4

Box **3.3**

Bushmeat as an example of non-timber forest products

Wild meat or bushmeat harvesting around the world remains an important source of protein and, more importantly, micronutrients, for many rural households and vulnerable populations such as indigenous groups and children (Swamy and Pinedo-Vasquez, 2014). Poor families living in rural areas, isolated from markets, rely heavily on wildlife - including bushmeat, insects and fish - for food, nutrition, as well as an income source (FAO, 2013; Oishi and Hagiwara, 2015; McIntyre *et al.*, 2016; Wilkie *et al.*, 2016; Lo *et al.*, 2019). Bushmeat harvesting is important in helping rural households to achieve healthy nutrition and food security (Golden *et al.*, 2014; Cawthorn and Hoffman, 2015; van Vliet *et al.*, 2015; Reuter *et al.*, 2016; Nielsen *et al.*, 2018). In the Abun region of West Papua, Indonesia, for example, hunting has proved to be an important factor in fighting food insecurity, as wild meat accounted for 49% of the diets of respondents (Pattiselanno and Lubis, 2014). While bushmeat is often consumed locally by hunters and their households (Wilkie *et al.*, 2005; Agustino *et al.*, 2011), the surplus is sold to both other community members and traders, with the latter often re-selling in cities (Nasi *et al.*, 2011; Nielsen *et al.*, 2017). In addition, the harvest of bushmeat may have ancillary benefits for agriculture, by reducing predation on crops, livestock and people working in remote fields (Wilkie *et al.*, 2011; Rentsch and Damon, 2013; Lindsey *et al.*, 2015). Harvesting of bushmeat has long been controversial due to concerns over its conservation impacts, when endangered species are targeted, and its long-term sustainability (Agustino *et al.*, 2011; Lindsey *et al.*, 2014).

billion in timber products per year (an order of magnitude less than just the single largest forest products company), but USD 76-309 billion/year worth of charcoal and firewood. Charcoal provides energy for over 80% of urban households in sub-Saharan Africa (Zulu and Richardson, 2013; Agyei *et al.*, 2020), and the informal charcoal industry provides employment to over half a million people in rural areas in Kenya alone (Njenga *et al.*, 2013).

In addition to generating employment and valuable forest products, harvesting timber and fuelwood for household use can reduce household expenditures and offer an additional income source. By growing trees on their own land, in woodlots or agroforestry systems, farmers can reduce the time and labour spent on gathering fuelwood (Njenga *et al.*, 2017), with the additional public benefit of reducing pressure on natural forests (Iiyama *et al.*, 2014). However, the ability of trees on farms to supply enough fuelwood for household consumption is dependent on the size of the landholding (Ndayambaje and Mohren, 2011), and thus many people remain reliant on wood collected off-farm. Even when trees on farms produce sufficient wood, it may be more lucratively sold as timber, poles or specialty products than used for fuelwood (e.g. in the case of *Acacia catechu* in India). Studies show that harvest and sale of timber (Antinori and Bray, 2005; Sikor and Baggio, 2014) and other wood-related forest products are important ways in which households augment their incomes (Humphries *et al.*, 2020; Macqueen et al., 2020).

3.3.2 Non-timber forest products

Compared to timber, non-timber forest products, including fuelwood (generally defined separately to NTFPs) and a wide range of other products, are less likely to enter the market economy and thus, less likely to be recorded in official economic accounts. This has meant that "the constant and profound reliance on forests by local people was under-observed by both Bureaux of Statistics and Forestry Departments in government" (Shepherd *et al.*, 2020), although there are efforts to remedy this (FAO *et al.*, 2016; Sorrenti, 2017). In contrast, the scientific literature of the past 25 years has provided a much richer understanding of the roles played by NTFPs in forest-poverty dynamics. In reviewing this literature, we include both plant and animal products from both forests and trees outside the forest. In many forest ecosystems across the world, including West and Central Africa, Brazil, Peru, India, and Indonesia, wild animals are important as both high-value

market products and critical sources of protein (Box 3.3). In Section 3.2.4, we highlight the ways that households use NTFPs to increase their food security and improve their nutritional status, as perhaps the most important contribution of this category of forest benefits to supporting human well-being.

Numerous studies have found that poor, rural populations are disproportionately dependent on NTFPs to meet their basic needs (Shackleton and Shackleton, 2004; Belcher *et al.*, 2005; Heubach *et al.*, 2011; Vira and Kontoleon, 2012; Wunder *et al.*, 2014; Leßmeister *et al.*, 2018). In many cases, rural people who depend on forest products live in remote areas with limited access to basic infrastructure, such as motorable roads, making it difficult to access markets and other services (Belcher *et al.*, 2005).

NTFPs are generally managed as open access resources and can be harvested using low-cost and/or traditional technologies (Belcher *et al.*, 2005). For rural dwellers with little financial and physical capital, the affordability and low barrier to entry of NTFP collection make them a viable livelihood strategy. As discussed in Section 3.4, their specific role in household livelihoods is often as a safety net and buffer during times of need such as natural disasters, crop failure, or family illnesses and periods of financial struggle (Leßmeister *et al.*, 2018). Closely related to the role of safety net, NTFPs are also used for seasonal gap filling, i.e., they are collected and sold seasonally based on the availability of time and labour that fluctuates with crop harvesting and planting seasons (Arnold *et al.*, 2011; Leßmeister *et al.*, 2018).

NTFPs play multiple roles in rural livelihoods. They can be collected and used directly for food, medicine, home construction and other traditional purposes. Studies have demonstrated that people who live near areas with more forest and tree cover have more diverse and nutritious diets (Powell *et al.*, 2011; Ickowitz *et al.*, 2014; Powell *et al.*, 2015b; Baudron *et al.*, 2017; Hall *et al.*, 2019). The micronutrients provided by forest foods improve health outcomes and prevent stunting and impairments of cognitive development (Johnson *et al.*, 2013; Ruel and Alderman, 2013; Vinceti *et al.*, 2013). NTFPs also serve as inputs to production, e.g. fodder, mulch and poles for constructing fences. Both intermediate and final products may also be sold, helping generate cash to pay school fees, purchase food from markets, and acquire agriculture inputs (Arnold *et al.*, 2011; Kar and Jacobson, 2012; Hall *et al.*, 2019).

One particularly important role of forests is as a 'natural pharmacy' or source of medicinal plants that play important health care roles for people living in remote rural areas where modern medicine is not accessible. A significant proportion of the population in tropical Asia, Africa and Latin America (Colfer *et al.*, 2006) relies on medicinal plants that form an integral part of their primary health care systems because of affordability, access and effectiveness. As the oldest known health care products, they constitute the medicines used by up to 75-80 % (RAFI, 1994; Ten Kate and Laird, 2020) of the population in developing countries, about 3.5 billion people (WHO, 1993). Cunningham (1993) estimates that 70-80% of Africans consult traditional medical practitioners for health care. Colfer *et al.* (2006) have documented a large body of literature on the wide use of medicinal plants in traditional health care systems thus contributing to the well-being of rural *forest-dependent* people in most regions of the world. Also, the market for them is large and expanding, meaning that they can also generate cash income. Further, medicinal plants are important for pharmacological research and drug development when they are used as basic materials for the synthesis of drugs or as models for pharmacologically active compounds, thus offering the opportunity for increased income for custodians and knowledge holders of such plants through bioprospecting ventures. However, with increased deforestation and *forest degradation*, many such plants are threatened with extinction leading to a loss of health care benefits for those who depend on them.

The literature on the contribution of NTFPs to rural livelihoods is dominated by local level case studies (Angelsen *et al.*, 2014). Some studies have found high dependence on NTFPs (Pattanayak and Sills, 2001; McSweeney, 2004; Debela *et al.*, 2012), but results across studies even within the same region can differ drastically (Leßmeister *et al.*, 2018). This is partly because the diversity of NTFPs and the level of dependency vary greatly with the local context. Belcher and Kusters (2004) also attribute this inconsistency to the lack of an agreed-upon definition of NTFPs and variation in focus, scale, approach and methodology. For instance, studies vary in whether they include relatively low-value products collected in high volumes like fodder, mulch and fuelwood. Some studies focus on specific NTFPs and extrapolate claims on NTFP dependence based on those select products (Belcher and Kusters, 2004; Belcher *et al.*, 2005; Ahenkan and Boon, 2011; Leßmeister *et al.*, 2018).

To generate a more global understanding of NTFPs, the Center for International Forestry Research's (CIFOR) Poverty Environment Network

(PEN) applied consistent methods to estimate "environmental income" derived from forests and other non-cultivated lands across sites in 24 developing countries (Angelsen *et al.*, 2014). Across their study sites, environmental income accounts for an average of 28% of household income, 77% of which originated from forests (Angelsen *et al.*, 2014). Only 10.4% of households in the sample used environmental resources, predominantly forests, as their primary safety net (Wunder *et al.*, 2014), as discussed further in Section 3.4.

3.3.3. Products from trees on farms

More than 43% of agricultural land globally has at least 10% tree cover on-farm, and thus, trees on farms affect the livelihoods of hundreds of millions of farmers (Zomer *et al.*, 2016). Agroforestry practices directly contribute to increased income through sales of tree products, increased yields, or payments for sustainable land-use practices through payments for ecosystem services (PES) and certification programmes. Agroforestry and trees on farms can produce high-value tree crops, such as rubber, coffee, cacao, leaves, cashews, macadamia and shea nuts. Rubber agroforestry, for instance, is widely practised in South and Southeast Asia as a low-input production system that generates significant income and can enhance tenure security (Gouyon *et al.*, 1993). Rubber can be intercropped with food crops, fruit trees or timber species in diverse agroforestry systems, which can substantially increase net farm incomes as well as provide resiliency to rubber price fluctuations and promote environmental benefits (Viswanathan, 2008; Somboonsuke *et al.*, 2011; Jessy *et al.*, 2017; Kenney-Lazar *et al.*, 2018). Smallholder farmers may earn two to six times more from rubber monoculture systems with a high-value intercrop, such as pineapples, corn, custard apple, salacca or rice (Somboonsuke *et al.*, 2011). Barriers limiting the adoption of agroforestry systems including their technical complexity and increased labour and input requirements. The economic viability of these systems is also debated (Kenney-Lazar *et al.*, 2018).

Agroforestry can increase income and food security by providing various foods for household consumption and sale, particularly from the use of multi-strata agroforestry systems surrounding houses, known as home gardens (Soemarwoto, 1987). In Vietnam, for example, home gardens were found to contribute between 13-54% of total household income (Trinh *et al.*, 2003), and in Indonesia, to 7-56% of total income (Soemarwoto, 1987). In Brazil, small home gardens had the highest net income per hectare and highest income-to-cost ratio, followed by medium-sized home gardens, as compared to commercial agroforestry enterprises, commercial agroforestry by smallholder farmers, enriched fallow, pasture with babassu and *swidden* cultivation (Cardozo *et al.*, 2015). Brazilian small home gardens generated the equivalent of 7.47 minimum wages per hectare, and medium-sized home gardens generated 6.77 minimum wages per hectare, indicating high productivity of these systems, while also maintaining high levels of *biodiversity* (Cardozo *et al.*, 2015). For comparison, pastures with babassu only generated 0.77 minimum wages per hectare and shifting cultivation systems generated 1.85 minimum wages per hectare during the cultivation phase (not including fallow phase) (Cardozo *et al.*, 2015). In sub-Saharan Africa, fruit trees provide a significant source of income for many families, in some cases acting as a safety net and provide supplemental income to cover everyday household expenditures and education costs (Schreckenberg *et al.*, 2006). Recent evidence from Uganda using data from a national survey of nearly 1,400 households over a 10-year period shows that households that increased the area they allocated to trees on farms – particularly fruit trees – saw a significant increase in their total consumption (Miller *et al.*, 2020).

Many tree-crop-based systems are transitioning towards more intensive plantation systems, e.g. shifting along a gradient from high shade to unshaded coffee production systems. This change towards intensification can increase yields and incomes but at the cost of biodiversity and system *resilience* (Steffan-Dewenter *et al.*, 2007). Agroforestry systems managed for a greater diversity of products, as opposed to only one commodity crop like coffee, can increase resilience to market shocks and fluctuations. Crop diversity has also been shown to significantly reduce the probability of household poverty in some contexts (Michler and Josephson, 2017). There are trade-offs between productivity and environmental sustainability, but optimal configurations across both objectives may be found, such as with low-shade agroforestry systems (<30% shade) that maintain productivity while creating benefits for climate *adaptation*, climate mitigation and biodiversity (Blaser *et al.*, 2018). Coffee agroforestry can diversify and decrease expenditures or increase household incomes, through the consumption or sale of fuelwood, fruit and lumber beyond the sale of coffee (Rice, 2008). Under sustainable management, these types of agroforestry practices yield high-value products along with the commodity crops, while maintaining tree cover that delivers ecosystem

services. Exploiting these resources from agroforestry can help relieve pressures on *primary forests* to supply these products (Rice, 2008).

3.3.4 Forests and trees for food security and nutrition

Forests and tree-based systems contribute to food security and *nutrition*, particularly for vulnerable groups such as children and pregnant and nursing women. In this section, we focus on the direct provisioning of wild and cultivated foods such as edible plants, fruit, nuts and seeds from forests and trees, as one of a suite of ways that these resources support food security and nutrition (Vira *et al.*, 2015; HLPE, 2017; Rasmussen *et al.*, 2017; in addition, see Box 3.3 on wild meat harvesting). The indirect contributions of forests and tree-based systems are discussed in the next section.

Food harvested from the wild contributes to food security because of its nutritional value (Boedecker *et al.*, 2014). While wild foods may not necessarily contribute to the caloric intake of rural households, studies have indicated that their role is particularly important in providing essential vitamins and minerals (Powell *et al.*, 2015a; Vira *et al.*, 2015; Asprilla-Perea and Díaz-Puente, 2019). The collection of such wild foods is also a means of mitigating the risks and shocks that poor people face due to, for example, droughts, illness, conflict, a poor harvest (Pouliot and Treue, 2013; Clements *et al.*, 2014) or forced displacement for the creation or enforcement of strictly protected areas (Sunderland and Vasquez, 2020).

Evidence shows that in many countries rural populations living in or around forested areas rely, to diverse extents, on the harvesting of wild foods for their dietary needs (Sunderland, 2011; Sunderland *et al.*, 2013; Boedecker *et al.*, 2014; Rowland *et al.*, 2017). Hickey *et al.* (2016) carried out a comparative analysis at a global scale, which concluded that 77% of rural households surveyed

Box **3.4**

Sacred groves in Africa

Around the world, sacred groves represent a traditional form of community-based conservation, known to preserve areas that hold strong cultural and religious importance to local people (Oviedo and Jeanrenaud, 2007; Ormsby and Bhagwat, 2010; Bulkan, 2017). These sites can be individual trees, forest remnants, rivers, waterfalls, meadows, wildlife, sacred caves, lakes, hills and other sites (Bhagwat and Rutte, 2006; Ormsby, 2012; Liljeblad and Verschuuren, 2018) managed and sustained by a system of enduring religious beliefs and socio-cultural practices (Mgumia and Oba, 2003; Aniah and Yelfaanibe, 2016). The practice of establishing sacred groves is widespread across many countries in Africa, including Tanzania (Mgumia and Oba, 2003; Sheridan, 2009), Cameroon (Fru, 2014; Kemeuze *et al.*, 2016), Nigeria (Onyekwelu and Olusola, 2014; Oyelowo *et al.*, 2014; Daniel *et al.*, 2016), Ghana (Ormsby, 2012; Aniah and Yelfaanibe, 2016) and Ethiopia (Aerts *et al.*, 2016; Orlowska and Klepeis, 2018). Sacred groves exist throughout tropical Africa, and are usually designated as places for rituals of initiation and sacrifice. Generally, they consist of patches of forest in agrarian landscapes and are commonly found in the long arc of forest-savannah transition zone (Sheridan, 2009). The ecological status of African sacred groves is associated not only with their spiritual significance but also with political, economic and legal processes (Sheridan, 2009).

Ghana is considered as having the highest number and concentration of sacred natural sites in Africa (Ormsby, 2012). It was estimated that over 1,900 sacred groves of varying sizes ranging from very small patches (less than 1 ha) to larger expanses of several thousand hectares are spread across the country (Ntiamoa-Baidu, 1995). In the central and northern Ethiopian highlands, 'church forests' are a strong and longstanding tradition where small fragments of forests, mostly the remaining native forests, are managed by the Ethiopian Orthodox Tewahido Churches and monasteries as sacred groves (Aerts *et al.*, 2016; Woods *et al.*, 2016; Orlowska and Klepeis, 2018). In Nigeria, sacred groves are a symbol of identity for most of the Yoruba People in the south-west region of the country, and were historically established outside their settlements (National Commission for Museums and Monuments, 2005).

Harvesting acai (Euterpe oleracea) in the state of Amapá, Brazil
Photo © Reem Hajjar

collected food from the wild, highlighting the extent to which such harvesting is an integral part of many livelihood strategies, particularly in developing countries. Both in Malawi (Johnson *et al.*, 2013; Hall *et al.*, 2019) and Indonesia (Ickowitz *et al.*, 2016) a positive correlation has been found between tree cover and dietary diversity. A number of multi-country meta-analyses have also served to confirm this positive relationship between forests and diets. Ickowitz *et al.* (2014), for example, in their meta-analysis of 21 African countries, found a statistically significant correlation between tree cover and dietary diversity among the diets of children in all 21 countries. Similarly, Rasolofoson *et al.* (2018) also identified a positive relationship in their analysis of 27 African countries. In contrast, Galway *et al.* (2018) found that deforestation and the loss of forest around villages and agricultural fields resulted in poorer dietary outcomes for children in sub-Saharan Africa.

Farmed produce are often unable to fulfil all the dietary requirements of a rural family, and wild food collection often serves to complement their nutritional needs (Fischer *et al.*, 2017; Nakamura and Hanazaki, 2017). In fact, reliance on agricultural production may lead to lower quality diets lacking in vitamins and micronutrients such as iron, zinc and vitamin B12 (Sunderland *et al.*, 2013; Cawthorn and Hoffman, 2015; Powell *et al.*, 2015a). This lack of quality in the diet has been termed the 'hidden hunger' (Ickowitz *et al.*, 2014; Fa *et al.*, 2015; Powell *et al.*, 2015a) and leads to malnutrition, which can have severe impacts on the development of young children, leading for example to childhood stunting with life-long consequences (Golden *et al.,* 2011; Temsah *et al.,* 2018). A study by Blaney *et al.* (2009) exploring the contribution of natural resources to the nutrition of the local population in a protected area in Gabon, found that the consumption by children aged 5 to 9 of products stemming directly from their environment, was the best predictor for nutritional status. Similarly, although overall natural foods were found to contribute only 12% of the energy requirements of villagers in the Gamba Complex of Gabon, they contributed an estimated 82% of protein, 36% of vitamin A and 20% of iron requirements (Blaney *et al.*, 2009). In this context, the role of wild foods collected from the forest is all the more important to help to combat micronutrient deficiencies.

Fruit trees, both wild and cultivated, are an important source of dietary diversity for many rural households. They have the advantage that they are often easy for households to domesticate and manage on their land (Willett *et al.*, 2019). Fruits like baobab, mango, papaya and orange are par-

ticularly vitamin-rich sources of nutrients (Vira *et al.*, 2015). A nationally-representative panel data study from nearly 1,400 households in Uganda, for example, showed that those that increased the share of trees on their farms, especially fruit trees, saw improved child health and nutrition outcomes (e.g. less child wasting and stunting) (Miller *et. al.*, 2020).

Box **3.5**

An example of how poor communities have profited from timber harvesting

In Mexico, as a result of a national agrarian reform that occurred in several waves in the 1900s (Bray *et al.*, 2006), many communities have control over and log forests with commercial timber potential. In the Yucatan region, forestry authorities, civil society organisations and the state government of Quintana Roo cooperated under the Forestry Pilot Plan, or *Plan Piloto Forestal* (PPF), to provide technical assistance to communities for commercial forest management. Bray *et al.* (2007) found a suggestive correlation of lower poverty rates with direct control over more of the value chain, i.e., via the establishment of sawmills rather than simply selling stumpage or logs. The distribution of benefits from logging also varies across communities, with some choosing to share profits within workgroups that manage particular stands and others investing in local social services or public goods, such as schools, drinking water systems and health posts, that benefit all families living in the community (Huelsz and Negreros-Castillo, 2014). This is particularly relevant for women, who typically do not participate directly in commercial forestry but do benefit from local social services.

3.3.5 Forest and tree inputs to production in other sectors

In addition to the sale and consumption of goods from forests and trees, many households derive benefits from the contributions of forests and trees to production in other sectors, most notably agriculture and fisheries. These indirect benefits are particularly important to poor households who cannot afford to purchase substitutes for the free inputs provided by forests and trees (Chavarría *et al.*, 2018). For example, hundreds of thousands of smallholders, half of them women, plant fodder trees in East Africa, where they reduce the cost of producing milk (Franzel *et al.*, 2014). The inputs include services generated as externalities of forests, such as reduced sedimentation downstream, and as a result of deliberate management of trees, such as shade and nitrogen fixation. They also include inputs gathered from forests, such as fodder and poles, and produced in tree-based agricultural systems. These systems are diverse, ranging from trees retained on farms following forest clearance, to simple agroforestry systems such as improved rotational fallow, alley cropping, intercropping and hedgerow systems, to complex agroforestry systems that mimic natural forest ecosystems (McNeely and Schroth, 2006). While there have been numerous initiatives to promote these tree-based systems because of their benefits to farmers and society in general, farmers must balance these expected benefits against potential costs of competition for resources and negative effects on the microclimate, such as increasing relative humidity and lowering air temperature in sub-humid zones (Kuyah *et al.*, 2016).

Forests and trees can increase crop and livestock productivity (Baudron *et al.*, 2019). Tree-based systems can increase agricultural yield and nutritional quality through various provisioning and regulating ecosystem services (Reed *et al.*, 2017; Barrios *et al.*, 2018). The resulting product diversification and regulating services that maintain productivity can increase resiliency to climate change and other shocks (Thorlakson and Neufeldt, 2012; Kenney-Lazar *et al.*, 2018; Quandt *et al.*, 2019). A review of 438 studies spanning over 20 countries across sub-Saharan Africa shows that crop yields increased under tree-based systems such as fallowing, tree-crop intercrop and alley cropping compared to treeless systems in 68% of the studies due to improved microclimate, nutrient cycling and soil fertility (Kuyah *et al.*, 2016). However, 18% of these studies also reported a decline in crop yields mainly due to trees competing with crops for nutrients, water and light (Kuyah *et al.*, 2016).

Likewise, at a landscape level, crop yields can be maintained or enhanced at a level comparable to intensive monoculture when forests and trees are incorporated effectively in an agricultural landscape (Reed *et al.*, 2017; Baudron *et al.*, 2019). The presence of trees and forests in agricultural landscapes showed an overall positive or neutral effect on crop yields in 52% of the case studies in a pan-tropical review of 74 studies (Reed *et al.*, 2017). In two studies in Ethiopia, livestock productivity

Box **3.6**

The forestry sector in the Congo Basin as an inequality machine? A brief overview of the issues

In many tropical forest-rich countries, among them, Cameroon and the Democratic Republic of the Congo (DRC), the exploitation of forests and forestland is justified by the promise of development and increased societal welfare.

When investigating the specific cases of Cameroon and DRC, we find that this development discourse is contradicted by the long stagnating national incomes (Alvaredo *et al.*, 2018) in both countries, and documented violation of rights and exclusion of indigenous people from access to forest resources and related benefits (Logo, 2010; Assembe-Mvondo *et al.*, 2013). Paradoxically, since the colonial period, the marginalisation of indigenous people and forest communities' rights at domestic level co-exists with an increasing proliferation of policies driven by international forest-related agreements that promote an improvement of their participation, land tenure security and benefit-sharing (Maggio, 1997; Adams and Hulme, 2001; Larson *et al.*, 2010; Schroeder, 2010; Sikor *et al.*, 2010). Over the longer term, the forest sector appears to have contributed more to the economic prosperity of European countries that have historically dominated forest exploitation and forestland conversion in the Congo Basin as colonial powers, namely Belgium, France and Germany (Hardin and Bahuchet, 2011; Coquery-Vidrovitch, 2017). More recently, China emerged as a new power in the region, engaging with a similar dual agenda of linking promises of development for societal welfare in exchange for the (over) exploitation of forests that are combined with forestlands and large-scale land acquisitions (Sautman and Yan, 2008; Germain *et al.*, 2018). Not least, state bureaucracies and national elites are also entangled in rent-seeking behaviour (Ross, 2015), with powerful groups having gained access and using their influence and power to capture and/or enlarge the forest rent. This is reflected throughout a set of dominant strategies in the politics of land acquisitions, forest concessions, trade and investment patterns (Ribot, 1999; Ekoko, 2000; Karsenty and Ongolo, 2012).

Social inequality within and among societies in different parts of the world is currently part of many public debates (Alvaredo *et al.*, 2018; UNDP, 2019) and often narrowly expressed in (economic) opportunities and outcomes, for example in access to education or participation in decision-making over the use of natural forests (Sen, 1997; Obeng-Odoom, 2020). Underlying those inequalities as starting points (opportunities) and finishing lines (outcomes) are multidimensional, socio-political processes that often feed into a machinery of increased 'production' of social inequalities (Afonso *et al.*, 2015). Inequality resulting from uneven distribution of, and access to, the many materials and immaterial benefits from forests in the tropics has been discussed to some extent in recent literature, for example with regard to global North-South dynamics driving and justifying access to forests and large scale conversion of forestlands in the name of development (Ribot and Peluso, 2003). Here, social inequality is manifested in institutional path-dependencies and power relations, defining who has the right to access and benefit. Other scholars refer to benefits and burdens in the context of climate change and specific policies and programmes (Ribot, 1999; Phelps *et al.*, 2010; Luttrell *et al.*, 2013; Pham *et al.*, 2014). Detailed accounts of the role of colonial exploitation in generating inequality, such as Peluso (1991) for the case of Java, are limited for the forest sector, in the Congo Basin and elsewhere. Much of the literature focuses on particular inequalities in benefit sharing within a particular tropical forest country, while often missing the link between major financial actors in the Global North investing in industries driving deforestation in the Global South (Galaz *et al.*, 2018). Scholars also highlight the underlying long-term dynamics of power and politics in the global forest and land-use sector, and the political economy establishing incentive structures and discursive practices which drive and justify unequal outcomes from tropical deforestation (Angelsen and Kaimowitz, 1999; Rudel, 2007; Dauvergne and Neville, 2010; Burgess *et al.*, 2012). Meanwhile, today's decision-making over forests and forestlands in the tropics seems still to be shaped by persistent myths that create

barriers to transformation towards global forest sustainability (Delabre *et al.*, 2020). With emerging datasets on forest change, global trade, investments and related inequalities among countries, as well as increasing access to digital information in colonial archives, it is now crucial more than ever to examine the as yet largely unanswered question (McDermott, 2017) of 'who, and whose societies, benefit from tropical forest exploitation and deforestation?' And to what extent do current global forest governance arrangements reinforce or break with existing patterns of inequality?

and nutrient balances, and the nutritional value of crops both improved with proximity to a forest (Chavarría *et al.*, 2018; Wood et al., 2018).

The key ecosystem services from forests and trees that support crop production include nutrient cycling (Power, 2010), pollination (Garibaldi *et al.*, 2011), seed dispersal (Thrupp, 2000), soil formation (Hurni *et al.*, 2015), reduced erosion and leaching (Mbow *et al.*, 2014), natural pest and disease control (Karp *et al.*, 2013) and climate and water regulation (Daily and Matson, 2008). In particular, 'fertiliser trees' (that are grown in agricultural fields or pastures to increase nitrogen availability) can offer an alternative or supplement to fertiliser application, which can reduce expenditure on fertiliser and increase income through higher yields. Nitrogen-fixing trees maintain and enhance soil fertility by cycling atmospheric nitrogen, thereby increasing yields (Akinnifesi *et al.*, 2010; Ajayi *et al.*, 2011). A review of 90 studies suggests that maize yields increased, and crop production stabilised during drought after the integration of nitrogen-fixing trees on farms in Eastern and Southern Africa (Sileshi *et al.*, 2007). Similarly, incorporating trees in wheat fields increased nitrogen availability in soil, water use efficiency, reduced heat stress and increased yield significantly compared to wheat fields without trees (Sida *et al.*, 2018), resulting in higher net income (Place *et al.*, 2005; Kuntashula and Mungatana, 2013; Coulibaly *et al.*, 2017; Amadu *et al.*, 2020).

Forests and trees support pollinators and natural predators of crop pests. Although many major crops are self- or wind-pollinated, wild pollinators such as bees, butterflies, birds and bats directly affect the productivity of 75% of globally important crops (Potts *et al.*, 2016). For instance, yields in coffee crops in Costa Rica and watermelons in California increased in sites near forest fragments due to more frequent visits by pollinators (Scherr and McNeely, 2008). Similarly, a global study found that pollinator richness increased crop yield across 89 crop systems (Dainese *et al.*, 2019). The stability of pollination services declines in crop fields with increasing distance from forests and trees (Garibaldi *et al.*, 2011).

Another key service is pest control. Incorporating forests and trees within agricultural landscapes creates heterogeneity in the habitat and supports diverse natural predators of crop pests (Maas *et al.*, 2016; Chaplin-Kramer *et al.*, 2019; Kebede *et al.*, 2019), especially in perennial crops (Pumariño *et al.*, 2015). For instance, forest cover in farmland improved pest control by increasing natural predators such as bats and birds in Costa Rica and Western Kenya (Karp *et al.*, 2013; Guenat *et al.*, 2019). Similarly, effective management of ants and shade trees increased crop yields in cocoa agroforestry in Indonesia (Gras *et al.*, 2016). Conversely, forest cover loss reduced agricultural production by 45% due to the loss of biological pest control in Indonesia (Yamamoto *et al.*, 2019).

Forests and trees can also increase crop productivity and resilience by improving microclimate conditions in agricultural landscapes (Pramova *et al.*, 2012). For instance, trees can buffer extreme climatic fluctuations such as temperature spikes that have negative impacts on crop growth (Hatfield, 2016). Shade trees have been found to enhance production by regulating temperature and humidity fluctuations in coffee agroforestry systems in Latin America (Lin *et al.*, 2008) and India (Nesper *et al.*, 2017). Trees in agricultural landscapes can also enhance understory growth by reducing air and soil temperature and by regulating water retention and gas exchange (Lott *et al.*, 2009).

In livestock systems, trees provide both the key service of shade and the key input of fodder. These systems include grazing livestock on pastures with trees and allowing livestock to graze on the trees or shrubs, as well as supplying tree cuttings as fodder for livestock. Fodder trees, when used as a protein supplement, improve milk and meat production, livestock growth, and livestock health and reproduction (Franzel *et al.*, 2014). This increase in productivity leads to improved incomes and food security. In East Africa, for example, fodder trees and shrubs contributed about USD 3.8 million annually to farmers' incomes by 2006 (Franzel *et al.*, 2008). At the household level, this translated to an increase in net returns of between USD 13- 334 per year in Zimbabwe, USD 30-114 per year in Kenya

Box **3.7**

Shea butter market as an example of NTFPs as a way out of poverty

The nuts of the shea tree (*Vitellaria paradoxa*), found in the dry savannah and grassy woodlands of Africa, are both consumed at home and sold in the market for end uses including food, oils and cosmetics. Shea nut prices increased five-fold from the 1990s to 2013 (Rousseau *et al.*, 2015). This strong market means that a single shea nut tree has an estimated net present value of USD 211 (IUCN Uganda, 2016). In particular, shea collection, processing and subsequent sale of shea-based products generate income and offer employment to rural women and children (Aboyella, 2002; Abdul-Mumeen *et al.*, 2013; Mohammed *et al.*, 2013; Sarkodie *et al.*, 2016). Laube (2015) finds it "unlikely that shea nut pickers will be able to substantially increase their production with labour shortages and dwindling access to shea trees". However, women involved in the shea business are more likely to effectively increase their family income when they have access to microcredit, e.g. through the Community Life Improvement Programme (CLIP) in northern Ghana (Robinson, 2001; Bawa *et al.*, 2017). At the country level, FAO estimated that Ghana exported 42,424 metric tonnes (MT) of shea worth USD 14.8 million in 2008 (FAOSTAT, 2008). This same quantity of shea nuts could have yielded 21,212 MT of shea butter at a total value of USD 21.2 million (Omane, 2014). The implication is that value addition through the processing of shea nuts into butter presents an opportunity for increasing income, improving livelihood outcomes and alleviating poverty.

and Uganda, and USD 68-503 per year in the Philippines due to increased production and income from cattle (Franzel *et al.*, 2014).

While not as well recognised as contributions to crop and livestock productivity, forests and trees also support fisheries. Fish and other products (e.g. freshwater prawn, crayfish and crabs) have long been recognised as an important source of protein for the poor, who consume less but are more dependent on (and have fewer substitutes for) these products in their diets, as compared to wealthier populations (Kent, 1997; Jones *et al.*, 2006; HLPE, 2014). A growing body of literature highlights the contribution that 'blue forests', notably mangroves, make in supporting local community well-being, livelihoods and food security (Himes-Cornell *et al.*, 2018). McIntyre *et al.* (2016) report that hundreds of millions of people globally benefit from low-cost protein and commerce that freshwater fisheries provide, particularly where alternative sources of protein and employment are scarce.

Deforestation, overexploitation or contamination of water by agriculture, mining or other land use changes can have drastic effects on aquatic foods with subsequent impacts on downstream people reliant on these systems for income, nutrition and food security (Carignan and Steedman, 2011). Forests play a role in the maintenance and regulation of aquatic food webs by regulating flow, controlling sedimentation rates, regulating in-stream temperature and contributing energy flows through terrestrial resource subsidies in the form of terrestrial fauna entering the aquatic food web. Losing this regulating function of forests impacts on the health of the people whose food security and nutritional needs rely on them. For example, in the Amazon Basin, fish is in many cases the most important source of protein consumed by traditional rural peoples. In freshwater streams and rivers, fish are dependent on fruits and seeds from riparian vegetation for their survival (Goulding, 1981).

Mangroves play an important role in the productivity of marine fisheries, providing habitat, spawning grounds and nutrients for a variety of fish and shellfish, including many commercial species. Falling leaves and woody matter from mangroves are essential to the marine food chain that supports fisheries (FAO, 2007; Hutchison *et al.*, 2014). Juvenile fishery species can hide among the roots of mangrove trees and grow to a size where they are less prone to predation, leading to higher survival rates. Fish and shellfish from mangroves support a large number of fishing and rural communities around the world providing them with income and food security. Mangroves contribute to the employment of an estimated 38.4 million people globally, of whom 90% are artisanal fishers (Hutchison *et al.*, 2014). As mangrove forests

Box **3.8**

Vanilla production as an example of agroforestry as a way out of poverty

Approximately 80% of the world's vanilla is produced in Madagascar, largely in the north-eastern SAVA region, constituting up to 26% of Madagascar's crop export revenue and up to 6.8% of the country's national revenue (Organisation Internationale du Travail, 2016; World Bank, 2019b). Vanilla orchids (*Vanilla planifolia*) are grown on other vegetation for support, including in native forest that has not been significantly altered (Hending *et al.*, 2019). In the SAVA region, these agroforestry plantations have become the main source of income for many farmers. Hänke *et al.* (2018) report that the cultivation of vanilla has improved the socio-economic status of smallholders, as indicated by income, education, access to electricity and ownership of assets. These benefits generally arise from contracts with vanilla exporters or collectors and thus are concentrated among smallholders able to obtain those contracts. Female-headed households are much less likely to get contracts because of their significant social disadvantages (e.g. lower labour availability and smaller fields). Additionally, tight integration with the export market results in both unstable prices (Zhu, 2018) and perceived exploitation due to the wide spread between the prices offered to smallholders and the export value.

are destroyed, local fish catches drop, leading to a direct loss in livelihoods. More broadly, the loss of mangroves may have significant negative impacts on the fisheries sector. Mangroves also contribute to aquaculture, both open-water estuarine mariculture (e.g. oysters and mussels) and pond culture (mainly for shrimps) (FAO, 2007). Shrimp farming, for example, has a high economic rate of return and has been promoted in several countries to boost the national economy and alleviate poverty.

3.3.6 Non-material contributions

The first SDG recognises that poverty is multi-dimensional, calling for a reduction "at least by half [in] the proportion of men, women, and children of all ages living in poverty in all its dimensions according to national definitions." Culture, religion and spiritual values are clearly important to human well-being and thus their loss is a form of impoverishment.

Forests and trees are significant to spiritual and cultural traditions central to the identity of forest-proximate communities, especially indigenous peoples (Oteng-Yeboah *et al.*, 2011; Asselin, 2015; Daniel *et al.*, 2016). Information on the cultural significance of forest resources can be gleaned from anthropological, ethnobotanical and ethnoecological studies (Toledo, 2002; Alexiades, 2003; Cocks, 2006). These cultural values manifest in ways ranging from forests being objects of animist-based beliefs to traditional forest products marketed globally based on their joint natural and cultural attributes. Box 3.4 provides an example of the spiritual role of forests. Specifically, for people who traditionally lived near and with forests, one dimension of poverty alleviation is restoring the cultural, spiritual and religious values of forests.

Cultural identity and integrity

Forests are culturally important to the self-identification of indigenous peoples in the role they play in their well-being, and are an important factor in non-material aspects of quality of life of many indigenous peoples (IPBES, 2019). They symbolise cultural cohesion in a rapidly changing environment and, hence, cultural integrity. Intimately linked with ancestry and cultural heritage, forest symbols strengthen social and cultural identity. For example, most sacred forests in southeastern Nigeria and coastal Kenya are important sites for the coronation of paramount rulers, exclusive meetings for spiritual leaders, traditional rites and celebrations (Kibet and Nyamweru, 2008; Umazi *et al.*, 2013; Daniel *et al.*, 2016).

This value is not limited to forests or indigenous populations. For example, studies of immigrants from lower-income countries living in Europe highlight the spiritual and cultural importance of agroforestry as a connection to their culture and traditions (Mazumdar and Mazumdar, 2012). In the western Brazilian Amazon, social movements and a state government have emphasised cultural connections to the forest among descendants of migrants who came to the region to

tap rubber from the native *Hevea brasiliensis* trees (in the late 1800s and during WWII). Rubber tappers lived in the forest and walked forest trails daily to tap trees for rubber. Their livelihoods thus required conservation of the forest, and this brought them into conflict with farmer and cattle ranchers who migrated to the region in the 1970s and 1980s. Thus, as recounted by Gomes *et al.* (2012), "the term 'rubber tapper' acquired a new emphasis that highlighted sustainable resource use and traditional claims to forested lands, set against an unsustainable development model involving land speculation and deforestation." In 1998, the state of Acre elected a new government that emphasised 'florestania' or forest citizenship, thus recognising the centrality of forests to the culture and identity of rubber tappers and claiming those cultural traditions and that identity as a source of pride for the entire state. To support both the ecosystem services and the cultural values associated with rubber tapping, the government offered a subsidy for rubber as a mechanism to simultaneously increase rubber-tapper incomes, incentivise protection of the forests with rubber trees and recognise the cultural value of rubber-tapping (Sills and Saha, 2010; Jaramillo-Giraldo *et al.*, 2017). As Gomes *et al.* (2012) argue, "the cultural content of rubber tapper identity is rooted in historical material conditions" and thus, its continuation depends on the competitiveness of the forest economy (Hoelle, 2015).

Importance of forests as sacred spaces

Traditionally managed by indigenous communities, in many regions forests are considered sacred and are governed by a set of traditional norms and rules (Munyi and Mutta, 2007; Rutte, 2011; Ngoufo *et al.*, 2014). Preserved forest patches are usually close to human settlement, thus, forming an integral part of traditional closely-knit rural communities (Ray *et al.*, 2014). They provide the venue for social, cultural and religious ceremonies and a range of products for traditional ceremonies from food and beverages to costumes and musical instruments.

Most sacred forests in south-eastern Nigeria are used for the coronation of paramount rulers and are deemed sacred to non-initiates, as an exclusive meeting place for the members of the Ekpe occult society (Umazi *et al.*, 2013; Daniel *et al.*, 2016). In Kenya, the Kayas (sacred forests) of the Mijikenda tribal group fulfil many roles: they are burial sites of an ancestral or founding figure, or of revered community elders, are former battlegrounds or the sites at which a community leader first established title to the location. They are also sites of seclusion for initiates, meeting places for secret societies and areas where community rituals and celebrations are held (Kibet and Nyamweru, 2008).

Many religions that originated in Central and South Asia, China and Japan (including Buddhism, Daoism and Hinduism) integrate nature as a critical component of their belief systems (Dudley *et al.*, 2009). Sacred forests provide essential spiritual services to Tibetan Buddhists, who believe in both the Buddha and local deities. For them, sacred forests are naturally forested Holy Hills where village gods that protect a person for their entire life (Liu, 2006) and spirits are believed to reside (Taylor and Kaplan, 2005). Improper actions or disrespect of these forests are punished by misfortunes. Rituals are practised each year to consecrate the sacred forests and honour the gods and spirits that live there. The traditional annual rituals provide an essential mechanism to integrate widely scattered households into a close-knit community (Liu, 2006). Sacred forests also provide similar spiritual services to the Dai people who live in Southwest Yunnan Province of China, Northwest Vietnam, Northern Thailand and upper Laos (Taylor and Kaplan, 2005). To the extent that cultural practices contribute to a shared sense of belief among communities, they are essential complements to economic approaches to livelihoods through the collective community *capabilities*.

Importance of forests in customary and religious rituals

In a study of the uses of fallow tree species in Ho (Ghana), Asamoah (1985) found that half of the identified species were valued in customary rites. Most musical instruments are made from forest products. For example, the seed shells of *Chrysophyllum albidum* and *Mammea africana* are worn by dancers as rattles and the wooden strips of *Ricinodendron heudelottii* are used to make xylophones in Igboland, Nigeria (Okigbo, 1980). The long history of the sites and the related rituals, and the reference to the ancestors give these forests their high value (Darr *et al.*, 2009).

In Nepal and India, all Hindu families have to perform pujas (religious rituals) on certain occasions that require plants and their products. Traditional Hindu books such as *Ramayana, Mahabharata* and *Veds*, all call for preservation of the forest as a part of the cultural heritage. In Hindu theology, some plant species (such as *Ficus religiosa*) are considered as "incarnations or symbols of deities and other supernatural forces" and therefore must be

Wildlife is a main attractive for ecotourism businesses (Giraffe at Massai Mara, Kenya)
Photo © Daniel C. Miller

worshipped (Ingles, 1997). Consequently, harvesting of such sacred species is "thought to be against the god, a belief that is still common". Forests and trees are also often linked to some cultural events. For instance, "plates made from sal leaves are essential for all ritual functions and are regarded as *chokho* (uncontaminated)." Another example of forest or tree contribution to the cultural well-being of Nepalese people is the practice that "a dead body must be carried in a green bamboo casket to the place of cremation where it has to be burned with firewood from the plant *Ficus benjamina*" (Acharya, 2003).

There are also ecological implications of these cultural practices which directly or indirectly contribute to people's well-being. It has been reported that the maintenance of religious forests, especially in hilly regions of Nepal, has had positive impacts on soil conservation and microclimate preservation. There are 40 religious forests in the Kathmandu Valley alone (NBAP, 2001). In Borneo, Meijaard *et al.* (2013) found that forest use and cultural values are highest among people who live close to the remaining forest, and especially among older Christian residents. In their study, perceived values of forests were generally high, with 48% of respondents considering the importance of forests for cultural and spiritual purposes to be very significant and 26% considering them quite significant. A study by Melnykovych and Soloviy (2014) showed that economic, environmental, social, cultural and aesthetic functions of forests contribute considerably to the well-being of forest-dependent communities in the Ukrainian Carpathians.

3.3.7 Gender considerations

Taking gender into consideration in relation to forest landscapes matters because how, why and where men and women access, use and manage forests and trees differ (Mai *et al.*, 2011; Mwangi *et al.*, 2011; Kristjanson *et al.*, 2019). Further, the feminisation of agriculture is a global trend, making gender a particularly important variable for understanding the role of trees on farms. A review of the literature on forests and gender identified persistent gender gaps across regions in access to services, access to markets and value-addition activities, land and tree tenure voice and agency, and hiring labour (Colfer *et al.*, 2016). In addition to these, gender differences in the capacity for addressing climate change have been recognised as an issue that affects not only productivity but widen existing gender gaps in many places (Pérez *et al.*, 2014). And in some areas, men's migration from rural areas has left women to assume the spectrum of agricultural and *forest management* roles, often without the resources or agency to do so successfully (Giri and Darnhofer, 2010; Jaquet *et al.*, 2015).

CIFOR's pan-tropical PEN study found evidence of distinct male and female roles in relation to the collection of forest products that vary across regions (Sunderland *et al.*, 2014). In Africa, they

found that women are the main collectors of subsistence-oriented forest products, while in Latin America, they found that men dominated firewood collection. Men were also more involved in fuelwood collection in Africa than often assumed. In all regions, men were more involved in hunting, wood harvesting and mineral extraction than women. They found that in Latin America, men earn seven times more income than women from unprocessed forest products, while in Asia earnings are similar for men and women, and in Africa the share of income from forests is greater for women. With respect to income from processed forest products (e.g. furniture), the share of overall income is higher for men (61%) than women (25%) across the three regions (Sunderland et al., 2014). Women were also found to collect more forest products than men from common property resources in Latin America and Asia, but not in Africa (Jagger *et al.*, 2014; Sunderland *et al.*, 2014). This is, however, not always the case; for example, relatively few differences between men and women were found regarding the role of NTFPs in household coping strategies in South Africa (Paumgarten and Shackleton, 2011).

Harvesting from forests is often dangerous and exhausting, and collecting wood on-farm reduces the distance women have to travel and affords more time for leisure (Njenga *et al.*, 2017). Women are often responsible for managing livestock, so available shrubs also reduce the time required to gather fodder, allowing women more time for leisure activities and to prepare nutritious food for their families (Kiptot *et al.*, 2014). Women also directly earn money through the sale of milk, and the income they have control over often goes directly towards their children's education and providing nutritious food to their families (Kiptot *et al.*, 2014). Additionally, in some communities, women might benefit from the sale of fruit and fruit products (Kiptot *et al.*, 2014). Many agroforestry studies that consider nutrition outcomes highlight the importance of women and women's empowerment in decision-making as key factors determining household nutrition and dietary diversity along with agroforestry practices.

On the other hand, there is considerable variability in how the incorporation of fertiliser trees affects different population sub-groups, such as smallholder farmers, women and poorer or more marginalised households (Place *et al.*, 2005; Kuntashula and Mungatana, 2013; Coulibaly *et al.*, 2017). In many of these cases, women are often restricted in their ability to participate in agroforestry programmes due to social norms or programme design, and they often experience fewer benefits from the participation in agroforestry programmes compared to their male counterparts (Place *et al.*, 2005; Hegde and Bull, 2011). For high-value tree crop systems, such as rubber and coffee, men often control these tree crops with high commercial value, and women are often excluded from these high-value enterprises (Kiptot and Franzel, 2012).

3.4 Risk Management

Forests and trees help the poor manage risk by reducing exposure, and by providing a means to smooth income and consumption across seasons and years. In this way, they help to prevent transitory poverty and enable investments that are high risk but high return, by effectively offering insurance in the form of forest products (Shackleton and Shackleton, 2004; Paumgarten, 2005). This is especially relevant to the rural poor because they often do not have access to other forms of insurance and they often rely on activities that are subject to covariate shocks, such as variable weather, that affect entire communities (e.g. see Noack *et al.*, 2019 for the role of forests in stabilising incomes during droughts). Climate change is expected to exacerbate this situation in Africa, the region with the highest poverty rates.

Forests can help to reduce the vulnerability of households to climate change. For example, in coastal regions, mangroves buffer human settlements from tropical cyclones and storm surge (Sierra-Correa and Kintz, 2015) and on steep slopes, forests help prevent landslides in response to extreme precipitation events (de Jesús Arce-Mojica *et al.*, 2019). Unlike annual crops, many trees are able to tap into deeper water sources through their roots and produce leaves, fruits and other products during periods of water shortage or high temperatures, which also contributes to households' capacity to cope with weather and climate-related shocks (Shackleton and Shackleton, 2004; Fisher *et al.*, 2010; Place et al., 2016).

Most frameworks for risk management include both ex-ante and ex-post actions, where ex-ante may include diversification through tree-based systems (Krishna, 2011; Kristjanson *et al.*, 2019), and ex-post may include capturing income from sources that are otherwise too labour intensive or too long-term to be competitive, such as harvest of NTFPs. Investing in harvest systems for natural assets that are either slow-growing or that produce low but very consistent yields is also a form of ex-ante adaptation. Because these activities are not the first choice of households, they tend not to be recognised as an important part of local economies. However, preventing shortfalls in con-

sumption is both a worthy end in and of itself and can contribute to long-term poverty alleviation, by helping to maintain human capital.

A large case study literature demonstrates that people use forests as safety nets, increasing their collection of NTFPs to smooth shortfalls in other income sources, especially in response to covariate shocks that limit options for the sale of assets or borrowing from neighbours. This does not appear to be the most common or the preferred strategy employed by rural people in general (Wunder *et al.*, 2014), and there is little evidence available on the relative quality or efficiency of forest-based versus other risk management strategies, such as crop insurance (for an exception, see Mbiba *et al.*, 2019). However, forests can be particularly important for remote rural populations that are poor and have few alternatives. For example, for people without access to financial services, forests and trees may act as stores of wealth in terms of both food and income sources during droughts and other events that would otherwise increase debt loads (Thorlakson and Neufeldt, 2012; Angelsen *et al.*, 2014; Wunder *et al.*, 2014).

Public demand and initiatives to conserve forest are providing new ways for poor households to diversify their incomes directly from forest landscapes, including income from wildlife conservancies and ecotourism (e.g. Andam *et al.*, 2010; Bedelian and Ogutu, 2017). Payments for environmental services, such as carbon sequestration and watershed restoration, are increasingly important income sources for local and indigenous communities in many regions (Pagiola *et al.*, 2005). Conservation policy can also affect sensitivity to climate shocks by determining access and management rights to forests that buffer income shortfalls (Lawlor *et al.*, 2019).

3.5 Forest Negative Externalities

Standing forests and trees also generate negative externalities for forest-proximate populations. That is, in addition to benefits, there are costs originating from the existence of forests, leading to harmful, unpleasant or unwanted consequences for people (Lyytimäki, 2015). The role of forest as habitat for wild animal populations leads to negative outcomes including crop-raiding, livestock predation and transfer of diseases from wildlife to livestock and humans. The effects of invasive tree species also can be considered a negative externality of forests (McGarry *et al.*, 2005; Sun *et al.*, 2006; von Dohren and Haase, 2015).

Over the last 8,000 years, about half of the forests on the planet were cleared by human activities (Foley *et al.*, 2005). This extensive loss of forests has meant an equally dramatic loss of wildlife habitat which increases the potential for human-wildlife conflict. Interaction with wildlife can also pass dangerous pathogens to livestock or human beings, such as bovine tuberculosis and rabies (Megaze *et al.*, 2017; Matseketsa *et al.*, 2019). Both the SARS-CoV, the virus that caused the SARS epidemic in China in 2003, and SARS-CoV-2, the virus that caused the 2020 COVID-19 pandemic, are believed to have originated from wildlife living in the forest (Li *et al.*, 2005; Hu *et al.,* 2017; Zhang *et al.*, 2020).

Forests generally have much higher leaf area per unit ground area than other vegetation types (Gray and Song, 2012) and some evergreen tree species have long growing seasons. In areas with limited precipitation, the water demand by trees reduces water availability for agricultural and domestic use (Sun *et al.*, 2006; Li *et al.*, 2016). Similarly, trees on farms compete with crops for water and light. However, the net effects of trees on farms depends on the balance between this increased competition and improvements in the microclimate and soil fertility (Kuyah *et al.*, 2016).

3.5.1 Crop raiding and livestock depredation

Crop raiding and livestock depredation happen wherever people live close to forests, but especially near protected areas with high wildlife density (Naughton-Treves, 1998; Karanth and Ranganathan, 2018). Crops and livestock in the buffer zones around those protected areas are convenient sources of food for some wildlife. The elephant, which is the largest crop-raiding mammal, not only destroys crops but may also cause human injuries and even death. Human-elephant conflicts happen primarily near protected areas in both Africa and South Asia. For example, Neupane *et al.* (2017) found that elephants are responsible for more than 40% of crop-raiding, causing the loss of 25% of crop production in the Terai region of Nepal. Harich *et al.* (2013) found that 84% of farmers experience crop damage from elephants around the Bia Conservation Area in Ghana.

Primates also cause serious crop damage, and it is difficult to guard against their opportunistic crop-raiding behaviour. Baboons, chimpanzees and numerous monkey species inflict damage on crops (Naughton-Treves, 1998; Tweheyo *et al.*, 2005; Mwakatobe *et al.*, 2014; Mackenzie *et al.*, 2015; Mohammed *et al.*, 2017). For example, Tweheyo *et*

al. (2005) found that 73% of people living around the Budongo Forest Reserve in Uganda reported crop damage by primates, and 79% of the residents consider baboons to be the most destructive.

Countless other species cause crop damage. Flying fox, squirrels, birds, field rats, rabbits, porcupines, bears, wild boars and peccaries, can all cause serious crop damage. For example, wild boars are reported to cause the most damage around Tianma National Nature Reserve in Anhui, China (Zhang *et al.*, 2018) and around Kerinci Seblat National Park in Sumatra, Indonesia (Linkie *et al.*, 2007), Ramnagar Forest Division, Uttarakhand, India (Kumar *et al.*, 2017), and the Kibale National Park, Uganda (Naughton-Treves, 1998). De Carvalho *et al.* (2019) reported that nearly every household interviewed suffered from crop-raiding in a landscape with cropland intermixed with small forest patches in southeastern Brazil. The primary cause of damage was the white-eyed parakeet (*Psittacara leucophthalmus*), which attacks maize and fruit crops.

Livestock predation by wildlife is another major problem for forest-proximate people, leading to losses as high as two-thirds of household cash income (Wang and Macdonald, 2006; Holmern *et al.*, 2007). The species most commonly responsible for predation are large felids (e.g., lions, tigers, pumas, cheetahs, leopards, snow leopards and jaguars), whose predation on livestock is most widely reported (Inskip and Zimmermann, 2009). For example, in the buffer zone of the Chitwan National Park (Nepal), Dhungana *et al.* (2019) found that more than 87% of livestock lost during 2007-2016 were goats taken by leopards. Moreover, people in disadvantaged social groups suffered disproportionately more attacks in the buffer zone of the Chitwan National Park according to data records, notably because they live closer to the forest and do not have suitable protection facilities (Lamichhane *et al.*, 2018). Around the Serengeti National Park in Tanzania, Holmern *et al.* (2007) found 27.4% of livestock owners experienced loss to wild predators with an average of 4.5% or 5.3 heads of stock in a year, 97.7% of which were taken by spotted hyenas, followed by leopard (1.6%), baboons (0.5%) and lions (0.1%). Wang and Macdonald (2006) reported that leopards, tigers, Himalayan black bear and dhole are the primary animals that attack livestock in the Jigme Singye Wangchuck National Park, central Bhutan, causing an average 17% loss in cash income by affected households. At higher elevations, snow leopards are the primary predator of livestock (e.g. Chetri *et al.*, 2019 for the Central Himalayas of Nepal). Demonstrating that this is a long-standing problem Mishra, (1997) reported that in the Indian trans-Himalaya (Kibber Wildlife Sanctuary), snow leopard and wolf are the primary livestock predators, causing a loss of 18% of livestock holdings over a period of 18 months. Although some governments or conservation management agencies provide financial compensation to livestock owners for the loss of livestock to wildlife depredation, the compensation is often far below the actual cost, e.g. only accounting for 3% of the perceived annual loss in the Kibber Wildlife Sanctuary (Mishra, 1997).

While the most prominent and well-publicised cases of human-wildlife conflict are often those around protected areas, conflicts can happen anywhere in forested landscapes. Michalski *et al.* (2006) reported that jaguars and pumas were the main animals attacking cattle in a fragmented forest landscape in the southern Brazilian Amazonia, with damages of up to USD 885 per year per farm. Bista and Song (under review) found local residents suffered significant economic loss from wildlife in the Middle Hills of Nepal where forest conditions had improved significantly from community forestry. On the other hand, around the Nilgiris Biosphere Research and Bhadra Tiger Reserve in the Western Ghats of India, Puyravaud *et al.* (2019) found that deforestation increased the frequency of crop-raiding by elephants.

3.5.2 Negative effects of trees

Forests, and especially high productivity *forest plantations*, are major water users and thus compete with other downstream uses of water (Calder, 2007). This may be especially true of the fast-growing and non-native species planted in industrial plantations, such as ponderosa pine (*Pinus ponderosa*) plantations in the forest-steppe ecotone in western Patagonia (Licata *et al.*, 2008). Sun *et al.* (2006) estimated that extensive forest plantations in China could reduce the water yield by 50 mm/year or 50% in the semi-arid region of the Loess Plateau, and as much as 300 mm/year or 30% in the tropical south. Yu *et al.* (2010) estimated that a 10% increase in forest cover would lead to 25.6 mm/year or 13% of water yield reduction in a watershed in the Qilian Mountains of northwest China. Zhang *et al.* (2018) identified a lack of water as a major factor contributing to cropland abandonment in a rural community in China.

This competition for water must be seen in the context of the overall relationship between water availability and forests and trees, as reviewed by the 2018 Global Forest Expert Panel of the Collaborative Partnership on Forests (Creed and van

Noordwijk, 2018). On the one hand, forests – especially natural forests – contribute to the resilience of water supply through conservation of soil and water resources, providing freshwater during dry seasons and mitigating floods during wet seasons in many parts of the world. On the other hand, forests – especially fast-growing plantations – use water themselves, reducing freshwater availability (Kim *et al.*, 2014). A systems approach that integrates hydrological processes at all scales is needed to understand the role of forests in water availability and the subsequent impact on people's livelihood under a changing climate. If properly managed, forests can help enhance the resilience and quality of water supplies.

Some tree species that are planted can also become invasive, and in turn, compete for water and growing space. This is particularly true of species that have deep roots, high transpiration rate and a long growing season. In South Africa, the invasive species black wattle, *Eucalyptus* and pines can blanket the landscape with non-native forests (McGarry *et al.*, 2005). Le Maitre *et al.* (2019) estimated that forests of these invasive alien species use as much as 970 m^3/ha/year of water, having a significant negative effect on the Western Cape water supply system. Guava (*Psidium guajava*) and its sister species strawberry guava (*Psidium cattlenianum*), native species to tropical America, have become invasive in many parts of the world, including Australia, southern Africa, southeast US, Hawaii, Galapagos Islands and Madagascar, following human introduction. Many are dispersed by seeds and regenerate by root suckering and are extremely difficult to remove and almost impossible to eradicate (Walsh *et al.*, 2008; DeSisto *et al.*, 2020). These tree species drastically change the character of the ecosystems that they invade, including cropland and pastures.

This is related to the phenomena of woody encroachment and expansion (also known as "bush encroachment" or "woody thickening"). This process, whereby trees become more numerous, larger or expand into open ecosystems such as grasslands, has been widely reported in the dry tropics of Africa and to a lesser extent in Australia and Latin America (Liu *et al.*, 2015; Skowno *et al.*, 2017; Stevens *et al.*, 2017). The causes of encroachment and its heterogeneous manifestation remain controversial, but CO_2 fertilisation, climate change and land use management have all been suggested as possibilities (Bond and Midgley, 2012; Abreu *et al.*, 2017; Venter *et al.*, 2018), and some models predict it will increase rapidly over the coming century (Higgins and Scheiter, 2012).

Woody encroachment is often associated with negative impacts on biodiversity (Parr *et al.*, 2012; Ratajczak *et al.*, 2012; Parr et al., 2014) as many species require the open habitat that is lost. There are also large potential impacts on social well-being and rural economic activities. These include the loss or reduction in productivity of grazing land and the extra costs incurred by pastoralists or ranchers for 'debushing' or thicket clearance (Stafford *et al.*, 2017). These impacts can have severe consequences for livelihoods during drought years (Angassa and Oba, 2008). There is also concern that if open savannahs become more woody, then they will be less attractive to tourists interested in viewing large mammals (Gray and Bond, 2013).

3.5.3. Winners and losers

Most people lose in human-wildlife conflicts, but some more than others. Poor people bear the brunt of the impacts and stand to lose the most with respect to their total income. Losses of crops and livestock and human injuries or casualties are the direct costs of human-wildlife conflicts. There are also numerous indirect costs as reviewed by Barua *et al.* (2013). Crop damage contributes to food insecurity among the rural poor. The potential of wildlife-caused human injury or mortality stokes fears in residents, damaging psychosocial well-being. For example, Jadhav and Barua (2012) argue that the fear of an elephant attack exacerbates the mental illness of marginalised people, imposing greater health damage than the physical threat. To mitigate wildlife impacts, farmers engage in extensive guarding, sometimes day and night, and divert limited financial resources to purchase materials for fences and stalls. School-age boys may be deployed to guard crops during peak crop-raiding time, compromising their performance at school (Mackenzie *et al.*, 2015).

There are also some hidden ecosystem service benefits of crop-raiding. In South African macadamia orchards, bats and birds directly reduce yields by 26%, but at the same time, they serve as a biocontrol for insects. Exclusion of bats and birds resulted in losses of up to 60% of yield to insects (Linden *et al.*, 2019). Therefore, the presence of bats and birds provides a net gain in macadamia orchards. Byg *et al.* (2017) argued for a 'disaggregated accounting' of both forest services and disservices, and their distribution across people and places. For example, some of the species involved in human-wildlife conflicts are highly attractive to tourists and may, therefore, generate higher revenues from ecotourism than losses from crop-raiding and livestock predation.

Likewise, the impacts of invasive alien tree species on local people's livelihoods are complicated,

Smallholder logging activities in the state of Amapá, Brazil
Photo © Reem Hajjar

as reviewed by McGarry *et al.* (2005). Depending on the traits of an invasive species and its invasion history, its impacts on people's livelihoods can be extremely disruptive, neutral, or positive. For the same invasive alien species, it may have a large range of influences for different people depending on their culture and adaptability. For example, some invasive alien tree species may take up precious space, disrupting subsistence agriculture. But other people can take advantage of the species by harvesting valuable components, such as fruit, nuts or wood to burn as firewood or convert to charcoal for sale. This further depends on people's ability to manage these species to neutralise their negative impacts (McGarry *et al.*, 2005).

3.6 Negative Impacts of Deforestation and Forest Ecosystem Disturbance

The negative impacts of deforestation lie on the other side of the coin from the ecosystem services provided by standing forests. Such negative impacts include both the direct effects of land-use changes and the effects of other simultaneous changes. The direct effects of deforestation include the physical effects of road construction, reduction in tree cover, and habitat *fragmentation* (Laurance, 1999; Evans, 2016). These may, for example, change the hydroclimate, with potentially more variable rainfall (De Sales *et al.,* 2020). As this report is written in the context of the COVID-19 pandemic that is believed to have originated in wildlife markets (Mackenzie and Smith, 2020), we focus here on the public health implications of deforestation.

A causal chain links land use change and the spread of zoonotic diseases. For example, changes in land-use associated with mining, agriculture and plantations bring about new risk factors that affect the transmission of diseases (Bauch *et al.*, 2015; Whitmee *et al.*, 2015). As habitats are altered, so is the predator-prey relationship leading

to a change in the ecological regulation of parasitic diseases. This change also leads to a reduction in the diversity of organisms, and facilitates the flow of pathogens. In-migration and human population growth accompany deforestation, resulting in greater exposure to disease. In turn, diseases that may not have been viable in small populations may thrive and become endemic. In addition, and in similar ways, deforestation may also increase the likelihood of emergent infectious diseases by increasing contact between forest animals, domestic animals and humans (Patz *et al.*, 2005). For example, encroachment into forest lands is thought to have been a factor in the emergence of several viral diseases including Ebola, Marburg, Nipiah and Ross River Viruses (Chua *et al.*, 2002). Similarly, the loss of forests and the construction of roads leading to an increase in bushmeat hunting and trade are thought to have contributed to the original zoonosis of HIV (Wolfe *et al.,* 2004).

Conversion of forests and the alteration of physical characteristics may create new breeding sites for populations of disease-carrying organisms, alter micro-climatic conditions and eventually lead to the emergence of zoonotic diseases (Dobson *et al.*, 2020; Gibb *et al.*, 2020). Road building, mining pits and logging can all create new breeding grounds for insect vectors such as mosquitoes. For example, in the Peruvian Amazon, the biting rate of the malaria carrying mosquito *Anopheles darlingi* was found to be proportional to the area of land modification and inversely proportional to the area of remaining forest (Vittor *et al.*, 2006). In some instances changes in habitat have had positive effects on the prevalence of infectious diseases. For example, in many parts of sub-Saharan Africa, a reduction in the prevalence of malaria has been traced back to the draining of wetlands (Keiser *et al.*, 2005). Equally, in Thailand, deforestation is thought to have reduced the overall burden of malaria (Yasuoka and Levins, 2007). Overall, negative effects of deforestation in terms of disease prevalence, however, outweigh positive effects (Melrose, 2011). In their study in the Amazon, MacDonald and Mordecai (2019) found that deforestation increases the risk of malaria transmission. Garg (2019) found similar results in Indonesia, concluding that primary forest loss increased the incidence of malaria based on robust counterfactual estimation methods. In contrast, in their study across sub-Saharan Africa, Bauhoff and Busch (2020) found no relationship between deforestation and malaria, suggesting that the socioeconomics of deforestation may be different in that region compared to Latin American and Asian contexts.

3.7 Conclusions

Evidence from around the world shows that the goods and ecosystem services of forests and tree-based systems can play important roles in poverty alleviation, especially by consistently contributing to income or consumption, thereby helping poor households secure their socio-economic and cultural status. In particular contexts, poor households also use forests and trees on farms to exit poverty and to mitigate risks, thereby avoiding transient poverty. On the other hand, those forests and trees may also generate negative externalities that contribute to trapping or moving households into poverty. All four forest-poverty relationships are strongly context-dependent: which relationship manifests in a particular location depends on the natural resource endowment and cultural, religious, economic, political and institutional setting. However, regardless of context, there are relatively few documented cases of forests or trees either being the primary *pathway out of poverty* or generating significant negative externalities, and thus it is not possible to draw any general conclusions about those dynamics.

The contrast between the widespread dependence of the poor on forests and trees for their livelihoods and well-being, but their limited ability to use those same resources to exit poverty, begs an explanation. Possibilities that deserve more consideration include the influence of international investment and trade on the allocation of benefits from forests and the influence of the rules governing access to forests on the global distribution of prosperity. More research on the dynamics between forests and *inequality* across countries is merited.

While forests and trees also do not offer a 'silver bullet' for securing or stabilising well-being, there is more evidence that the poor have been able to harness them to meet these objectives. The role of forests and trees is relatively more important in locations that are remote and thus offer limited access to markets and public services. Further, this role may become more important with climate change, as a way to maintain livelihoods and manage risks in a future that presents ever more challenges for the rural poor.

3.8 References

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4

Chapter 4

Contextual Factors Shaping Forest-Poverty Dynamics

Coordinating Lead Authors: Mónica Gabay and Johan A. Oldekop
Lead Authors: David Humphreys, Judith Kamoto, Doris N. Mutta, Nitin D. Rai, Conghe Song, Joleen Timko, Laura Vang Rasmussen and Jennifer Zavaleta Cheek
Contributing Authors: Dikshya Devkota and Dietmar Stoian

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Abstract
Forests and tree-based systems represent complex social-ecological systems. Gaining a better understanding of how contextual factors influence forest-poverty dynamics is essential for the design, targeting and implementation of policy instruments and interventions to alleviate poverty. In this chapter we explore key social, economic, political and environmental factors affecting forest-poverty dynamics, and use a series of illustrative examples to demonstrate how factors can take multiple roles in causal chains of processes of social and environmental change in forest and tree-based systems. We conclude the chapter by highlighting how future research can provide a better understanding of the processes and contexts shaping forest-poverty dynamics, including elucidating the relative effects of different drivers of change on multiple social and environmental outcomes.

4.1 Introduction

Major advances have been made over the past three decades to identify and characterise the socio-economic, political and biophysical processes and conditions that influence forest-poverty dynamics (Geist and Lambin, 2002; Phelps *et al.*, 2009; Meyfroidt *et al.*, 2018; Miller and Hajjar, 2020). In addition to shaping forest-poverty dynamics directly, these processes and conditions create diverse contexts within which policy operates to affect social, economic, and environmental change. Advances in understanding forest-poverty dynamics have been catalysed by the development of theoretical frameworks that enable us to categorise social, economic and environmental systems and their components, and accompanying empirical work to understand how these factors influence the *livelihoods*[6] of *forest-reliant* households and communities. A better understanding of contexts and how they shape change in *forests and tree-based systems* is essential for the design and implementation of forest-based policies and interventions aiming to address *poverty*.

Formerly forested hills in Indonesia converted into agricultural land
Photo © Reem Hajjar

In this chapter, we bring together elements from research strands focusing on land use change, political science, economics and political ecology to identify social, economic, political, and environmental factors (Figure 4.1) operating in forests and tree-based systems that constrain or enable *poverty alleviation*. We also demonstrate how interrelationships among contextual factors can be conceptualised and analysed to better understand how contexts shape forest-poverty dynamics using a series of illustrative examples.

4.2 Frameworks to Contextualise Forest-Poverty Dynamics

Over the past thirty years, scholars have produced various analytical frameworks to understand connections among the multiple components of social, economic, and environmental systems. Notable examples include the Ecosystem Services and Human Well-being framework developed as part of the Millennium Ecosystem Assessment (MEA, 2005), Elinor Ostrom's Social-Ecological System's framework (Ostrom, 2009) and the conceptual framework for the recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2013). These frameworks highlight linkages between the various dimensions of the natural environment and social, economic, and political systems. Linkages include direct relationships (e.g. *human well-being* benefits derived from provisioning *ecosystem services*), feedback loops linking multiple mechanisms (e.g. relationships among *governance* systems, resource users and *ecosystem* outcomes) and dynamics across temporal and spatial scales. Other frameworks have aimed to describe causal pathways and use overlapping terminologies to disentangle their individual components and mechanisms (e.g. Shaw, 1989; Lüdeke *et al.*, 2004).

6 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

Geist and Lambin's (2002) characterisation of *deforestation* drivers, is perhaps the most commonly used classification of socio-economic, political and biophysical factors influencing *forest* cover change, and distinguishes between underlying and proximate causes. Geist and Lambin (2002) define proximate and underlying causes in terms of their position within a causal pathway, with proximate drivers being directly linked to outcomes (e.g. logging) and underlying drivers preceding them (e.g. road construction, which facilitates logging). These frameworks are useful analytical tools to conceptualise and empirically analyse relationships among disparate components of socio-economic, political, and environmental systems. However, they provide insufficient insight to identify potential levers of change (see Chapter 5), and the factors that constrain/enable the efficacy of such levers.

Frameworks derived from causal inference analyses provide additional insight into the relationship among different factors by classifying them as drivers, mediators and moderators to understand and describe causal pathways within a system (Ferraro and Hanauer, 2014a). In this context, 'mediators' are defined as the mechanisms or intermediate steps through which drivers (and potential levers of change) exert their effect (Figure 4.1). In contrast, 'moderators' act as contextual processes and conditions that influence the magnitude of the effect that a driver can exert (Figure 4.1).

Social, economic, political, and environmental factors are often missing from analyses of forest-poverty dynamics (see Chapter 2), but are important because they provide some of the spatial, temporal and contextual elements shaping both forest-poverty dynamics as well as potential levers of change. Furthermore, social, economic, political, and environmental factors can act as any of drivers, mediators, moderators or outcomes (see Figures 4.2. and 4.3.). These factors may simultaneously operate as drivers, mediators, moderators and outcomes: their respective position within causal chains is specific to the analysis being conducted (see Box 4.1 for examples).

The factors that we present in this chapter were jointly identified through literature reviews by the chapter authors and iteratively discussed over multiple meetings. They are classified as relating to the social, economic, political and policy, and environmental contexts which all influence the forest-poverty relationship. Our aim in this chapter is to present a wide range of key social, economic, political, and environmental factors that have influenced, and are likely to continue to influence, forest-poverty dynamics over short and long time horizons. In so doing, we also demonstrate how some of these factors can simultaneously operate as drivers, mediators and moderators in forests and tree-based systems using a handful of illustrative examples in Box 4.1. Given the changing and contested nature of forest-poverty dynamics, our list of factors is not likely exhaustive. However, the factors presented here are broadly discussed in the literature and are key to understanding potential variation in forests-poverty dynamics in diverse settings around the world.

The categorisation and ordering of these factors into social, economic, political, and environmental contexts is but one way of organising them. We recognise that factors often straddle multiple contexts. Furthermore, social, economic, political, and environmental contexts (and the multiple factors within them) are not independent from each other: they often co-occur in space and time, and interact in multiple complex ways (Figure 4.1). Our empirical understanding of how these contexts and factors work together to shape forest-poverty dynamics still remains limited due to analytical limitations (see Chapter 2 and Section 4.7). By using the illustrative examples in Box 4.1 we aim to provide a better analytical perspective of how social, economic, political, and biophysical contexts and factors can shape forest-poverty dynamics, and influence levers of change.

4.3 Social Context

Large-scale social factors are key determinants of local forest-poverty dynamics. These factors can originate outside forests and tree-based systems and may operate at national or international scales (e.g. migration), exert influence at more localised scales (e.g. population dynamics), and be intrinsic to individuals, communities or societies (e.g. identity and culture). Feedback loops signify that these factors both shape and are shaped by the social context within which they take place; they may shape local forest-poverty dynamics through national-level policies that are often implemented at sub-national levels. More intrinsic characteristics and elements, such as identity, culture, social capital and associated local norms, have profound implications for livelihoods and forest-use.

4.3.1 Population dynamics and consumption

Population growth and density have often been considered key factors influencing deforestation because of increased local pressure to convert land to agricultural production, and because of

Figure **4.1**

Social, economic, political, and environmental contexts and factors influencing forest-poverty dynamics

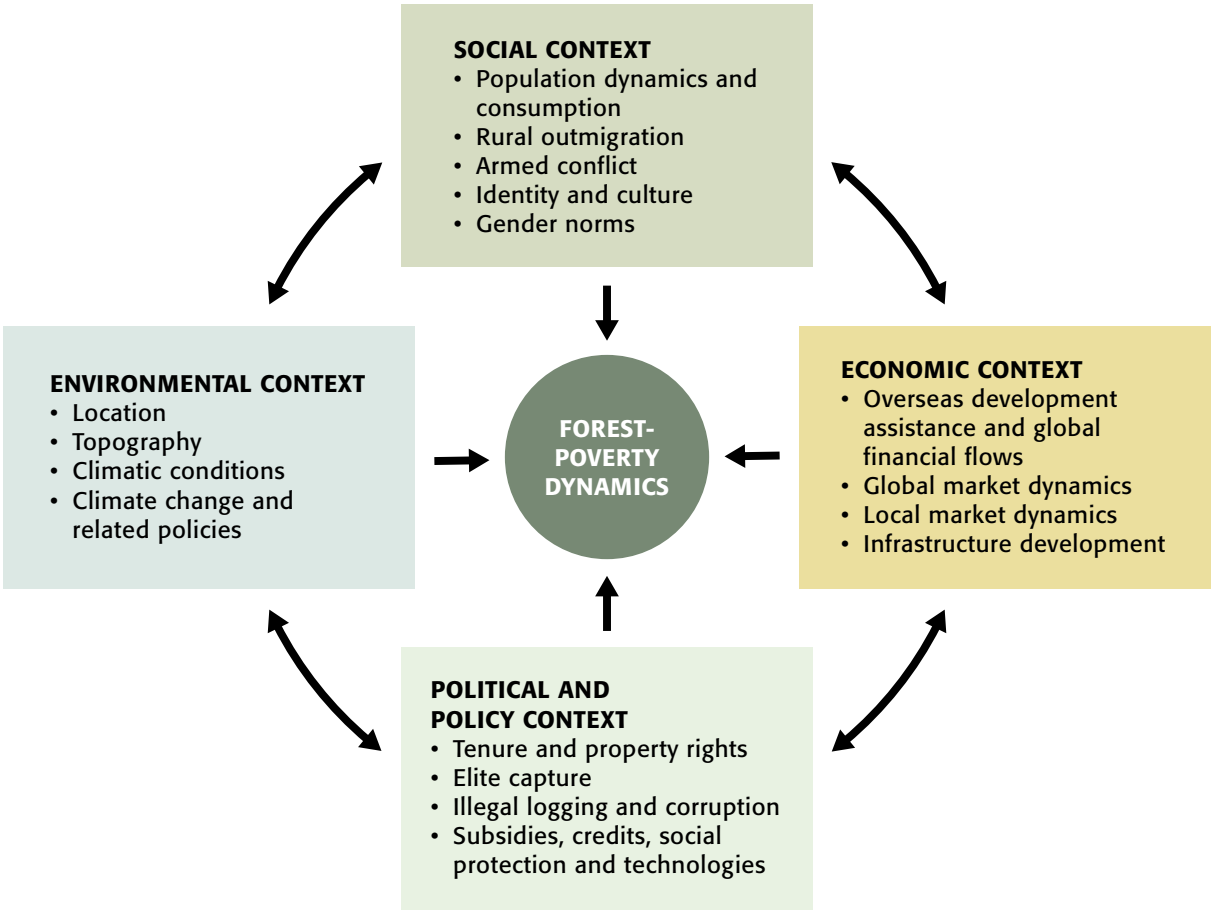
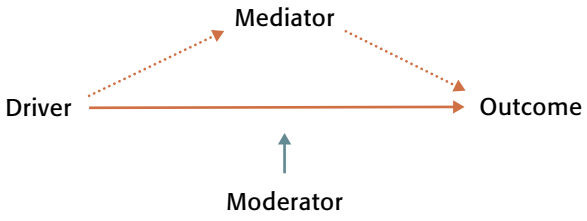


Figure **4.2**

Causal chain linking drivers, mediators, moderators and outcomes



Source: Ferraro and Hanauer, 2014

the increased demand for forest products. Agricultural expansion and associated deforestation patterns between the 1960s and 1980s were often linked to state-sponsored agricultural frontier colonisation programmes and land reforms in Latin America and Southeast Asia (Rudel *et al.*, 2009). This pattern is well exemplified by the demographic dynamics in the Brazilian Amazon that followed the National Integration Plan and the associated Transamazon Highway Colonisation Scheme (Moran, 1990).

The historical link between population growth, population density and deforestation has weakened. Rural populations globally have substantially declined over the past decades (World Bank, 2020). In their synthesis of 152 sub-national case studies Geist and Lambin (2002) found that increases in population due to fertility rates in forest areas was not a primary driver of deforestation (Geist and Lambin, 2002). While smallholder agriculture continues to be a driver of deforestation (Godar *et al.*, 2014), most tropical deforestation and associated *biodiversity* loss in recent decades have been driven by well-resourced farmers, ranchers and loggers as well as international agricultural corporations meeting consumer culture and market demands for timber, soy, beef and palm oil, much of it in high- and middle-income countries (Henders *et al.*, 2015; Green *et al.*, 2019; see Chapter 6).

Population shifts from rural areas to urban population centres, and the rise of the middle classes in lower- and middle-income countries have created new urban demands (African Development Bank, 2019). These demands have been linked to deforestation (DeFries *et al.*, 2010) and have been predominantly met by large industrial agricultural projects (Davis *et al.*, 2020). Critically, large-scale agricultural investments and land transactions, often termed 'land grabs', have been linked to multiple negative outcomes for rural and *forest-dependent* communities, including forced displacement and resettlements, and loss of access to land, resources and livelihoods (Agrawal *et al.*, 2019; Hajjar *et al.*, 2020).

4.3.2 Rural outmigration

Outmigration from rural areas represents one of the most important changes in population dynamics globally in recent decades (Hecht *et al.*, 2015; World Bank, 2020). Rural outmigration has been shown to have multiple and complex effects on forests and forest livelihoods. For example, outmigration in Nepal rose from near zero in 1980 to 29% in 2010 and has been a key driver of *reforestation* and poverty alleviation (Fox, 2018; Oldekop *et al.*, 2018), with remittances accounting for 26% of Nepal's gross domestic product (GDP) in 2019 (World Bank, 2020). We explore how rural outmigration can act as a moderator of *policy instruments*, as well as a driver of change in forests and tree-based systems in Box 4.1.

The effects of outmigration vary significantly at the household level (Sunam, 2017), and long-term development outcomes of outmigration in places of origin remain unclear (de Haas, 2010; Oldekop *et al.*, 2018). The notion that outmigration of male community members increases women's participation in *forest management* decisions is also debated (Giri and Darnhofer, 2010; Lama *et al.*, 2017; Prateek *et al.*, 2019). While remittances may reduce household dependence on agriculture and forests resources and help to diversify income sources (Hunter *et al.*, 2015), outmigration has also been linked to labour shortages and the weakening of community management institutions and the capacity for sound decision-making through a reduction in social capital (Robson and Nayak, 2010; Poudel, 2019). Migration effects also depend on whether migration is seasonal, national or international, with seasonal and national migrants often retaining close links to areas of origin, and international migrants sending larger remittances (Davis *et al.*, 2010). Remittance effects also appear to be context dependent, with evidence suggesting that remittances may be invested to switch to less labour intensive and land extensive agricultural systems, such as cattle ranching in some South American countries (Garcia-Barrios *et al.*, 2009). These investments and changes in production systems can deepen rural inequalities and increase deforestation as wealthier landowners consolidate landholdings, and clear additional tracts of forest as part of their agricultural expansion activities (VanWey *et al.*, 2012; Alix-Garcia *et al.*, 2013; Davis and López-Carr, 2014; Taylor *et al.*, 2016).

The 2020 COVID-19 pandemic has heavily impacted migration flows and remittances, and in many countries has driven the return migration of thousands of people to rural areas. The effects that these new migration dynamics will have on incomes, livelihoods and forests remain to be seen.

4.3.3 Armed conflict

Armed conflict and forest-poverty dynamics are interlinked in many contexts across the globe (Brainard and Chollet, 2007). Geography and poverty are both significant predictors of conflict intensity (Do and Iyer, 2010). For example, 80% of armed conflicts in recent history have occurred in biodiversity hotspots, many of them tropical for-

est regions (Ordway, 2015), leading some to speculate that violent conflicts are endemic to forests (Chomitz *et al.*, 2007). Conflict-related deaths are significantly higher in poorer districts and in geographical locations favoured by insurgent groups, such as mountains and forests, as they enable insurgents to hide easily from government forces (Do and Iyer, 2010).

Poverty is both a cause of insecurity and a consequence of it (Brainard and Chollet, 2007). The lack of economic opportunities is significantly and robustly correlated with a higher intensity of violence (Do and Iyer, 2010). Communities often fall into vicious cycles of conflict, environmental degradation and poverty, leading to what Brookings scholar Susan Rice calls a "doom spiral" that may be nearly impossible to overcome without outside aid (Brainard and Chollet, 2007; Bob and Bronkhorst, 2010).

Although literature explicitly untangling the connections between forests, poverty and conflict is scarce, three key linkages have been identified. First, conflict and warfare can drive deforestation (Ordway, 2015). Insurgent groups in forests frequently destroy forests during violent clashes, cleared for military purposes, and felled for valuable resources such as "conflict timber" to fund and sustain conflict (Harwell, 2011; Kleinschmit *et al.*, 2016). Forests are vital sources of refuge and emergency subsistence for both local and displaced peoples (Harwell, 2011), yet forest-dwellers frequently experience violence, displacement and livelihood insecurity as a result of conflict, leading to increased levels of poverty, malnutrition, illness and death (Buvinic *et al.*, 2013). Massive migrations of internally displaced peoples can also result in a redistribution of pressure on forests in settlement regions (Ordway, 2015). Second, conflict may lead to the active exclusion of activities from certain geographic regions, favouring forest recovery in what has been referred to as war zone refugia or 'gunpoint conservation' (Ordway, 2015). As agricultural fields are abandoned and wood extraction is hindered, forests are able to recover (Kaimowitz, 2006; Sánchez-Cuervo and Aide, 2013). Third, conflicts may lead to the collapse of institutions (Ordway, 2015). Extreme poverty exhausts governing institutions and depletes resources, fuelling a volatile mix of desperation and instability (Brainard and Chollet, 2007). Weakened institutions, plagued by ineffective governance, are unable to meet people's basic needs or to allow them to control their territory, leaving lawless areas and natural resources vulnerable to hijacking by predatory actors (Brainard and Chollet, 2007).

Post-conflict processes see governments prioritising socio-economic recovery, peacekeeping and *poverty reduction* (Pérez and Garzón, 2015) over natural resource management and environmental sustainability. Recognition that natural resources can be an opportunity and a challenge for peace has led international peacekeepers to intervene in post-conflict countries to establish governance reforms that promote sustainable peace and development (Beevers, 2015).

4.3.4 Identity and culture

Identity politics have strong links to forest conservation, rural livelihoods, and poverty. Anthias and Radcliffe (2015) use the term 'ethno-environmental fix', Adam (2010) and Hall *et al.* (2011) use the terms 'ethnoterritorialization' and 'ethnoterritorial claims' to show how identity is used to exclude others from forest titles and lay territorial claim based on ethnicity. Some governments use these ethnicity-based communal titling to retain territorial control while giving local people the illusion of self-government (Tubbeh and Zimmerer, 2019).

The history of forest use, governance, and dependence has been intrinsically linked with the making of a 'forest subject' (Li, 2010). Forest dwelling people have often been cast as non-market subjects who are dependent on the forest for subsistence and, therefore, needing to be protected from the market and micro-economic processes (Li, 2014). States have often used this identity of the non-market, subsistence-based forest dwellers to deny them ownership of land and assets (Li, 2014). Forest residents who are denied these rights may find their labour used in resource extraction efforts, such as timber operations (Münster, 2014). The lack of access to the market and land has 'arborealised' people, making them further dependent on the forests for such products as fruits, resins, tubers and fuelwood and, in some cases, *swidden* agriculture to meet their food needs (Walker, 2004). This has produced an identity of rural people as being 'ecosystem people' or 'living in harmony with the forest' (Gadgil and Guha, 1992). Such an identity has thus been 'fixed' in current forest governance narratives despite mounting evidence of their historical connections with markets and agrarian society. Although most governance regimes tend to simplify the community for ease of interventions, the 'community' is not homogeneous (Agrawal and Gibson, 1999). At the same time, the creation of an indigenous identity for forest dwellers might divide them and prevent them from making stronger claims for a redistributive regime (Shah, 2010).

Forest-dwellers obtain most of their daily resources from their immediate surroundings. Here, an ethnic Chakma woman stands in front of her house, Chittagong, Bangladesh
Photo © Terry Sunderland

4.3.5 Gender norms

Participation in forest usage and decision-making is largely determined by societal rules, norms, and perceptions, including those pertaining to gender. Predicated on gender norms and rules –especially the division of labour and economic endowment – women and men differ in the nature and extent of their reliance on, and use of, forests (Agarwal, 2009). Such norms shape the role of men and women, what they are expected to do or not to do, their preferences in terms of forest products, their knowledge of forests, and ultimately, the ability to use and protect forests.

Since agriculture and forests provide an essential resource to livelihoods in many parts of the world, including sub-Saharan Africa, South Asia, and Southeast Asia, gender patterns of work also play a crucial role in poverty reduction and food security (FAO, 2010; Mudege *et al.*, 2017). *Pathways out of poverty* differ for men and women as they require different types of interventions depending on their reliance on forests and resource usage (Cheng *et al.*, 2019).

Gendered patterns of participatory exclusion in resource access and decision-making persist in many contexts around the world due to the lower bargaining power women have based on pre-existing socio-economic inequalities and relations of power (Agarwal, 2001; Badola and Hussain, 2003; Deda and Rubian, 2004). Often, societal norms define women's role as centred around domestic work and childcare, and societal perceptions discount women's abilities and opinions (Agarwal, 2001). However, opportunities for effective participation are important as a measure of citizenship and a means of empowerment, as well as for *equity*, efficiency, and sustainability of resource usage (Agarwal, 2001). For example, land is a key determinant of production and central to agricultural and economic development in developing countries, but women are less likely to own land compared to their male counterparts (Kiptot *et al.*, 2014). Even where the law might grant equal land ownership and inheritance rights, customary laws often bar women from land ownership. Research in African contexts has also shown that women have less access than men to productive resources and opportunities such as labour, education, extension, financial services, and technology (Kiptot *et al.*, 2014). Likewise, women in Nepal and India are often excluded from decision-making consultations and training related to community forest management, resulting in the exclusion of

The lack of resources creates harsh living conditions in the mountains of Nepal
Photo © Nelson Grima

their existing knowledge in forestry programmes, and women having less chance of acquiring new knowledge (Agarwal, 2001). Such unequal distribution of access and benefits of resources further worsen women's plight, particularly in already poor households.

4.4 Economic Context

Economic factors shaping social and environmental change in forests and tree-based systems reflect multiple political, financial and market-related processes. Typically, economic and political forces originate outside forests and tree-based systems and represent contexts shaped primarily by external actors and institutions, including international markets and international agreements. Important economic factors include overseas development assistance and global financial flows, global and local market dynamics, and investments in infrastructure that facilitate the movement of goods and people.

4.4.1 Overseas development assistance and global financial flows

Global financial flows are key drivers of forest cover and poverty dynamics (Meyfroidt *et al.*, 2013; Folke *et al.*, 2019). Key flows include overseas development assistance (ODA), export credits, and tax avoidance and evasion.

An estimated USD 70 to 160 billion annually is needed to sustainably manage the world's forests (World Bank, 2014). Financial estimates for the effective conservation of biodiversity, much of which resides in forests in *low- and middle-income countries* (LMICs), are of a similar magnitude, ranging between USD 76 to 440 billion per year (McCarthy *et al.*, 2012; Drutschinin and Ockenden, 2015). However, since 2014 only USD 7 billion in international aid has been allocated to forest-related projects. To assess recent trends in forest aid, we collated a dataset on funding to all forest and tree-related projects from the databases of major aid organisations (e.g. GEF, OECD, World Bank) using keywords (such as 'forest', '*agroforestry*', 'deforestation', 'tree'). Furthermore, many ODA disbursements often support actors that favour the extraction of natural resources, which may conflict with forest resource conservation aims.

Export credits to businesses are an important source of loans for LMICs, and are managed by government agencies, private sector bodies or a mixture of the two. Loans are often tied to business contracts with favoured companies in lending countries (Clapp and Dauvergne, 2011). Evidence suggests that such forest developments have often disregarded the traditional lands and forests claimed by indigenous peoples and communities and, in the process, undermined local

livelihoods. For example, Asia Pulp and Paper, the holding company for the interests in pulp and paper of Sinar Mas, a major Indonesian business, has been implicated in various deforestation scandals, despite formal commitments to sustainability (Jacobson, 2018).

Tax avoidance (through the use of legal loopholes) and tax evasion (through the use of illegal loopholes) deprive states of funds that could be applied for a range of social and environmental measures (Global Financial Integrity, 2019). The financial secrecy surrounding tax havens makes it difficult to track the money that flows through them and to hold financiers accountable for the environmental and social consequences of their investments (Galaz *et al.*, 2018). However, although estimates are difficult to come by, money channelled through offshore tax havens has been used to finance deforestation that impoverishes communities (Galaz *et al.*, 2018).

4.4.2 Global market dynamics

Global production and trade of principal wood-based products recorded their highest ever values in 2018 (FAO, 2019). This provides forest-dependent people with increased opportunities for the marketing of forest products. However, many marginal communities require technical assistance for post-harvest processing, and stronger support to facilitate market integration, strengthen bargaining power, and access to technology and credit (Belcher, 2005).

Unlike agricultural markets where the advance of voluntary sustainability standards, such as organic, Fairtrade or Rainforest Alliance/UTZ certification, has allowed smallholder farmers to strengthen their position in global value chains (Potts, 2018), international markets for forest products tend to offer less opportunities for resource-poor people to differentiate their offer of timber or *non-timber forest products* (NTFPs). Timber markets, in particular, provide for little differentiation of logs or sawn wood originating from forest-based communities. Demands for Forest Stewardship Council (FSC) certification are often too costly for forest-based communities, and local communities continue to be at a market disadvantage (Macqueen *et al.*, 2006; Wiersum *et al.*, 2013).

NTFPs and agroforestry products linked to ethical trade schemes in global value chains tend to be more accessible options for gaining added value to commodities and improving revenues (Nelson *et al.*, 2002; Duchelle *et al.* 2014). In some cases, the orientation toward global markets for certified wood products has also allowed community forest enterprises (CFEs) to thrive, with important benefits for resource-poor members. In the Maya Biosphere Reserve in the Petén, Guatemala, for example, CFEs managing forest concessions rich in mahogany and other woods valued in international markets have generated employment and income that have enabled community members to move out of extreme poverty, if not poverty altogether (Stoian *et al.*, 2018).

With limited opportunities for differentiating community-based forest products in the market as such, a viable pathway out of poverty for forest-based communities is adding value to timber and NTFPs through processing and orientation toward emerging markets. Prominent examples for CFEs involved in processing logs into dried sawn wood, plywood, furniture and other value-added products include Mexico (Antinori, 2000) and Brazil (Humphries *et al.*, 2012). Certain NTFPs, in turn, may be directed toward emerging markets for 'superfoods', such as acai, camu camu, sancha inchi, aguaje and other fruits from the Amazon. Adding value to timber and NTFPs requires CFEs to have a sawmill and other diversified processing infrastructure, such as driers, furniture and mouldings factories, or chip mills (Bray and Merino-Pérez, 2002). Such infrastructure is based on investments that often imply donor or government funding, or a combination thereof.

Global markets for forest and tree crop products are entering a new phase of commitments and sustainability standards, such as 'zero net deforestation' (promoted under the UNCCD). In light of the emerging sector of impact investments which often relate to such standards, there are increasing opportunities for CFEs managing forests sustainably to attract this new type of investment to produce more semi-finished and finished products and, based on the value added, to enable their members to move out of poverty.

4.4.3 Local market dynamics

The exact proportion of forest products traded in local markets vis-à-vis those traded in global markets (see Section 4.4.2) is not readily available, nor is the exact value of trade in NTFPs which are critical for many forest-dependent communities for both income generation and household consumption (see Chapter 3). Regional market trends are available for some of the principal forest product markets in the Global North (Europe, Commonwealth of Independent States, North America), with demand for several wood-based products on the rise (UNECE/FAO, 2019), but less so for regional and local markets in the Global

South. The latter provide viable outlets for diverse forest products for individual forest users, collective businesses such as CFEs, and other types of small and medium forest enterprises (SMFEs). Compared with international markets, local markets for timber and NTFPs tend to be less demanding in terms of quality and volume requirements, certification or other sustainability standards. Barriers to enter such markets are generally lower, as are potential rewards in the form of quality or other price premiums. Even in domestic timber markets, formal and informal barriers relating to forest and tree tenure, high transaction costs due to cumbersome regulations, and bribes to speed up bureaucratic procedures, may restrict growth and obstruct opportunities for CFEs (Southgate *et al.*, 2000; Gritten *et al.*, 2015; Pulhin and Ramirez, 2016).

In view of growing populations in most of the Global South, local demand is growing for agricultural products, timber, wood-based products and NTFPs such as traditional medicines, fruits, fibres, dyes, seeds, oils, resins and gums (Kusters *et al.*, 2006). Recent studies of NTFP markets in the Brazilian Amazon, for example, have shown economic potential, along with a need for investments in infrastructure for production, training and organisation of extractive communities, and marketing support (Angelo *et al.*, 2018). Better positioning of CFEs and other SMFEs in national and international markets requires upgrading their technical, business and financial capacities to add value to timber and NTFPs, reduce production and administration costs, engage in new business relationships, and negotiate more favourable terms of trade (Donovan *et al.*, 2006). Timber and NTFP marketing may also be combined with recreational ecosystem services in pursuit of multifunctional livelihoods and enhanced social values of communities engaged in forest product extraction (Carvalho Ribeiro *et al.*, 2018). More generally speaking, there is potential for using a forest-based bioeconomy frame for NTFPs to contribute to human nutrition, renewable materials, cultural and experiential services, job creation and income opportunities in rural areas (Weiss *et al.*, 2020).

4.4.4 Infrastructure development

The development of infrastructure has profound implications for forests and tree-based systems (Laurance *et al.*, 2015). Yet, improved access to commodity and labour markets through the construction of roads, clean water and energy can lead to substantial reductions in poverty (Collier, 2007). These benefits are often driven by lower transportation costs to and from markets, the diversification of livelihoods as rural households complement agricultural incomes with other income sources, and better health outcomes through improvements in sanitation and access to health facilities. However, market integration is often associated with increases in deforestation (Geist and Lambin, 2002) driven both by the expansion of agricultural production of already resident households (Oldekop *et al.*, 2013), as well as through access to forest frontiers that facilitate in-migration for access to new lands, and illicit activities such as illegal timber extraction (Barber *et al.*, 2014). In-migration to forest frontiers has also been linked to land disputes, especially when land tenure and rights are unclear or contested (Messina *et al.*, 2005). We explore how roads can act as both moderators of policy instruments, as well as drivers of change in forests and tree-based systems in Box 4.1.

The development of other types of infrastructure, including the construction of hydroelectric dams and expansion of extractive industries such as mining, is often associated with pollution and rural livelihood losses due to conflicts over land and access to natural resources, although beneficial effects may include electrification and increases in incomes through the creation of low-skilled labour markets. Dams and mining activities are also often associated with increases in deforestation (Bebbington *et al.*, 2019), and the down-grading, down-sizing and de-gazettement of protected areas (Golden Kroner *et al.*, 2019).

The development of mega-infrastructure projects such as the Chinese-led Belt and Road Initiative, the Lamu Port and Lamu – Southern Sudan – Ethiopia Transport Corridor (LAPSSET Kenya) and India's 'Make in India' initiative, which aim to increase national and international connectivity and secure access to energy and natural resources, will be transformational for forest landscapes (Ascenção *et al.*, 2018), and likely generate both positive and negative effects for forests and rural communities.

4.5 Political and Policy Context

The political context frames the ways in which stakeholders will interact within the forest-poverty space. Many of the actions and resources required to maximise the potential of forests to contribute to economic growth and poverty alleviation are linked to the effective design and implementation of institutions. Commonly understood as "humanly devised constraints that shape human interaction or the rules of society" (North, 1990),

institutions determine the structure of formal and informal power arrangements and include social norms, customs, and informal rules that are locally devised and locally enforced, as well as more formalised laws, agreements and policies implemented by governments, non-governmental and international organisations at local, national and international scales. Effective institutions are a necessary condition for well-functioning social and economic relations, and economic development (North, 1990), and are thus an important part in the analysis of natural resource use and poverty (Box 4.2). Numerous factors operate within the political and policy context. Here we highlight tenure and property rights and decentralisation, elite capture, illegal activities and corruption, and a range of government support programmes such as subsidies, credits, social protection mechanisms and agricultural technologies.

4.5.1 Tenure and property rights and decentralisation

Contemporary policy issues in the forest sector related to tenure and property rights include: the devolution of tenure from centralised governments to communities and private entities, and the decentralisation of forest management to local governments and movements to formalise property rights throughout the developing world (Agrawal and Ostrom, 2001; Jagger *et al.*, 2014, Galik and Jagger, 2015; Sikor *et al.*, 2017; Miller *et al.*, 2019). Tenure and property rights thus act as levers of change (Chapter 5) and also provide a policy environment linked to other types of interventions and agendas (e.g. *forest restoration* initiatives) (Erbaugh *et al.*, 2020).

Indigenous peoples and local communities have legally recognised rights to an estimated 15.3% of the world's forests (RRI, 2017), although a much larger share is contested. Theoretical and empirical work has shown that where tenure and property rights are unambiguous, justly enforced and secure, rightsholders are more likely to invest in forest-enhancing behaviours because they are more likely to capture the benefits of their investments (Ostrom, 1990; Somanathan *et al.*, 2009; Mogoi *et al.*, 2012). This improved efficiency, accountability, equity and sustainability in the production and provision of forest goods and services presents opportunities for poverty alleviation (Adam and Eltayeb, 2016). Forest benefits and household income can come from the sustainable use of forest products, such as timber, construction materials and firewood. Forest revenue streams can account for as much as half of a household's income (Hill, 1999). Access and withdrawal rights to productive resources for forest-dependent people, indigenous people and women are therefore considered a crucial factor in poverty alleviation (Schlager and Ostrom, 1992).

Decentralisation is the process by which a central government cedes powers to actors and institutions at lower levels of government (Ribot 2002). Many natural resource management decentralisation reforms involve changes in ownership or changes in property rights structures (Larson and Soto, 2008; Jagger *et al.*, 2014). Although there is evidence that decentralisation and tenure reforms can lead to reductions in deforestation and poverty (Blackman *et al.*, 2017; Oldekop *et al.*, 2019; Miller *et al.*, 2019), the extent to which decentralisation programmes in developing countries should incorporate goals of poverty alleviation continues to be debated (Samii *et al.*, 2015). Tenure reforms continue to face challenges in lower- and middle-income countries, including: states retaining control of high-value forest (Barrow *et al.*, 2016) and decentralising low-value degraded forestland in need of restoration (de Royer *et al.*, 2018); persistent marginalisation of women's rights to resources (Namubiru-Mwaura, 2014; Elias *et al.*, 2017); and differential livelihood impacts on ethnic minorities, and other marginalised groups (McElwee, 2009; Jagger *et al.*, 2014).

4.5.2 Elite capture

Elite capture refers to the process of corruption through which individuals with high-level political status derived from their wealth, education, ethnicity or other social characteristics reap a disproportionately large share of benefits from resources (Bardhan, 2002; Persha and Andersson, 2014). Elite capture is thus a leading driver of *inequality* in access to resources.

In forests and tree-based systems, elite capture manifests itself through systematic forest policy biases that benefit an influential group (elites), and has often been linked to decentralisation, tenure reforms and community-driven initiatives (Platteau, 2004; Dasgupta and Beard, 2007; Lund and Saito-Jensen, 2013; Persha and Andersson, 2014). For example, despite evidence that community forestry can reduce poverty (Rahut *et al.*, 2015; Bijaya *et al.*, 2016; Oldekop *et al.*, 2019), and in some instances also reduce income inequalities (López-Feldman *et al.*, 2007), many studies have also demonstrated that community forestry can make life harder for the poor and marginalised through various forms of unequal benefit distribution. In Kenya, Chomba *et al.* (2015) and Mutune

et al. (2017) found that community forestry has led to increases in inequality by restricting forest access for the poorest community members. Similar inequities have also been observed in numerous other countries with community forestry programmes, including Ghana (Baruah, 2017), India (Mukherjee *et al.*, 2017), Indonesia (Bong *et al.*, 2019), Madagascar (Brimont *et al.*, 2015), Mexico (Garcia-Lopez, 2019) and Nepal (Bijaya *et al.*, 2016). Failure to account for heterogeneities in political power, socio-economic status, knowledge among forest resources users, and vulnerable groups in the decision-making processes allows wealthier elite members to exercise power over poor and disadvantaged households, and capture the majority share of benefits from community forestry (Adhikari *et al.*, 2014; Persha and Andersson, 2014; Sunam and McCarthy, 2016; Essougong *et al.*, 2019). Critically, elite capture can constrain the implementation of forest conservation and development policy instruments that leverage land titling and community institutions (To *et al.*, 2012; Chomba *et al.*, 2015). For example, payment for ecosystem services schemes require secure titles. In Kenya and Vietnam colonial land tenure legacies have disproportionately disadvantaged households with few or no land entitlements (To *et al.*, 2012; Chomba *et al.*, 2015). Similarly, communities with weaker internal governance structures in Ecuador were less likely to perceive benefits from payments for ecosystem services to be equitable (Hayes and Murtinho, 2018).

4.5.3 Forest crime and corruption

Forests can conceal a number of illicit activities, including cultivation of illegal drugs and illegal mineral extraction as well as harbouring insurgent groups. Illegal logging is perhaps the most widespread 'forest crime', and forms part of a broader problem of malpractice and crime associated with the timber trade (Kleinschmit *et al.*, 2016; Tacconi *et al.*, 2016). Illegal logging has significant negative environmental and social consequences. It results in biodiversity depletion, soil erosion and increased carbon dioxide emissions (Putz *et al.*, 2012; Edwards *et al.*, 2014). Economically, it deprives governments of tax revenue and increases the global supply of timber, depressing prices and placing businesses that trade in legally-sourced timber at a comparative disadvantage (Pacheco *et al.*, 2016). Socially, the problem erodes the lifestyles of traditional forest communities and often accompanies criminal activities that lead to poverty in forests, such as violence against communities that resist illegal logging, illicit drug cultivation, armed insurgency and the forced exploitation of labour (Reboredo, 2013; Pacheco *et al.*, 2016).

Globally, forest crimes were estimated to total USD 30-100 billion per year, or 10 to 30% of the global timber trade (Nellemann *et al.*, 2014). Pellegrini (2011) reported that illegal logging made up 70-80% of the total timber volumes extracted from forests in Bolivia, Honduras and Nicaragua. The countries most afflicted are the tropical regions of Latin America (Brazil, Colombia, Peru), Africa (Cameroon, Democratic Republic of the Congo, Republic of Congo), Asia and the Pacific (Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea), and Russia (Humphreys *et al., 2006*; Smirnov *et al.*, 2013; Gan *et al.*, 2016). Corruption and weak governance of the forest sector remain widespread (Sündstrom, 2016). In Indonesia alone, a report from Human Rights Watch (2013) found that forest sector corruption cost the government USD 7 billion per annum between 2007 and 2011, equivalent to the country's entire spending on health care, with half of all timber logged illegally.

Well-equipped and armed illegal loggers are often the most powerful organised force in many remote forest regions, with a greater visibility and presence than the state. Forests also conceal other criminal activities such as drug cultivation, guerrilla armies, illegal mining and enslavement. For example, *habilitación* in Peru is a form of debt servitude. A lender, or *habilitador*, will lend money to an intermediary (the *patrón*) who will lend it to loggers at a high rate of interest. From the loan the logger must buy equipment and tools, hire labour, such as chain saw operators and cooks, and procure fuel and food. The logger must then hand over to the *patrón* an agreed volume and type of timber in order to pay off the debt. Often repayment of the full debt is impossible, especially when the *patrón* deliberately undervalues the timber harvested in order to perpetuate the debt. The logger must often ask for a further loan to repay the original debt, so the vicious cycle of poverty and crime continues (Urrunaga *et al,*. 2012).

4.5.4 Government support programmes for rural areas

Subsidies, credits, and social protection programmes (e.g. conditional cash transfers or public work programmes) can help reduce vulnerabilities of rural households and have important implications for poverty and livelihoods in forests and tree-based systems. While the adoption of new technologies also occurs independently from the implementation of public policies, often

Simple huts made with locally available materials are a common sight on the hills of Vietnam
Photo © Terry Sunderland

subsidies, credits, social protection programmes and agricultural technologies are intertwined. For example, rural credits and cash transfers are common components of social protection programmes (Dyngeland *et al.*, 2020), and are often invested in agricultural technologies. Similarly, public work programmes can specifically target the development of irrigation technologies to improve agricultural production and household *resilience* to environmental shocks.

Understanding these factors is critical, because the adoption of agricultural technologies (e.g. mechanisation, agricultural inputs and irrigation) can help improve agricultural production, increase income through improved yields, and reduce household reliance on forests. Critically, the uptake and use of inputs has, in turn, been catalysed by advances and adoption of mobile phone technologies. In Kenya, the M-PESA mobile phone-based money transfer service (now operating in several other African countries), has significantly eased and lowered financial transaction costs in rural areas (Mbiti and Weil, 2016) and significantly increased the use of agricultural inputs by rural households (Kirui *et al.*, 2013). Information and communication technologies more broadly, are having transformational impacts in forest communities allowing them to map and monitor forest resources (Oldekop *et al.*, under review; see Chapter 6).

Similarly, subsidies (e.g. in the form of agricultural inputs and technologies) and the availability of rural credits can provide financial incentives to support investments in agricultural production by rural households (Druilhe and Barreiro-Hurlé, 2012). However, the ability of subsidies and credits to reduce rural poverty and deforestation – at least in the absence of additional land-use conditionalities – remains disputed (Hemming *et al.*, 2018; Vang Rasmussen *et al.*, 2018). Critically, subsidies and other types of policy incentives can also generate perverse outcomes, if they are not well designed. For example, the Grain-for-Green programme in China was developed to combat soil erosion on sloping lands in the wake of the Yangtze River flood (Liu *et al.*, 2008). Despite evidence of some positive socio-economic impacts and enhanced reforestation efforts (Peng, 2007; Liu *et*

al., 2008), much of the reforestation efforts of the Grain-for-Green programme has been monoculture *plantations*, which have little ecological or biodiversity value (Hua *et al.*, 2016).

Social protection policies have improved education outcomes of forest-dependent communities in Mexico (De Janvry *et al.*, 2006), and nutrition in the Brazilian Amazon (Piperata *et al.*, 2011). In addition to formal state-led social protection programmes, forest producer organisations can provide informal social protection by offering financial support in savings and credits as seen in China, India and Uganda (Tirivayi *et al.*, 2018). However, the effects of social protection programmes on deforestation remain poorly understood (Alpízar and Ferraro, 2020). Mexico's *Oportunidades* programme was found to increase deforestation (Alix-Garcia, 2013). Brazil's *Fome Zero* programme has been shown to have both positive and negative effcts on forest cover (Dyngeland *et al.*, 2020), while recent evidence from Indonesia suggests that social protection has helped to reduce deforestation (Ferraro and Simorangkir, 2020).

4.6 Environmental Context

Environmental factors are predominantly time invariant and, in the case of climate change, effects are often of slow onset and characterised by long time lags. These factors and processes characterise boundaries, constraints, and limits to forest dynamics and livelihood activities, and are thus extremely difficult to change through interventions and policy instruments. For the purposes of this analysis, we highlight both geographical factors and climate change.

4.6.1 Geographical factors: location, topography and climatic conditions

Geographical factors – including location, topography and climatic conditions – have a strong influence on the relationship between forests and people (Sunderlin *et al.*, 2005). This link is perhaps most starkly evident in Geist and Lambin's (2002) seminal study of the drivers of tropical deforestation across 152 cases. They found striking regional differences, with only the development of market economies and the expansion of permanently cropped land for food to have geographically invariant effects on deforestation. All other factors (e.g. institutional, technological, and demographic) were found to have distinct regional patterns in the ways that they influence forest loss and, by extension, livelihoods.

Topography affects forest structure, function, dynamics – including post-disturbance recovery rates – in its regulation of temperature, precipitation and moisture, as well as energy and nutrients along elevation gradients (Hadley, 1994; Muscarella *et al.*, 2020) and thus indirectly influences the forest resources available to local people. For example, in a mountainous community in a subtropical climate zone in China studied by Song *et al.* (2018), ample heat and water resources led to high forest coverage. The vast majority of households studied relied on fuelwood as the primary source of energy despite tremendous economic growth, and a significant number of households cultivating cash crops used fresh logs inside forests as a major source of income (Zhang *et al.*, 2019). In contrast, in a semi-arid community in the Loess Plateau, China, the major source of income is from apples and walnuts (Song *et al.*, 2014).

In addition to influencing forest-poverty dynamics through integration into market economies and access to amenities, geographical location, in particular distance to urban centres and transportation hubs (e.g. seaports), has also been shown to influence political agency. Remote communities are often at a disadvantage, because political relations are often formed and maintained in urban settings (Sunderlin *et al.*, 2005). Despite broad acknowledgement that biophysical factors are key determinants of forest-poverty dynamics, our understanding of factors like location, topography and climatic conditions remains limited due to biases of where studies are conducted (Hajjar *et al.*, 2016; Cheng *et al.* 2019; Miller and Hajjar, 2020) and the variables that are included in analyses (Hajjar *et al.*, 2016).

4.6.2 Climate change and related policies

Contemporary climate change policies and actions place both forests and the communities that depend on them in the global spotlight – both in terms of the impact of climate change on forests and the role of forests in reducing or exacerbating climate change (Parrotta *et al.*, 2012; Griscom *et al.*, 2017; Watson *et al.*, 2018).

First, climate change – manifested through increasing temperatures, variations in rainfall, and more frequent and intense natural disasters – threatens both forest cover and the integrity of forests' biological functions (Trumbore *et al.*, 2015). For example, excessive precipitation (Hubbart *et al.*, 2016) and exceptional droughts (Millar and Stephenson, 2015) increase forests' susceptibility to floods, wildfires and diseases. When climatic stressors affect biological processes, this in turn

threatens ecosystem services provided by forests, like nutrient cycling, soil and water conservation, and preservation of biodiversity (Ellison *et al.*, 2017; IPBES, 2019; Piao *et al.*, 2019). Moreover, climatic stressors might cause defoliation and tree mortality leading to declining forest productivity over large spatial scales (Brienen *et al.*, 2015). Severe droughts have caused widespread *forest degradation* in Amazonia (Xu *et al.*, 2011) and the Congo Basin (Zhou *et al.*, 2014), and drought-induced large-scale tree mortality in the western United States (van Mantgem *et al.*, 2009). Forest fires are also expected to increase with subsequent consequences for forest-dependent livelihoods and human health (Barbero *et al.*, 2015; Alencar *et al.* 2015; Tan-Soo and Pattanayak, 2019). A separation of cause and effect may be observed, with the consequences of climatic change on forests and large-scale forest clearance often experienced thousands of kilometres from where the deforestation occurs (Lawrence and Vandecar, 2015). The cumulative effects of climate change on biodiversity threaten more than one million species (IPBES, 2019). Finally, negative impacts on natural resource dependent livelihood strategies might be an immediate consequence of extreme climatic events, although households may also be able to recover over the longer term (Bauer *et al.*, 2018).

Second, forests are a key mechanism for mitigating climate change through forest restoration, protection and sustainable management because forests (including peatlands) are the most important biome that removes CO_2 from the atmosphere for long-term storage (Dixon *et al.*, 1994; Pan *et al.*, 2011; Bastin *et al.*, 2019). The Bonn Challenge on *forest landscape restoration*, launched in 2011 and extended in 2014 by the New York Declaration on Forests, has a target of restoring 350 million hectares across the globe by 2030 – corresponding to 3% of the global ice-free land area. These forest-based climate change *mitigation and adaptation* efforts (i.e., wide-scale reforestation and restoration initiatives) have the potential to sequester large amounts of carbon and will provide new opportunities and challenges for forest-dependent communities – notably concerning alignment with other sustainability agendas, including poverty-alleviation, land rights and food security (Mansourian *et al.*, 2020).

4.7 Implications for Forest-Poverty Dynamics, Conclusions and Gaps

The factors that we highlight in this chapter represent a wide range of social, economic, political, and environmental contexts that shape forest-poverty dynamics. Although they influence forest-poverty dynamics at very local scales, they represent processes and forces that are often external to local forest communities (e.g. labour markets driving rural outmigration), exert influence over large geographical scales (e.g. climate change) and are subject to political and economic forces operating at subnational, national and international scales (e.g. large-scale infrastructure investments). Critically, many of these contexts and factors co-occur in time and space, and our illustrations in Box 4.1 demonstrate how different factors can simultaneously act as drivers, mediators, and moderators within causal chains. The multi-scalar nature of contexts and their complex interactions have implications for the design, implementation and evaluation of levers of change (Chapter 5). This includes the need for policy instruments that can operate across scales (e.g. international climate agreements that influence the implementation of different interventions at local scales).

However, despite substantial theoretical advances, our empirical understanding of complex social-ecological systems, and how different social, economic, political and environmental factors intersect to shape forest-poverty dynamics remains limited. Equally, there is a dearth of evidence on the effectiveness of policy instruments in the forest sector to reduce poverty. This is due to four key features of scholarly work on social-ecological systems study so far.

First, studies so far have been largely mono-deterministic (Alix-Garcia *et al.*, 2015; Schleicher *et al.*, 2017; Oldekop *et al.*, 2019). Research has predominantly focused on trying to estimate the effects of single drivers or processes of change (e.g. how do remittances affect poverty in rural households? or, what is the role of community forest institutions in reducing poverty?). While these approaches have highlighted some key drivers of change in forests and tree-based systems, they have been unable to shed light on the relative effects of different drivers of change or how they interact to jointly shape socio-environmental outcomes.

Second, studies have so far largely been mono-consequential (Agrawal and Chhatre, 2011). Research has focused on estimating single effects (e.g. how does market integration affect rural incomes?). While these studies have highlighted key relationships between drivers and outcomes, they have been unable to account for multiple effects, including positive and negative feedbacks, or unintended outcomes that might signal synergies, positive joint outcomes or substantial trade-offs (Dyngeland *et al.*, 2020).

Third, studies have largely been unable to account for local socio-economic contexts. This is due to: i) a lack of comparative case studies (either within or between countries) that explicitly focus on elucidating the role of local socio-economic, political, and biophysical contexts in shaping both forest-poverty dynamics and how forest-based interventions and policy instruments are implemented (Angelsen *et al.*, 2014); ii) insufficient integration of socio-economic, political, and cultural variables into quantitative analyses (Hajjar *et al.*, 2016); and iii) insufficient use of analytical tools to assess how local contexts shape the outcomes of forest-based interventions and policy instruments. Finally, most socio-economic and policy contexts are fluid and dynamic. Despite this, most studies of forest-poverty dynamics have been conducted at single points in time (e.g. Persha *et al.*, 2011), thus failing to capture important shifts in the relationship between forests and poverty that play out over long time horizons. While the number of studies assessing changes over two time-points has increased in the past decade (e.g. Andam *et al.*, 2011; Alix-Garcia *et al.*, 2018; Oldekop *et al.*, 2019), there is a critical dearth of studies tracking forest-poverty dynamics over multiple time points (Jung *et al.*, 2019; see also Chapter 2).

These gaps in our knowledge hamper our ability to understand important relationships among the numerous components of social-ecological processes, and how these change over time, and the importance of social and environmental feedback loops. Many studies conclude that forest-poverty dynamics are the outcome of irreducible complexity because they have neglected to examine long-term change. We therefore recommend that future research should focus explicitly on comparisons over time, and not simply comparisons between different forest spaces. Failing to capture the temporal dimension of forest-poverty dynamics in future studies will continue to hamper our ability to identify the levers for positive change that maximise joint and lasting outcomes for forests and people.

Advances in analytical tools, and the increasing availability of social and environmental data from multiple sources (see Chapter 6) provide a potential way of bridging existing knowledge gaps. To better understand the role of socio-economic, political, and biophysical contexts, future research should place greater emphasis on longitudinal approaches, causal chains and comparative analyses. In addition to leveraging novel data sources, gaining a deeper understanding also requires closer alignment between qualitative and quantitative approaches.

Protected areas attract tourism, becoming a source of income for local communities. Photo of a landscape in the Tian Shan Mountains, Kyrgyzstan
Photo © Nelson Grima

Box **4.1**

Empirical examples of drivers, mediators and moderators

We illustrate how factors discussed in the social, economic, policy, and biophysical contexts relate to each other and can take on multiple roles as drivers, mediators, and moderators of social and environmental change in forests and tree-based systems using two examples. Our examples are centred on the effects of two policy levers discussed in Chapter 5, protected areas and community forestry, and how they intersect with multiple factors.

Protected areas

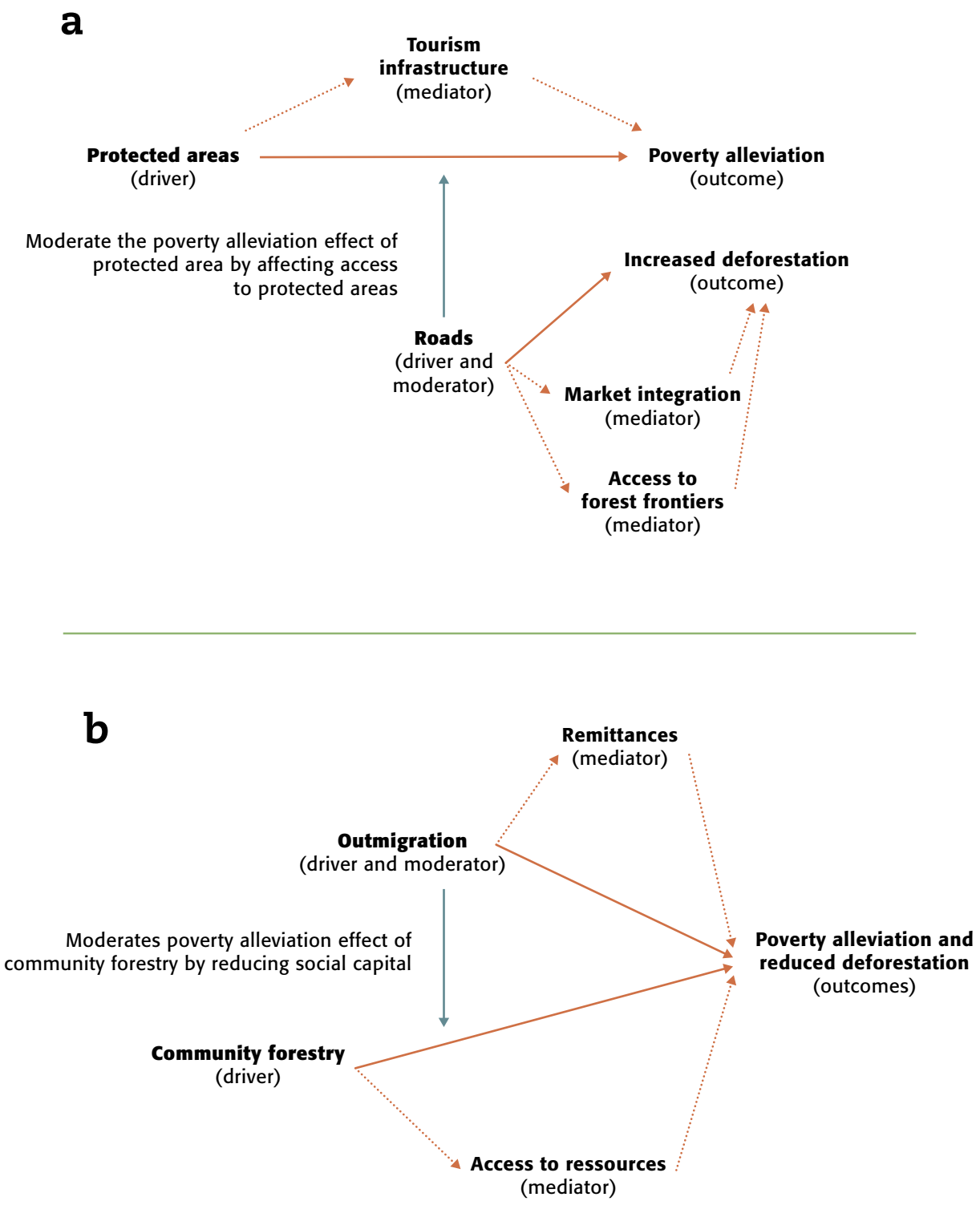
Protected areas are a cornerstone of forest conservation (Watson *et al.*, 2014). Several large-scale data-driven studies that specifically sought to control for numerous socio-economic factors, have demonstrated that protected areas can be key drivers of poverty reduction and improved well-being (Andam *et al.*, 2010; den Braber *et al.*, 2018; Naidoo *et al.*, 2018, Figure 4.2a). One of the mechanisms or mediators through which protected areas reduce poverty is tourism-related infrastructure (Ferraro and Hanauer, 2014; den Braber *et al.*, 2018), which generates opportunities for income generation. The poverty alleviation effect of protected areas is influenced or moderated by roads, which facilitate access to protected areas (Ferraro *et al.*, 2011): the poverty alleviation effect of protected areas that are more remote and more difficult to access is lower than the poverty alleviation effect of protected areas that are more accessible. In addition to being a moderator of protected area effects, roads can also act as a driver of deforestation (Geist and Lambin, 2002; Laurance *et al.*, 2015). This effect is mediated by various factors, including market integration which stimulates agricultural production and expansion (Oldekop *et al.*, 2014), and facilitated access to forest frontiers (Laurance *et al.*, 2015). In this example of protected areas, roads act both as moderators and drivers of social and environmental change.

Community forestry

Both community forestry and rural outmigration have been shown to act as drivers of poverty alleviation and reductions in deforestation (e.g. Oldekop *et al.*, 2018; Oldekop *et al.*, 2019; Figure 4.2b). One of the mechanisms or mediators through which outmigration affects poverty alleviation in rural households and reductions in deforestation is through remittances, which provide direct cash revenue for rural households and reduce dependence on agricultural production and forests. In the case of community forestry, one of the mediators through which poverty alleviation and reductions in deforestation are affected is through greater access to forest resources, such as timber and non-timber forest products (e.g. composting materials) that can be sold or used as inputs for agricultural production, and thus providing an incentive for long-term management. However, both drivers co-occur in time and space, and thus have the potential to interact to jointly shape poverty alleviation and deforestation outcomes. Evidence from Mexico suggests that rural outmigration also acts as mediator of community forestry. Outmigration has weakened community social capital and negatively influenced community forestry management institutions (Robson and Berkes 2011a), with potential negative environmental effects (Robson and Berkes, 2011b). Our understanding of the interactions between outmigration and community forests, or indeed how other drivers of change interact to affect social and environmental outcomes in forest landscapes, and how these interactions are influenced by broader socio-economic and biophysical contexts remains a key research frontier. A better understanding of these relationships has implications for the design of forest-based interventions that are more attuned to local, social, and environmental dynamics.

Figure **4.3**

Relationship between drivers, mediators and moderators of protected areas (a), and community forestry effects (b) on poverty and forest outcomes



Box **4.2**

Forest management institutions: Examples from Africa

Analyses of the forestry sector in diverse countries in Africa show that the sector has changed considerably in recent times. New actors have emerged to fulfil unique roles in forestry. The private sector, local communities and NGOs are increasingly taking up forest management roles (FAO, 2003; Cheboiwo *et al.*, 2018) thus expanding the democratic space for public and private sector interests. While NGOs and the private sector play a role in ensuring that forestry activities improve economic outcomes for forest dependent people, governments' facilitating role has become crucial to ensuring that policies create conditions to promote economic growth, increase incomes and minimise inequalities.

Most African countries have official forest agencies whose mandates mostly relate to protection and management of government forests, law enforcement, and advisory services. In the past few decades, reforms have focused on decentralisation and the devolution of powers, and placed increased emphasis on community participation and benefits. In Mali, Mozambique, and Uganda, national *poverty eradication* strategies have included public investment plans that empower local communities (Greely and Jenkins, 2000), although tangible benefits for many forests and rural communities are yet to materialise (e.g. Banana *et al.*, 2014). In contrast, decentralisation efforts in most other African countries have not been accompanied by such efforts to build human, financial and technical capacities (Lundgren, 2015). Serious staff shortages at field operation levels (Lundgren, 2015) have severely constrained support to communities' forestry activities, and local organisations created to improve incomes feature weakly in national plans and budgets. The relationship with governments remains weak and community activities are considered only informally.

Close collaboration between the state and non-state actors championing the interests of the poor, weak and marginalised remains an important enabling factor for realising poverty reduction in many parts of Africa. Comprising "a sphere of public life beyond the control of the state" (Colas, 2002), NGOs have an economic role to play in providing the collective goods that would otherwise be undersupplied by the private market. Their increasing role in influencing forest resources management and governance through advocacy for, and support of, community participation is prominent. Their capacity building efforts on livelihoods development facilitate the participation of poor communities in economic activities. Many NGOs have supported communities in establishing community forestry associations as locally based platforms to engage in agroforestry as a pathway out of poverty. Ghana, Somalia, and Uganda have reported positive contributions by NGOs towards improved representation of poor and marginalised communities in governance processes (Adjei *et al.*, 2012; Dahie, 2019).

Private sector participation in forestry in Africa has increased substantially over the past few decades with substantial investments in concessions for timber and agricultural production (Brandt *et al.*, 2016). Although large-scale land acquisitions (often termed 'land grabs') have become integral to national development strategies in Africa (and beyond), there is evidence that concessions – including those under sustainable management – are active contributors to deforestation (Brandt *et al.*, 2016). Further, evidence on the livelihood impacts of concessions is mixed. Land acquisitions have been linked to losses in agricultural lands and livelihood displacements that particularly disadvantage women (Hajjar *et al.*, 2020). However, other studies suggest that land acquisitions can contribute to indirect, non-subsistence job creation through increased demand for goods and services (Jung *et al.*, 2019).

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Chapter 5

Levers for Alleviating Poverty in Forests and Tree-Based Systems

Coordinating Lead Authors: Reem Hajjar and Peter Newton
Lead Authors: Markus Ihalainen, Arun Agrawal and Mónica Gabay
Contributing Authors: Jennifer Alix-Garcia, Sarah E. Brown, James T. Erbaugh, Karl Hughes, Samuel Mawutor, Pablo Pacheco, George Schoneveld, Conghe Song and Joleen Timko

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Abstract

An extensive set of policies, programmes, technologies and strategies have been implemented in the forest sector. Collectively, these 'levers' cover a diverse range of approaches, at a variety of scales and are governed by many different stakeholders. It is important for decision-makers to understand which levers might be most useful in achieving poverty alleviation. This chapter seeks to answer the question: which forest management policies, programmes, technologies and strategies have been effective at alleviating poverty? We studied 21 different rights-based, regulatory, market and supply chain, and forest and tree management levers for which we could identify a plausible theory of change of how implementation of that lever might alleviate poverty. For every lever we: define and describe the lever; describe the logic or theory of change by which the lever might plausibly be expected to alleviate poverty; summarise the available evidence showing how the lever has alleviated poverty; and discuss the variables that explain heterogeneity in outcomes. Overall, we found substantial, varied and context-dependent evidence of these levers being associated with mitigating poverty (i.e., by improving well-being). We found limited evidence of these levers being associated with reducing poverty (i.e., moving people out of poverty). Some of the strongest evidence for poverty reduction came from ecotourism, community forest management, agroforestry and, to a lesser extent, payments for ecosystem services (PES). A multitude of cases showing positive outcomes for poverty mitigation came from community forest management, forest producer organisations, small and medium forest enterprises, PES, and tree crop contract production. A combination of more rigorous and long-term research designs, along with examinations of the cost-effectiveness of different levers, would go a long way to contributing to the design of effective interventions for poverty alleviation.

5.1 Introduction

Governments, donors, international organisations, companies and communities have used a diverse array of policies, programmes, technologies and strategies in the *forest*[7] sector to reduce *poverty* (or at least, improve *human well-being*) as the primary or secondary goal. These 'levers' include regulatory and voluntary strategies, are implemented at a variety of scales, and affect and are governed by many different stakeholders. Many levers affect poverty and well-being in conjunction with other aims: to reduce *deforestation*, conserve *biodiversity* or reduce greenhouse gas emissions. The purpose of this chapter is to assess how and to what extent different forest sector policies, programmes, technologies and strategies (hereafter 'levers') have been effective in alleviating poverty. This chapter identifies forest-sector levers that could plausibly alleviate poverty, and evaluates the strength of available evidence for the effect that each lever has had on reducing poverty (moving people above a certain threshold of income or consumption) and mitigating poverty (lessening deprivation or disadvantage such that well-being is improved). That is, we focus on two roles that *forests and tree-based systems* play in *poverty alleviation* as identified in Chapter 2: 1. movement out of poverty and 2. supporting well-being. To a certain extent, we also consider where a lever may have led to an increase in poverty. We identified 21 levers, and reviewed them individually.

To identify the key levers, firstly Coordinating Lead Authors and Lead Authors for the chapter brainstormed the full range of possible levers. All other members of the Global Forest Expert Panel on Forests and Poverty subsequently reviewed the list to suggest any additional levers that were missed during the first step. No new levers emerged. While this provides some confidence in the robustness of the initial list, we cannot be certain that some relevant levers escaped our initial search and scan.

We selected levers for assessment and analysis if they met two criteria. First, the lever had to be clearly related to forests and/or trees within a wider landscape as per the remit of this report: that is, they had to specifically address the management, use, conservation or *restoration* of forests or trees. Levers that were principally related to the agricultural sector or to other landscapes were not considered, even if they in principle could affect the poverty of people living in or around forests. For example, certification programmes that target agricultural products may affect people living in and around forests, but were not included. Second,

7 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

the lever had to have some plausible expectation of alleviating poverty, even when alleviating poverty was not its primary purpose. This was interpreted broadly, and included any lever with an identifiable theory of change supporting the provision of one or more socio-economic benefits from forest products and services.

5.2 Overview of the Levers

The chapter considers four main categories of levers: 1) rights-based levers; 2) other regulatory levers; 3) market and supply chain levers; and 4) forest and tree management levers (Table 5.1), acknowledging that alternative taxonomies of levers relevant to this review have been developed by others (e.g. Newton *et al.*, 2013; Agrawal *et al.*, 2018). We also acknowledge that some levers could fall into multiple categories (e.g. community forest management as an intervention often combines aspects of rights-based and regulatory reforms while engaging in markets and introducing new *forest management* practices). The taxonomic division of levers into different categories would only become pertinent if one were trying to understand whether, for example, regulatory levers were more or less effective than market and supply chain levers as an aggregate category, or if rights-based levers as a whole might be more appropriate than regulatory levers for particular country contexts. We discourage use of this review to try to extract such high-level conclusions. For every lever we: define and describe the lever; describe the logic or theory of change by which the lever might plausibly be expected to alleviate poverty; summarise the available evidence showing how the lever has alleviated poverty (e.g. by increasing income, assets or well-being) and, where available, the magnitude of those changes; and discuss the variables that explain heterogeneity in outcomes. Some of this information is summarised in Table 5.1.

5.2.1 Caveats

There are some important caveats to note. First, drawing lines between different interventions was sometimes partially arbitrary. There is considerable overlap between some of the levers. For example, third-party certification can be considered as a form of supply chain initiative, REDD+ can be conceived as a particular type of *payment for ecosystem services* (PES) programme, community forest management (CFM) can emerge through *tenure* reform, and small forest management enterprises (SMFEs) can include ecotourism. As such, separating literature, and consequently the effects of these levers on poverty, into discrete categories is somewhat interpretative. It seems at least conceivable that two or more of these levers in tandem could have greater impacts on poverty than any one of them alone. We did not explore such multiplicative interactions, except to the degree that any of the literature did so by virtue of the cases or sites that they studied.

Second, many of the reviewed levers were implemented based on multiple objectives and a win-win logic: improving both conservation and well-being outcomes. In this review, we have not taken into consideration poverty outcomes in relation to other potential programmatic or policy objectives. Thus, while the levers presented may not have been the most impactful or cost-effective from a *poverty reduction* perspective, they should not be discounted as they may have had multiple positive outcomes in other realms.

Finally, it bears repeating that we did not conduct a systematic review of all available literature on each of these levers. As such, some relevant evidence may have been missed.

Wood processing plant in the state of Oaxaca, Mexico
Photo © Reem Hajjar

Table **5.1**

Forest-sector levers that may alleviate poverty

LEVER	THEORY OF CHANGE	SUMMARY OF THE EVIDENCE: QUANTITY AND TYPE OF STUDIES	SUMMARY OF THE EVIDENCE: CONCLUSIONS
Rights-based levers			
Tenure reform	Secure access to land and forest resources is often seen as a first step for forest-reliant poor to be able to reliably benefit, monetarily and non-monetarily, from forests.	Mostly case studies and some quasi-experimental studies. Much more evidence for land tenure reform in agricultural settings, but a fair amount also on forest property rights. Very limited assessments of tree tenure reform on poverty.	A systematic review of forest property reforms found generally positive or mixed impacts on income consumption and capital, and that devolution of more limited rights were less likely to alleviate poverty than the devolution of more extensive rights. Effectiveness of tenure reform in impacting poverty is enhanced by the presence of a number of enabling conditions and additional intervention levers discussed in this chapter. Social differentiation in tenure reform impacts is substantial.
Community forest management interventions	In recognising the rights of local user groups to common forest resources, it is expected that the users will benefit directly and indirectly from forest products and services for subsistence and commercial purposes.	There are few reliable national level assessments of the contributions of community forests to poverty alleviation. But there is a wealth of both case literature and reviews of research on community forestry. A predominant focus on South Asian cases, qualitative analyses, and data and analytical gaps prevent generalisable conclusions about observed socio-economic and environmental outcomes of community forest management.	Much case study evidence points to clear material benefits from CFM for the poor, but its potential has not been realised in most countries. Rigorous national-level analyses have shown that CFM has reduced poverty or provided economic benefits to the poor in Indonesia, Madagascar, and Nepal.
Forest concessions	Central governments or forest departments provide companies and communities with forest resource (typically timber) extraction rights in commercially valuable forests in exchange for a stream of revenues. Besides stumpage or taxes paid to governments, concession agreements often include provisions for local public goods such as employment, schooling and healthcare.	National-level statistics on concessions' contributions to national incomes are available, but contributions of concessions to local incomes and poverty alleviation are only visible for specific locations through case studies. Limited studies using national panel data or a large number of case studies.	Households living near a concession had greater wealth in Cameroon and Liberia. In Gabon, NTFPs from forest concessions minimally affected livelihoods. Case studies in general only provide limited evidence of their contributions to poverty reduction even as they generate substantial benefits and profits for large logging companies.
Protected areas (PAs)	PAs can support livelihoods by securing rights of people to forest lands, supplying ecosystem services, generating income from tourism opportunities and improving rural infrastructure.	Several national-level studies, using quasi-experimental quantitative methods. Few multi-national, quantitative studies.	Several studies show that PAs can reduce poverty, particularly where ecotourism opportunities exist (e.g. in Costa Rica and Thailand) and where local people are involved as stakeholders. However, much documentation exists of physical and livelihood displacements of rural poor for the sake of conservation.

Regulatory levers			
Decriminalisation and formalisation of informal workers	Formalisation can: allow the poor to convert their possessions and labour into capital, which can in turn be used to generate added value (e.g. through accessing credit); enhance protection of rights; encourage productive investments; fetch higher prices for products; and minimise risks from forest law enforcement.	A few studies (mostly case studies) in the forest sector in the tropics have focused explicitly on the relationship between formalisation and poverty alleviation.	Mixed results, as formalisation alone does not guarantee success of enterprises. Some formalisation efforts have further marginalised poor small-scale workers; others have improved access to credit and markets, and have supported social projects.
Modifying/simplifying regulatory frameworks, including management plans	Overly burdensome regulations keep the forest-reliant poor from engaging in formal forestry sector. Simplified management plans can make it easier for them to engage and benefit from formal activities.	A few case studies in Latin America and Africa have examined the effects of simplified forest management plans on poverty, but none have attempted to empirically disentangle the effects of simplified management plans on poverty from the effects of other factors (such as tenure reform, market access and other barriers to SMFEs).	Mixed results. One study found that simplified management plans brought financial benefits to some communities, but did not compare the effects of simplified plans relative to non-simplified plans. Many studies continue to point to the difficulties associated with overly bureaucratic and technical processes to participate in the formal sector.
Log export bans (LEBs)	Log export bans are put in place to enhance domestic forest industries and thus domestic employment.	Empirical studies and economic models have examined the effects of LEBs on domestic processing and employment. One study specifically modelled effects on households in poverty.	Empirical and economic models have found no evidence that LEBs target the poor, or increase overall employment in the country. One model indicated that a LEB in Indonesia would result in decreased incomes across agricultural and rural households.
Procurement policies	Sourcing legal timber in international trade has resulted in bilateral trade agreements that have pushed for domestic governance reform – an opportunity for pro-poor policy reforms. Domestic procurement policies can also favour small scale or community-owned forest businesses.	No studies have effectively traced the effects of bilateral or international agreements on poverty reduction. We found one case study of a domestic procurement policy enhancing community forestry.	Authors have pointed to negative effects of international procurement policies affecting small-scale producers. There are cases showing improved small-scale production with domestic procurement policies that purchase from community forests, but specific links to poverty were not examined.

LEVER	THEORY OF CHANGE	SUMMARY OF THE EVIDENCE: QUANTITY AND TYPE OF STUDIES	SUMMARY OF THE EVIDENCE: CONCLUSIONS
Market and supply-chain levers			
Payments for Ecosystem Services (PES) programmes	Payments for ecosystem services are expected to either have no impact on poverty (if they exactly compensate for lost profits from forgone environmental activities) or increase incomes.	A number of large-scale, rigorously designed studies.	Small positive impacts on household incomes or assets. One study found a small but significant decrease in poverty in a PES programme in Mexico. Evidence of positive contributions to food security. Where there is annual income variation, timing payments to the moment when incomes are lowest may generate important impacts on poverty.
Reducing Emissions from Deforestation and forest Degradation (REDD+)	REDD+ initiatives provide monetary compensation in exchange for reductions in terrestrial emissions through fostering conservation, sustainable management of forests and enhancement of forest carbon stocks. REDD+ initiatives may influence poverty via two pathways: 1) through REDD+ payments to governments and local bodies and benefit sharing of such payments, and 2) as a result of changes in forest benefits to local users and governments as they limit use of forests to conform to REDD+ objectives.	No comprehensive and rigorous assessments of the effects of REDD+ on poverty but several localised case studies, comparative analyses and reviews.	Two comprehensive reviews showed small or insignificant REDD+ contributions to income across cases. Case studies are mixed, with many showing small increases in incomes (at least in the short term), and others showing increasing inequalities in communities following REDD+. One quasi-experimental study found negative effects on well-being. Local tenure security was enhanced in many cases.
Ecotourism	Ecotourism can contribute to poverty reduction in four different ways: 1) improvements in employment and wages of those who find employment, 2) visitor fees for forested locations in protected areas, 3) revenues from visitor purchases of local goods and services, and 4) infrastructure development with spillover effects in areas with high numbers of travellers and visitors.	Estimates of its economic contributions to national economies and some local communities are available, but not specific to poorer groups. Evidence tracked through number of visitors and their effects on local and national economies. Thousands of case studies at the local level.	Case studies have focused on measures of development and poverty-related impacts in terms of generation of local jobs and incomes. A number of studies have examined local effects of ecotourism and point to positive outcomes in relation to livelihoods, socio-economic development, and poverty reduction. Many studies suggest that those who are better off will be more likely to benefit, exacerbating local income inequalities.
Small & medium forest enterprises (SMFEs)	SMFEs generate local employment opportunities in rural areas and spread wealth locally.	Many case studies showing their positive contributions to local prosperity but few impact assessments linking SMFEs directly to poverty reduction.	Difficult to isolate evidence of impacts of the presence of SMFEs, as a number of other levers are relevant to creating an appropriate enabling environment for SMFEs to thrive.
Market access	Enhanced market participation can lead to positive impacts on household income and poverty alleviation.	Primarily case studies.	Mixed and context-dependent evidence that this lever reduces poverty, due to the number of additional factors at play in producers' ability to make use of enhanced market access.

Forest producer organisations	Producer organisations can help forest producers overcome a number of challenges they face in deriving economic benefits from forests (including market access, technical services and information, and collective bargaining).	A large number of case studies, both econometric and qualitative.	Several studies show that producers who were members of a larger organisation or cooperative had higher incomes than non-members.
Company-community partnerships	Partnerships provide leverage for local forest communities to enter capital-intensive timber production or better access markets, potentially improving incomes and net returns from land and labour.	Despite many examples of CCPs, only a few case studies have carefully examined the explicit impacts of company-community contracts on poverty alleviation.	Mixed results. Some partnerships resulted in increased incomes and employment and improvement to social infrastructure. Other, poorly negotiated contracts, resulted in greater inequities, dependency and other negative effects.
Contract production	Contracts between producers and processing or marketing companies help poor producers overcome many market and technical barriers, potentially translating into higher incomes and more resilient livelihoods.	Mostly case studies of particular contracting relations. Some quasi-experimental studies on tree crops. Most studies of timber were largely qualitative, published as grey literature, relied on descriptive statistics, and/or failed to consider counterfactuals.	Considerable evidence of positive effects with agricultural tree crops. Less evidence with respect to timber or NTFPs. Some evidence that contract production can exacerbate social differentiation.
Certification	Certified products are expected to either fetch a higher price or help producers to reach dedicated markets. Adoption of practices prescribed by certification standards may improve productivity and reduce production risks.	Mostly case studies. Many studies are grey literature, with unclear methods and analytical rigour. Few studies on certified community forest management conform with standards for impact assessment.	There is no robust evidence that certification has reduced poverty, particularly because of the difficulties that small-scale producers have in acquiring and maintaining certification. Some evidence of improved income and well-being from cacao certification.
Zero deforestation commitments	Zero deforestation commitments frequently include guarantees to improve a company's conduct towards various groups of people, including indigenous and other forest-dependent people who live in and around forests used for commodity production; labourers employed by commodity-producing or processing companies; and smallholders who produce commodities and sell them into larger supply chains. Therefore, if companies that adopt zero deforestation commitments honour their pledges, then poverty may be reduced in one or more ways.	No evidence.	We found no evidence that supply-chain commitments have reduced poverty or improved human well-being.
Boycotts	Coordinated consumer action can hurt the profitability of a company, nudging it to adopt more sustainable production practices for timber, including social standards with potential poverty reduction ramifications (e.g. adoption of FSC standards).	No evidence.	Some suggestion that boycotts led to wider adoption of FSC certification. Impacts on poverty depend on whether FSC certification in turn has led to poverty reduction.

LEVER	THEORY OF CHANGE	SUMMARY OF THE EVIDENCE: QUANTITY AND TYPE OF STUDIES	SUMMARY OF THE EVIDENCE: CONCLUSIONS
Forest and tree management levers			
Agroforestry	Agroforestry and tree planting can deliver additional income directly through sale of tree products or indirectly through increasing crop and livestock productivity, PES, and value-adding certification systems.	Many studies available on contributions to incomes, food security: some impact assessments with high risk of bias; very limited randomised control trials; and several studies using non-randomised regression analysis.	Several studies show that with extension and training, agroforestry adoption can lead to increased yields, household income, food security and dietary diversity, and tree planting can lead to diversifying incomes and improving livelihoods. A few studies have found that agroforestry programmes are associated with significant poverty reduction.
Forest restoration, reforestation and afforestation	Restoration, reforestation or afforestation can reduce poverty through transfer of payments for tree planting activities, PES, improvements in forests goods and services, securing tenure rights and trainings.	Multiple case studies. Few studies with robust counterfactual analysis.	Evidence shows that forest restoration, reforestation or afforestation can result in short-term livelihood benefits from direct involvement in tree planting (e.g. via payments and increased asset ownership). There is little evidence that livelihood benefits from services provided by restored forests meaningfully benefit proximate households to alleviate poverty.

5.3 Rights-based Levers

Rights-based levers tend to be developed and implemented by local, sub-national or national governments, with their implementation often supported by civil society actors. We review different types of tenure reform, community forest management, concessions, and protected areas, and examine the evidence that these levers have demonstrably affected poverty.

5.3.1 Tenure and property rights reform

Tenure can be defined as any arrangement that allocates rights to those who hold land and may also establish conditions for access and use of natural resources (FAO, 2011). Tenure may also be viewed as including a bundle of different property rights (Schlager and Ostrom, 1992; Galik and Jagger, 2015; Sikor *et al.*, 2017) with a combination of rights and responsibilities assigned to individuals or groups, permanently or temporarily, exclusively or not, to land or resources on that land (Bromley and Cernea, 1989; Bromley, 1992; Pacheco *et al.*, 2009; FAO, 2011; Cronkleton *et al.*, 2012). The bundle of rights comprises access, withdrawal, management, alteration, exclusion and alienation rights (Schlager and Ostrom, 1992; Galik and Jagger, 2015). Tenure reforms and forest property rights interventions can include a devolution of one or more of these rights to households, communities or other actors, as well as activities such as individual or collective land titling, tenure administration (such as cadastral or other recordkeeping), dispute resolution and enforcement relating to property rights and their security or redistributive land reforms (Miller *et al.*, 2020). Also of importance to *forest-reliant* people is tree tenure reform, and the devolution of the accompanying bundle of rights related to trees and tree products, which in some countries is considered separately from land tenure (where a person or community has ownership of land but not the naturally occurring trees on that land – Fortman, 1985).

In the context of poverty alleviation, the formal recognition and allocation of these rights to local communities and other *forest-dependent* people is expected to improve their livelihoods and well-being through secured access to resources, enable investments as a result of increased tenure security and, as a consequence, reduce poverty and *inequality* (Deininger, 2003; Meinzen-Dick, 2009; Lawry *et al.*, 2017; Miller *et al.*, 2019). Hence, SDG 1, target 1.4 aims to "ensure that all men and women, in particular the poor and the vulnerable, have equal rights to […] ownership and control over land and other forms of property, inheritance, natural resources […]."

The proportion of forests with secure tenure rights for local communities and other forest dependent people is currently considered a thematic metric of forests' role in ensuring equal rights to economic resources for all (FAO, 2018). Tenure reforms here range from partial devolution of forest management rights to local communities resulting in co-management systems (e.g. Senegal) to strong management and exclusion rights empowering local community forest organisations (e.g. Mexico), to formal titling of Indigenous territories (e.g. Peru). Currently, approximately 15.3% of forests worldwide, and approximately 28% of forests in *low- and middle-income countries* (LMICs), are formally owned or managed by Indigenous peoples and local communities (RRI, 2018). Yet it is estimated that Indigenous peoples and local communities hold as much as 65% of the world's land area under customary systems, only a fraction of which are formally recognised by governments (RRI, 2015).

Much of the literature on securing land rights has focused on environmental degradation, productivity and incomes in agricultural settings. A recent systematic review of this literature on the impacts of interventions to recognise individual/private land tenure on agricultural productivity showed substantial productivity and income gains, although these differed by region (Lawry *et al.*, 2017). In the context of forests, a systematic review of the impact of forest property rights interventions on poverty reported generally positive or mixed impacts on income consumption and capital, although quasi-experimental assessments in the review reported positive and negative impacts in equal proportions (Miller *et al.*, 2019). The review noted that most of the studies focused on the devolution of access and withdrawal rights to communities, and that interventions providing more limited rights are less likely to alleviate poverty than those devolving more extensive rights.

Impacts of reform of tree tenure outside forests are much less studied. In Ghana, where much of the studies on tree tenure focus and where naturally occurring trees remain under the purview of the government regardless of land ownership, several studies call for tree tenure reform to address loss of forests and trees on farms and to enhance related livelihoods (Acheampong and Marfo, 2011; Marfo *et al.*, 2012; Hajjar, 2015). There has been some progress in implementation of tree registration programmes and other rights documentation of planted trees, aiming to provide landowners and farmers with the security that they will be able to

benefit from the tree when it matures (Fisher *et al.*, 2012; Sullivan *et al.*, 2018), but poverty impacts of such programmes have yet to be adequately measured.

Overall, the available evidence shows that tenure reform can play a role in poverty reduction, but that it seems to work best when combined with other *policy instruments* (Carter, 2003; Werner and Kruger, 2007; Meinzen-Dick, 2009; Shyamsundar *et al.*, 2020). Hence, the effectiveness of tenure reform is enhanced by interventions on access to justice and the rule of law, enforcement of property rights, technical support, and access to finance and basic infrastructure, e.g. water, electricity, roads, communications, schools, and healthcare (Werner and Kruger, 2007; Prosterman *et al.*, 2009; Meinzen-Dick, 2009; Akinola and Wissink, 2019; Gabay and Rekola 2019). Indeed, tenure reform, including devolution of forest rights and enhancing tenure security, is often a necessary but not sufficient enabling factor for the successful implementation of several levers discussed in this chapter.

The available evidence of the impacts of land tenure reform on vulnerable groups is variable and less promising. Tenure reforms have increased conflicts and tension between communal and individual rights, commodification of land subjecting it to market forces, and elite capture of benefits, as well as having limited benefits for women and Indigenous peoples (Benjaminsen *et al.*, 2008; Prosterman *et al.*, 2009; Okuro, 2011; Akinola and Wissink, 2019). Smallholders lacking requisite social and financial capital have great difficulty in registering trees to claim tenure over them (Johnson Gaither *et al.*, 2019). Even in studies that reported positive outcomes of tenure, many noted that wealthier households, better educated individuals, or men benefited more from tenure reforms (Miller *et al.*, 2020). In 30 of the most forested LMICs, over 50% have laws protecting women's property rights, but for community tenure regimes, only 29% protect women's membership, 10% protect inheritance rights and 3% their right to vote (Bose, 2011; Monterroso *et al.*, 2019). More work is necessary to protect and enforce women's tenure and access rights as women are still left behind (Prosterman *et al.*, 2009; Bose, 2011; Monterroso *et al.*, 2019; Gabay and Rekola, 2019).

5.3.2 Community forest management interventions

Community forests, or forest commons, are "forests used in common by a large number of heterogeneous users… [who] have a stake in good governance… [that] central governments formally or informally recognize" (Chhatre and Agrawal, 2008). Such forests constitute more than 18% of the global forest area and make important contributions to carbon sequestration, biodiversity conservation and livelihoods (Agrawal *et al.* 2008). Their management historically predates more centralised forms of forest *governance*. But the postcolonial version of community forest management (CFM) has become a key instrument of forest policies since the late 1970s. Community forestry is now one among several strategies of forest management on which governments rely throughout the world for achieving dual objectives of forest conservation and livelihood improvement.

In recognising the rights of local user groups to manage common forest resources, it is expected that users will benefit directly and indirectly from forest products and services for subsistence and commercial purposes. However, the ecological diversity of forest commons, the institutional diversity of their forms of management, the variable national and local market and policy contexts in which they exist, and the wide range of benefits and ecosystem services that multi-functional community forests provide, have meant that there are few reliable national level assessments of the contributions of community forests to poverty alleviation. Such assessments are especially difficult because many of the benefits community forests provide are not sold in markets but harvested directly by users. It is therefore difficult both to quantify them and to price them.

At the same time, the role of community forests in providing subsistence, livelihood and commercial benefits to users has been a core focus of research for more than two decades (Antinori and Bray, 2005; Anderson *et al.*, 2006; Bray *et al.*, 2006; Ali and Behera, 2015). There is thus a wealth of both case literature and reviews of research on community forestry. This literature enables some generalisations, despite patchiness in country and regional coverage, about whether, how and to what extent CFM improves well-being.

Much case study evidence points to clear material benefits from community forest management for the poor (Thoms, 2008; Beauchamp and Ingram, 2011). McDougall *et al.* (2013) show that community forests in Nepal helped improve incomes, financial and forest assets, and employment. Reporting on findings from a multi-country study of forests and poverty, Jagger *et al.* (2014) suggested community forests do contribute in important ways to household incomes but less than do state-owned forests. In reviewing 40 years of community-based forestry, Gilmour (2016) states that there is much potential for CFM to produce benefits, but that the

Box **5.1**

Community forest management in Nepal

Nepal's Community Forestry Management (CFM) programme is considered one of the most successful of its kind in the world (Bijaya *et al.*, 2016). There are 19,361 Community Forest User Groups (CFUGs), which encompass 2.5 million households, managing 30% (~1.8 million ha) of the nation's forests (Government of Nepal, 2020). A CFUG has the management and use rights of the forest, but the community forest land ownership belongs to the state (Acharya, 2002; Thoms, 2008; Dahal, 2017). CFM has been touted as a means to improve both forest condition and local livelihoods, and has led to significant improvements in forest condition in Nepal (Gautam *et al.*, 2004; Nagendra *et al.*, 2008; Sunam and McCarthy, 2010; Shrestha and McManus, 2013; Bijaya *et al.*, 2016), with forest cover in Nepal increasing from 35% in 1985 to 44% in 2015 (Forest Research and Training Centre, 2019).

Community forest management has also alleviated poverty in Nepal (Oldekop *et al.*, 2019). Villages with CFM reduced the number of households living in poverty more than villages without CFM, between 2000 and 2012 (Oldekop *et al.*, 2019). Yet, benefits of CFM are unequally distributed among CFUG households. A majority of studies on CFM in Nepal have found that benefits to poor and low caste households are often much less than those to the well-off households in absolute terms (Adhikari *et al.*, 2004; Iversen *et al.*, 2006; Yadav *et al.*, 2015; Bijaya *et al.*, 2016). Poor and marginalised households are often more reliant on forests for livelihoods (Adhikari *et al.*, 2004; Chhetri *et al.*, 2016). Yet they often bear more costs both directly (e.g. contribution of time and labour for patrols) and indirectly (e.g. fewer livestock due to grazing controls) (Sunam and McCarthy, 2010; Parajuli *et al.*, 2015). CFM institutional arrangements often fail to effectively account for heterogeneity in power, socio-economic status and knowledge among forest resource users within CFUGs, allowing rich and elite members to exercise their power over poor and disadvantaged households (Sunam and McCarthy, 2010; Adhikari *et al.*, 2014). In sum, despite the success of CFM in Nepal in improving poverty outcomes, there is still much room for improvement, particularly with respect to equitable distribution of benefits and democratic engagement in decision making with poor and marginalised households.

potential has not yet been realised in most countries. In their recent authoritative review of available evidence on community forests examining 697 published cases of CFM, Hajjar *et al.* (2016) found that 68% of cases that reported on livelihood outcomes indicated that community or household incomes increased after CFM implementation.

Several reviews of community forest management have found the strength of evidence of the potential of CFM to generate welfare improvements as lacking. As Bowler *et al.* (2012) asserted, "poor study design, variable reporting of study methodology or context, and lack of common indicators make evidence synthesis difficult." In the systematic review of CFM referenced above, Hajjar *et al.* (2016) also showed that the available literature is characterised by a predominant focus on South Asian cases, qualitative analyses, and data and analytical gaps preventing generalisable conclusions about observed socio-economic and environmental outcomes of CFM.

Despite this, several recent studies have shown that community forests indeed provide material benefits to users (Chhatre and Agrawal, 2009; Persha *et al.*, 2011). In a rigorous analysis of 18,000 community forests in Nepal, Oldekop *et al.* (2019) show that CFM reduced both poverty and deforestation (Box 5.1). In a similar national-level analysis, Rasolofoson *et al.* (2017) found that CFM in Madagascar had a small but positive impact on household living standards, particularly for those closer to forests and with more education. Similarly, Santika *et al.* (2019) show that Indonesian village forests contributed to win-win outcomes and substantial economic benefits to the poor, but that the flow of poverty reduction benefits was linked to higher order variables related to land use classifications and zoning regulations. Studies such as these are beginning to create the knowledge and evidence base necessary to assess quantitatively the contributions of community forest management to poverty reduction at the national rather than the local scale.

Interviewing rural people to understand policy effects on their livelihoods and the environment
Photo © Conghe Song

5.3.3 Forest concessions

Under concessionary forest governance, central governments or their forest departments provide companies and communities with forest resource (typically timber) extraction rights in commercially valuable, government-owned forests in exchange for a stream of revenues (Agrawal *et al.*, 2008; Bulkan, 2014). The private concession model in forest governance has been in existence at least since the imperial trading period of the early 1700s and was implemented widely during colonial rule in countries such as Burma (now Myanmar), India, Indonesia and different parts of sub-Saharan Africa (Hardin, 2002; Hardin and Bahuchet, 2011). The largest concession areas occur in the cool temperate and boreal forests of Canada and Russia (FAO, 2018). But concessions also affected 20% of tropical forests in the 2000s, and most tropical timber is harvested through concessionary arrangements that vary in details across countries (Asner *et al.*, 2009). Concessions enabled the extraction of 270 million cubic metres of tropical timber (ITTO, 2015) valued at more than USD 7 billion in 2015 (Pearson *et al.*, 2018), with the FAO estimating the export value of timber from tropical countries to be in excess of USD 10 billion annually (Kishor and Damania, 2007).

A variety of logging concession arrangements exist including community concessions in Central America (Gretzinger, 1998; Taylor, 2010). Private and corporate forest concessions are the dominant form of forest governance in tropical forests in Southeast Asia, parts of the Amazon, and especially in Central and West Africa (World Bank, 2002a), covering at least 75 million hectares of forests (Agrawal *et al.*, 2008; Banerjee *et al.*, 2009; Grut, 2010; Sodikoff, 2012). Commercial logging companies supply the capital and the technical expertise needed to undertake the different forms of planning and selective logging for forestry operations in remote, capital-poor contexts where harvestable timber exists. Governments provide the legitimacy and legal foundations for resource extraction that the companies need to undertake logging operations.

The most basic concession agreements specify the area of concession, the volume of timber extraction, and amounts and cadence of royalty payments to governments by concession holders, usually companies. Over time, concession agreements have evolved in many countries to include provisions for local public goods in the form of employment, schooling and basic healthcare for communities near logging concessions (van Hensbergen, 2016).

The concession form is vulnerable to corruption at all stages of its development and implementation (Kishor and Damania, 2007). Poor enforcement and price variations mean that tropical

country governments lose vast sums in revenues and as value addition to their national income. The World Bank estimates that poor countries lose upwards of USD 5 billion because of illegal logging (World Bank, 2002b). Illegal revenues also fuel armed conflicts and military challenges to incumbent governments, leading to political instability and violence against community members living near concessions (Le Billon, 2001; Davis, 2005; Kishor and Damania, 2007). Sustainability certification (Section 5.5.9) and improved enforcement are among the instruments national and international decision-makers have used to try to improve forest concession outcomes, including: lower levels of logging, sustainable forest management, improved local incomes and increased revenue streams to national governments (Ebeling and Yasué, 2009). National and international forest sector reform efforts (Section 5.4) seek to improve governance, reduce corruption and control illegal logging, but these efforts have achieved only sporadic and patchy success.

Concessions generate substantial income through timber harvesting and trade, particularly for logging companies (Ross, 2001; Medjibe and Putz, 2012; Straumann, 2014). Aggregate estimates of the value generated through concessions are available for the formal sector. But the contributions of concessions to local incomes and poverty alleviation are only documented for specific locations through case studies. Part of the reason is that economic contributions of forest concessions can be direct – through employment, income and service provision, but also indirect – through improved road connectivity, sales of goods and services to concession employees, and agricultural production.

Assessments of contributions of forest concessions to local incomes and poverty alleviation vary by space and in time. In a recent study, Jung *et al.* (2019) used nationally representative panel data to estimate that the wealth score (based on asset holding) of those living close to forest concessions in Liberia improved by 10% or more compared to the assets of those farther away from concessions, likely as a result of indirect effects on agricultural output. Lescuyer *et al.* (2012) found a similar effect of forest concessions in two communities in eastern Cameroon. In another study focusing on Gabon and concerning 17 communities around two forest concessions, Iponga *et al.* (2018) found minimal contributions to livelihoods from the non-timber forest product gathering activities of local residents. In general, it is difficult to escape the conclusion that writings on forest concessions provide only limited evidence of their contributions to poverty reduction even as concessions generate substantial benefits and profits for large logging companies (Scudder *et al.*, 2019).

5.3.4 Protected areas

Protected areas (PAs) are, in theory, clearly defined geographical spaces, recognised, dedicated and managed to achieve the long-term conservation of nature with associated ecosystem services and cultural values (IUCN, 2008). They are a popular policy instrument in the global fight against loss of biodiversity and ecosystem services (Hanauer and Canavire-Bacarreza, 2015).

Protected areas are a global phenomenon covering just under 15% of the world's terrestrial surface and inland waters (UNEP-WCMC and IUCN, 2016), with countries committing to increasing this to 17% by 2020 (Schleicher *et al.*, 2019). The first formally-recognised national park (Yellowstone National Park in the U.S.) was established in 1872. Yet, community-protected areas have existed since ancient times and globally their land surface equals that of official reserves (Muench and Martínez-Ramos, 2016).

The International Union for Conservation of Nature (IUCN) classifies PAs according to their management objectives, ranging from strictly protected nature reserves and national parks, to community conserved areas and those areas allowing sustainable use of natural resources (Dudley, 2008). Depending on this classification, PAs can support poverty reduction by securing the rights of people to land and valuable natural resources, supplying ecosystem services, generating economic benefits including through ecotourism (see Section 5.5.3) and improving infrastructure in remote areas (Andam *et al.*, 2010; Brockington and Wilkie, 2015). However, there is also a large evidence base showing that people have been displaced or denied access to resources by the establishment of parks and reserves, threatening peoples' rights and livelihoods (Brockington and Wilkie, 2015). Indeed, the establishment and management of many national parks are often reflective of forest conservation, a top-down protectionist approach to park management (Bruner *et al.*, 2001). These are envisaged as places where rural livelihoods do not belong (Brockington *et al.*, 2006), human habitation is often excluded through the forced removal of local and Indigenous people (Magome and Murombedzi, 2003) and nature is seen to be preserved as 'wilderness' (Colchester, 2004). Human-induced pressures on PAs and the conflict between biodiversity conservation and the needs of local people are predicted to increase

due to numerous factors, including disputes over traditional territorial claims, land-grabbing by the landless or industrial-scale commodity producers, forced evictions, market forces, and a reduction in distance between PAs and human population centres (Brockington and Wilkie, 2015; Oldekop *et al.*, 2016).

Several studies provide strong evidence that PAs can reduce poverty. Using poverty measures based on national census data in Costa Rica and a poverty index in Thailand, one study found that the net impact of *ecosystem* protection was to alleviate poverty in both nations (Andam *et al.* 2010). However, not all segments, sub-districts or poor households experienced poverty alleviation from PAs (Andam *et al.*, 2010). Applying a quasi-experimental research design to data collected by Andam *et al.* (2008; 2010) in Costa Rica and Thailand, another study assessed the heterogeneity of PA impacts on poverty reduction, finding that PAs in areas associated with high poverty did, on average, reduce poverty while also reducing deforestation (Ferraro *et al.*, 2011). However, a quasi-experimental, panel study of three PAs in Cambodia found limited impact on poverty of households within the PAs as compared to their matched controls (Clements and Milner-Gulland, 2015). Another study using matching methods found an overall negative PA impact on household wealth in China (Duan and Wen, 2017).

Several studies provide evidence of trade-offs across the landscape and support for the simple theory that the opportunity cost of land has significant moderating effects on the impacts of PAs (Hanauer and Canavire-Bacarreza, 2015). Using quasi-experimental methods, Hanauer and Canvire-Bacarreza (2015) found that the biophysical characteristics associated with the most avoided deforestation were the characteristics associated with the least poverty alleviation in Bolivian cases; that is, the same characteristics that may have improved the social welfare impacts of study PAs may also limit their conservation effectiveness (e.g. PAs on lands that are highly suitable for agriculture, far from major cities and infrastructure, or where a high percentage of adults are employed in agriculture) (Ferraro *et al.*, 2011). Win–win outcomes were most commonly associated with locations at intermediate distances from major cities (40-80 km) and on land of moderate to poor agricultural potential (Ferraro *et al.*, 2011). Similarly, Sims (2010) found that the largest positive socio-economic impacts from tourism in PAs in Thailand occurred at intermediate distances from major cities. Another study using data from 190,000 households across 34 countries found that households near PAs with tourism had higher wealth levels and a lower likelihood of poverty (by 16%) than similar households living far from PAs (Naidoo *et al.*, 2019). In explaining heterogenous impacts of PAs, a meta-analysis found that PAs that integrated local people as stakeholders and sought to empower them tended to be more effective at achieving both positive conservation and socio-economic outcomes (Oldekop *et al.*, 2016).

While the science of PA mechanisms is still at a fledgling stage (Ferraro and Pressey, 2015; Hanauer and Canavire-Bacarreza, 2015), there is a growing empirical evidence base documenting whether, and by how much, PAs affect the environment and human welfare (Ferraro and Hanauer, 2014; Borner *et al.*, 2020). Though it faces a diversity of challenges, the global network of PAs will likely remain a key option for maintaining and enhancing biodiversity conservation, hence the potential of protected areas for exacerbating or alleviating poverty will need to be monitored. Given recent proposals to protect half of the earth (Dinerstein *et al.*, 2017; 2019) determining impacts is critical (Schleicher *et al.*, 2019), and the use of impact evaluation techniques using rigorous, quantitative methods to infer causality from non-experimental data is becoming the norm in this domain (Ferraro and Pressey, 2015).

5.4 Regulatory Levers

Although rights-based interventions (considered above) are a form of regulatory lever, in this section, we review other levers that are principally oriented around laws, policies, and regulations that determine how forests and trees are managed, used, conserved and/or restored. Regulatory levers tend to be developed and implemented by local, sub-national or national governments. We review decriminalisation and formalisation of informal operations, modification or simplification of regulatory frameworks, log export bans and procurement policies, and examine the evidence that these levers have demonstrably affected poverty.

5.4.1 Decriminalisation and formalisation of informal operations

The informal forestry sector (unincorporated enterprises that may also be unregistered and/or small – Lewis, 2016) is estimated to employ 45-50 million people worldwide, compared to 13 million employed in the formal forestry sector (FAO, 2014). Informality does not necessarily equate to dealing in illegal goods or purposefully evading regulations. Indeed, the vast majority of informal

workers are working poor, for whom existing regulations are simply irrelevant or inappropriate (Kaimowitz, 2003; Lewis, 2016). Informality in the forest sector then encompasses various 'shades' of illegality, ranging from unlicensed collection of forest products or charcoal production to harvesting and trading protected species. Importantly, the degree of illegality can vary significantly depending on national legislation (Weng, 2015). Formalisation in the context of the forest sector has been defined in a number of different ways, often focusing on the formal process of identifying, codifying and registering the rights to access, own or trade land and forest resources (e.g. Meinzen-Dick and Mwangi, 2009; Putzel *et al.*, 2015; Kelly and Peluso, 2015), or on enhancing the degree to which supply networks are controlled by official and explicit rules and institutions (Choi and Hong, 2002; Schure *et al.*, 2013) and the extent to which producers engage with them (Erbaugh *et al.*, 2016).

Formalisation can be a way of allowing the poor to convert their possessions and labour into capital, which in turn can be used to generate added value (e.g. through accessing credit) (de Soto, 2000). In addition, formalisation can benefit producers through enhancing the protection of rights (Chen, 2007), encouraging productive investments (Hirons *et al.*, 2018), reducing incentives for corruption (Zulu and Richardson, 2012), allowing producers to fetch higher prices for products on formal markets, and keeping producers out of law enforcement trouble and having equipment confiscated (Hajjar *et al.*, 2011). Yet, formalisation in the forest sector is rarely implemented with poverty alleviation as the sole or primary objective (Lele *et al.*, 2010; McDermott, 2014; Putzel *et al.*, 2015). Recent years have witnessed a particular interest in curbing informality – often wrongly equated with illegality – as a way to also enhance legality and sustainability.

Few studies in the forest sector in the tropics have focused explicitly on the relationship between formalisation and poverty alleviation. To date, fully formalised, small-scale forest product value chains are not yet mainstream in national or regional economies (Lewis, 2016; Doggart and Meshack, 2017). This is because poor, small-scale value chain actors struggle to comply with costly and complex formal regulations (Kaimowitz, 2012; Obidzinski *et al.*, 2014; see Section 5.4.2) that are often poorly adapted to their needs (Hansen and Treue, 2008). In many instances, various types of formalisation efforts in the forest sector have excluded and marginalised poor small-scale workers (Anderson and Pacheco, 2006), criminalised legitimate but informal livelihoods (Hansen and Treue, 2008; Purnomo *et al.*, 2009; Cerutti *et al.*, 2013; Hirons *et al.*, 2018), reduced incomes (Chen, 2007; Wynberg *et al.*, 2015), limited access rights to key commodities (Anderson *et al.* 2018), as well as increased elite capture and exploitation by more powerful actors (Lele *et al.*, 2010; Ndoye and Awono, 2010; Schure *et al.*, 2013; Weng and Putzel, 2017).

In contrast, Cerutti *et al.* (2019) found that some small and medium-sized forest enterprises registered within the national forestry licensing scheme (SVLK) in Indonesia reportedly found easier access to formal financial credit than they used to find when they operated in the informal sector, with improved access to the international market (Cerutti *et al.*, 2019). Schure *et al.* (2013) suggested that taxes generated through formalised and decentralised woodfuel chain governance in Central and West Africa had been reinvested in local social projects, while Hautdider and Gautier (2005) found that woodcutters in Mali benefitted from formalisation through harvesting quotas, formally allocated selling points, and improved oversight. However, implementation of forest commodity regulations is often weak and may incentivise corruption as well as free-riding (Schure *et al.*, 2013). In Mozambique, Jones *et al.* (2016) found that the lax enforcement of formal regulations in the charcoal sector was in fact critical to enabling the participation of small-scale producers – and especially women – participating on a casual basis.

When costs are perceived to outweigh benefits, Obidzinski *et al.* (2014) found evidence of Indonesian producers opting not to renew SVLK certificates. Recognising the potential social pitfalls of formalisation, recent discourses tend to emphasise various safeguards and complementary measures aimed at more inclusive and socially sustainable formalisation. Such measures may include decentralising land and resource governance (Putzel *et al.*, 2015), promoting cooperatives/producer organisations (Tilahun *et al.*, 2016) or simplifying regulations (Lewis, 2016). These levers and their impacts on poverty are assessed elsewhere in this chapter (see especially Sections 5.3.1., 5.4.2. and 5.5.6).

5.4.2 Modifying or simplifying regulatory frameworks

Among the oft cited barriers preventing communities and smallholders from engaging in the formal forestry sector are overly bureaucratic and technical processes in completing forest management plans, obtaining permits and other legal documents, and complying with burdensome regulations that were largely designed for a forest sector dominated by large companies (Medina

et al., 2008). As such, one proposed solution has been to require simplified management plans that are easier to complete by smallholders and communities, with the intention of bringing their forest activities into the formal sector. In having the necessary legal documentation, these actors could theoretically better access markets for their products and fetch higher prices than they would obtain on informal markets. They would also be less at risk of being fined or jailed for illegal activities (Hajjar *et al.*, 2011). This lever would likely be one of several regulatory changes needed to enhance the ability of small-scale forest enterprises to contribute to poverty alleviation (Badini *et al.*, 2018).

While it is not clear how widespread regulatory changes have been, a handful of studies in Latin America and Africa have examined the effects of simplified forest management plans on poverty. Forestry laws modified in the mid-1990s and 2000s in Bolivia and Ecuador allowed for a number of special regulations for small-scale management, simplifying the requirements for obtaining permits or plans so that they were less costly to prepare and implement or, as in the case of Beni province in Bolivia, allowing smallholders to extract timber without a management plan at all if they needed the income to buy basic goods (de Koning, 2011; Pacheco, 2012). Yet, the regulations still proved to be barriers for smallholders, requiring inputs and technologies. Often the benefits from following the law did not outweigh the costs, resulting in many smallholders continuing to participate in informal markets (Pacheco, 2012). In Cameroon, one study found that simplified management plans brought financial benefits to some communities, but the study did not compare the effects of simplified plans relative to non-simplified plans (Bruggeman *et al.*, 2015). In an ex-ante study, Sanogo *et al.* (2014) predicted simplified management plans in Senegal would only have a small impact on local development when considering small management areas.

In summary, to date no study has attempted to empirically disentangle the effects of simplified management plans on poverty from the effects of other factors (such as tenure reform, market access and other barriers to SMFEs), but many continue to point to the difficulties associated with overly bureaucratic and technical processes to participate in the formal sector.

5.4.3 Log export bans

Export bans (or high export taxes) for unprocessed log timber have been implemented in many countries (predominantly in low- and middle-income countries, but also in some high-income countries) to counter deforestation and environmental degradation associated with the timber trade and/or to induce development of a domestic processing industry. Effectively an export tax and input subsidy to domestic processing (Dean, 1995), these bans were expected to increase employment and value-added in a nation's forestry sector by increasing the overall domestic processing of logs. A number of countries in Southeast Asia, Africa and Latin America enacted such export bans, primarily during the 1970s, 80s, and 90s (Goodland and Daly, 1996), and in some cases, enacted them more than once (Resosudarmo and Yusuf, 2006). The costs and benefits of log export bans (LEBs) on both welfare and environmental resources have been debated extensively (Goodland and Daly, 1996; Kishor *et al.*, 2002; Resosudarmo and Yusuf, 2006; Tumaneng-Diete *et al.*, 2005). While some empirical studies and economic models indicated that export bans have indeed increased domestic processing capacity, exports of secondary processed wood products and employment in the domestic processing sector (reviewed in Goodland and Daly, 1996), a number of models show that the increased employment in the processing sector does not compensate for the number of jobs lost in logging operations following LEB policies (Resosudarmo and Yusuf, 2006). Gillis (1988) estimated that Indonesia lost millions of dollars by banning log exports. We found one study that specifically modelled the effects of an LEB on households in poverty, showing that an LEB in Indonesia would result in decreased incomes across agricultural and rural households, at least in the short run (Resosudarmo and Yusuf, 2006).

5.4.4 Procurement policies

Timber procurement policies aim to ensure that timber is coming from legal and/or sustainable sources. They have been implemented at the domestic level, where governments wish to source timber for public works from legal sources, or internationally, to ensure that timber being imported into a country is sourced legally (such as the EUTR or US Lacey Act). A particularly prominent international intervention in this realm has been the Voluntary Partnership Agreements (VPA) of the EU's Forest Law Enforcement, Governance and Trade Programme, which are bilateral trade agreements between 15 countries and the European Union that include a series of governance reforms in the exporting country to ensure that timber being imported into the EU comes from legal sources. Some argue that the opportunities

for domestic governance reform and opening of the political process that the VPA presents can be used by civil society to ensure pro-poor policy reforms such as strengthening land tenure and access rights for marginalised rural communities and Indigenous peoples (Hobley and Buchy, 2013; Richards and Hobley, 2016; Tegegne *et al.*, 2017). Yet, we did not find evidence suggesting that this pathway has resulted in poverty reduction or enhanced economic opportunities for the forest-reliant poor. Instead, some authors have pointed to potential negative effects of these legality policies on small-scale timber producers, particularly if they are required to bear the cost of implementation or if self-employed people in the informal sector are squeezed out, exacerbating poverty in forest-reliant communities (Eba'a Atyi *et al*, 2013; Hajjar, 2015).

Alternatively, procurement policies can be used domestically to boost small-scale producers. For example, in Oaxaca, Mexico, the state government's policy regulating the purchasing of furniture for government institutions from community forests has boosted furniture production in three community forest enterprises (Tanaka, 2012).

5.5 Market and Supply Chain Levers

In this section, we review levers that are based on market mechanisms and whose success depends, at least in part, on commodification or commercialisation of trees, forest products or forest ecosystem services. Market and supply chain levers may be developed and implemented by governments, private sector bodies, or NGOs. Participation in such levers is generally voluntary. We review payments for ecosystem services, REDD+, ecotourism, small and medium forest enterprises, market access, forest producer organisations, company-community partnerships, contract production, certification, zero deforestation commitments and boycotts, and examine the evidence that these levers have demonstrably affected poverty.

5.5.1 Payments for ecosystem services

Programmes of payments for ecosystem services (PES) are conservation contracts intended to encourage environmentally favourable activities. The usual structure of these programmes is that willing participants offer to conserve a landscape (e.g. forest conservation), engage in a productive activity with a reduced ecological footprint (e.g. *agroforestry*), or restore ecological services (e.g. *reforestation*). Once these efforts are verified, participants receive payment (Wunder, 2015).

When they yield additional environmental benefits, PES programmes are expected to compensate participants for the value they forego by not carrying out the productive activity in which they were going to engage in the absence of the payments (Engel *et al.*, 2008). Theoretically, people should not accept payments that are less than this minimal opportunity cost. Therefore, it should be the case that PES payments either have no impact on poverty (if they exactly compensate for lost profits) or increase incomes (in the event that they exceed the amount of lost profits). Nonetheless, if households do not fully understand the mechanism or the benefits from deforestation, they could lose out from the transfer scheme. Here we examine whether rigorous studies with large numbers of observations show this to be the case. There are already a number of reviews of the impact of PES programmes on poverty (e.g. Bulte *et al.*, 2008; Lipper *et al.*, 2009; Palmer and Engel, 2009; Alix-Garcia and Wolff, 2014). Much early evidence came from Mexico and China, two countries with large existing PES-type programmes that started in the early 2000s. All estimations documented declines in, or no effect on, poverty.

New evidence from a broader range of countries supports the finding that PES programmes have either a small positive or neutral effect on poverty reduction. Two nationally-representative studies in Mexico showed small poverty reduction impacts that have decreased over time, probably due to the erosion of payment values from inflation. A combination of matching between accepted and rejected applicants and panel data approaches showed that beneficiaries experienced small increases in household assets that were greater in areas with lower deforestation risk (Alix-Garcia *et al.*, 2015). Sims and Alix-Garcia (2017) confirmed a small but significant decrease in poverty in Mexican PES-receiving localities from 2000-2010. Later work comparing beneficiaries to non-beneficiaries from 2011-2014 using a regression discontinuity approach showed zero impact on assets, food expenditures and housing characteristics (Alix-Garcia *et al.*, 2019). A smaller study (eight villages, 261 households) in southern Mexico comparing matched payment recipients and non-recipients (non-applicants) found positive impacts on household assets, but only where payments were large (Jones *et al.*, 2018). In Costa Rica, programme impacts estimated using matching (recipients to non-applicants) have generally revealed neutral effects despite the fact that payments are large (Robalino *et al.*, 2014; Arriagada *et al.*, 2015). The observation that programme recipients continue to re-enrol suggests that participation benefits

Box **5.2**

China's largest payment for ecosystem services programme

Following devastating natural disasters in the early 2000s believed to be caused by soil erosion from croplands on slopes of mountainsides, the Chinese government initiated the largest payments for ecosystem services programme in the world, the Conversion of Cropland to Forest Programme (CCFP) (China State Council, 2000). Also known as the Sloping Land Conversion Programme or the Grain for Green Programme, the CCFP enrolled farming households to convert their croplands on slopes to forests. In return, the government provided grain compensation to the farmers for the forests created on their cropland (Liu *et al.*, 2008), although the grain compensation was later replaced with cash. The secondary goal of the CCFP was poverty alleviation as most of the households who were eligible to participate in the programme live in poor regions of the country. The ecosystem services that the government buys from farmers are soil and water conservation. Farmers initially signed an eight-year agreement with the government for CCFP. After the initial contract ended, the Chinese government renewed the contract for another eight years, but at half of the initial compensation rate. In 2015, the Chinese government started a second round of the CCFP.

A recent report released by the Chinese government (Xinhuan News Agency, 2019) showed that the CCFP converted 13.27 million ha of cropland to forest or grass, enrolling 41 million households (158 million people) since 2001. The average compensation over the programme period is almost CNY 9,000 (USD 1,270) per household. In addition to the direct compensation, CCFP stimulated significant income structure change from farm work to off-farm employment (Song *et al.*, 2014; Rodriguez *et al.*, 2016) because CCFP freed farm labour, stimulating rural out-migration (Zhang *et al.*, 2018). Although the percent of cash compensation did not make up much of the total household income in general, it was a significant cash income for poor households (Song *et al.*, 2014). Additionally, farmers have several rights over the forests grown on their croplands, incentivising them to allow the forests to mature. The programme significantly increased forest coverage in China which is now providing ecosystem services such as carbon sequestration (Liu *et al.*, 2008).

likely exceed costs, but are not sufficient to induce detectable decreases in poverty.

A number of new studies have emerged in China and Vietnam. Using a selection model to compare participants to non-participants between 2008 and 2014, Phan *et al.* (2018) found a positive effect of PES on income growth. One caveat is that control households in the sample had significantly higher incomes than recipients in the baseline period. Treacy *et al.* (2018), using a difference-in-difference model, found a positive effect of the Sloping Lands Conversion Programme (SLCP) on migration in China and no impact on income. Using a matched panel of household data from 1996 to 2010, Liu and Lan (2018) estimated initial positive effects of the SLCP on agricultural productivity but this positive effect declined over time. One study examining the impacts of the SLCP on income between 1999 and 2006 found negative effects via a reduction in crop income (Yang *et al.*, 2018). However, these results should be taken with caution, as the data did not include any non-recipient group to help identify counterfactual trends, and there was no mechanism to allow causal identification of impacts.

Finally, there has been substantial new work focused on the poverty alleviation effects of PES in Africa. Two quasi-experimental studies in Mozambique estimate neutral to positive effects on household income. Using difference-in-difference techniques to compare project and non-project villages revealed neutral impacts of a long-standing PES project on household income between 2001 and 2008 (Jindal *et al.*, 2012), while a matching analysis of PES versus non-PES households in the same project (but only in the year 2006) showed positive association with cash incomes and consumption expenditures (Hegde and Bull, 2011). The discrepancy between these two could be due to a combination of noise in the recall data used to create the difference in differences, the difference between comparisons of changes versus levels, and/or different survey instruments.

A conservative interpretation would be that payments in Mozambique did no harm to the incomes of participants. Two recent randomised control trials (RCTs) also provide evidence of short-term positive impacts on participant incomes. In Uganda, a PES RCT found small increases in non-food expenditures (Jayachandran *et al.*, 2017). A similar methodology applied in Burkina Faso suggested that the timing of payments may be important (Adjognon *et al.*, 2019); food expenditures of participants in a reforestation RCT increased by 12% and food insecurity decreased for payments timed to coincide with the lean season.

Overall, our understanding of PES anti-poverty impacts continues to evolve. There is no substantial evidence that such programmes hurt participants' incomes, nor is there extensive evidence of substantial positive effects on poverty. In some cases, PES has resulted in win-win outcomes for both the environment and programme participants. The studies examined do not always provide information on why there are positive impacts in some settings and not others. However, the simple framework that began this section would suggest that payment levels may currently be only just sufficient to compensate for the opportunity cost of engaging in PES contracts. Targeting payments to properties that have low opportunity cost but high risk of deforestation could increase poverty alleviation impacts without sacrificing conservation objectives. Finally, the most recent work suggests that where there is annual income variation, timing payments to the moment when incomes are lowest may generate important impacts on poverty by smoothing consumption.

5.5.2 REDD+

Policies, projects and other interventions related to Reducing Emissions from Deforestation and forest Degradation, and fostering conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) are among the more prominent attempts to mitigate climate change since 2010 (Parrotta *et al.*, 2012). Belonging to the broad family of payments for ecosystem services interventions, REDD+ initiatives provide monetary compensation in exchange for reductions in terrestrial greenhouse gas emissions in the forest sector. Early REDD+ interventions were primarily at the local scale with performance-linked payments made to local communities and households by international NGOs, voluntary market mechanisms, or in many cases through pilot schemes supported by bilateral donors or multilateral organisations. As countries with forests have developed the capacity to implement REDD+ policies and monitor emissions reduction at the national scale, results-based payments to sub-national jurisdictions and countries are becoming more important (Maniatis *et al.*, 2019; Wunder *et al.*, 2020).

While the primary objective of REDD+ interventions is to reduce emissions, REDD+ may influence poverty via two pathways. The first is through REDD+ payments to governments and local bodies for verified emissions reductions or promises of emissions reductions, and benefit sharing of such payments, with adjustments for costs of adherence to REDD+ objectives (e.g. to monitor and enforce rules designed to limit emissions). The second is through changes in forest benefits to local users and governments as forests recover when users limit extraction of carbon-intensive products from forests to conform to REDD+ objectives. Such indirect effects may be positive in cases where forest recovery occurs and users are able to harvest non-carbon-intensive benefits such as fodder, foods or non-wood products. Restrictions on harvests may also turn out to be costly if they affect extraction of valuable timber or other carbon-intensive forest products such as firewood, or if local resource users are displaced (Beymer-Farris and Bassett, 2012). REDD+ safeguards have been widely adopted to protect against negative impacts on Indigenous and traditional forest-dependent people (UNFCCC, 2011).

We found no comprehensive and rigorous assessments of the effects of REDD+ on poverty or on consumption, incomes, asset building, education, health or other indicators of well-being. Although national level payments for avoided deforestation at scale have begun to flow, there are no analyses of how these payments have been shared with local populations and for what benefits, or how effectively recipient governments have used such payments to address poverty of stakeholders involved in reducing deforestation.

Two studies at the local level did not find evidence for effects of REDD+ on material indicators of well-being or poverty, and suggest that positive effects of REDD+ payments are possible, but have been modest at best (Danielsen *et al.*, 2011; Awono *et al.*, 2014). A study of benefit sharing for REDD+ in Nepal found that direct contributions of REDD+ projects to households' incomes were nominal – from 3.2% of income of poorest households to 0.3% of the income for the less poor households (Shrestha *et al.*, 2017). Payments had a small effect on inequality but also increased social tensions. Local incomes under the N'hambita Community Carbon Project in Mozambique were higher for

project participants, but primarily as a result of wage payments during the tree planting phase of the project. Annual carbon payments for agroforestry contracts were equivalent to about two months of wages (Groom and Palmer, 2012), but their study could not estimate whether incomes increased because of lack of baseline data. The permanence of payments was also unclear. The field experiment conducted by Jayachandran *et al.* (2017), although not a formal REDD+ intervention, found positive effects of payments on carbon outcomes, but statistically insignificant effects on incomes. Jagger and Rana's (2017) quasi-experimental analysis based on publicly available data for Indonesia found potentially negative effects on well-being in REDD+ sites.

A recent systematic review of REDD+ found 350 local-level projects in implementation across the tropics (Duchelle *et al.*, 2018). According to this review, no national level study of payments was available, and few existing studies of REDD+ projects provide careful causal estimates of carbon or non-carbon outcomes on the ground. The relatively more numerous studies of well-being outcomes "highlight small or insignificant results" (Duchelle *et al.*, 2018). In a review of 41 REDD+ projects across 22 countries that adhered to some reporting standards, Lawlor *et al.* (2013) found that participants received a wide range of payments (from USD 1 to USD 134 per year) and that contributions to infrastructure and education services were modest. The more important contribution of these projects was to local tenure security. Other studies have suggested that the effects of REDD+ may even be negative by adversely affecting local politics, institutions and livelihoods (Chomba *et al.*, 2016; Shrestha *et al.* 2017; Milne *et al.* 2019).

Overall, existing studies of REDD+ tend to focus on institutional structures, implementation procedures, relationships to past forest sector interventions and issues related to emissions reduction. A number of analyses have examined: a) how differing conditionality structures may affect emissions reduction outcomes (Irawan and Tacconi, 2009; Hoang *et al.*, 2013) and b) linkages from the local to the national and supranational levels (Bluffstone *et al.*, 2013; Kashwan and Holahan, 2014). But few studies, as discussed above, provide clear evidence on poverty outcomes of REDD+, in part because of the slow pace of national level implementation of REDD+ and subsequently because of unclear and complex benefit sharing structures. Because performance-based payments are only now beginning to supplant promise – or preparation-based payments for REDD+, it is difficult to attribute indirect REDD+ benefits from *forest restoration* or preservation of forests to local poverty reduction. Existing evidence on the effectiveness of REDD+ for poverty reduction is limited, but available analyses point to the critical importance of benefit sharing and stakeholder participation if REDD+ is to contribute to improvements in well-being either through direct transfers or indirectly.

5.5.3 Ecotourism

The tourism industry accounts for nearly 10% of the global economy (WTTC, 2019), and ecotourism is the fastest developing sector of the tourism industry. Much of the literature on ecotourism comprises case studies and reflections. These provide a range of perspectives on the value of ecotourism and different estimates of its contributions to national and local incomes. Defences and critiques of ecotourism both suggest that it is a promising route for generating material benefits for those living in proximity to tropical terrestrial and marine biodiversity.

Two common features of ecotourism are consistent across different definitions: it is a low impact form of tourism that helps conserve nature and it generates socio-economic benefits for local populations to help reduce poverty (Blangy and Wood, 1993; Buckley, 1994; Wunder, 2000). Ecotourism can contribute to poverty reduction in four different ways: 1) improvements in employment and wages of those employed; 2) shared visitor fees for forested locations in protected areas; 3) revenues from visitor purchases of local goods and services; and 4) infrastructure development with spillover effects in areas with high numbers of travellers and visitors. Typically, these benefits do not flow directly to the poor, but may be mediated through owners of hotels and restaurants, government agencies that receive protected area fees, and owners of businesses that sell goods and services to ecotourists. Further, ecotourism revenues result not just from the presence of forests and trees in protected areas but also from the presence of wildlife in forests.

Because ecotourism is such an important and growing part of tourism, estimates of its economic contribution, especially for national economies but in some cases for local communities as well, are widely available. One study on ecotourism used visits to protected areas in selected countries to estimate the total number of protected areas' visitors globally (Balmford *et al.*, 2015). Its estimate of ~8 billion visitors was associated with an amount of USD 600 billion per year in direct in-country expenditure and USD 250 billion per year in consumer surplus. These figures resemble other top down

estimates of total ecotourism revenues. WTTC estimates total direct and indirect contributions of tourism to the global economy at approximately USD 8.8 trillion per year and the share of ecotourism to be 10%, but growing at a faster pace compared to tourism. However, available statistics do not break down total spending by proportions for different social or economic groups.

Studies of ecotourism at the local level typically focus on measures of development and poverty-related impacts in terms of generation of local jobs and incomes, and in some cases the creation of new infrastructure (Snyman, 2012; Wishitemi *et al.*, 2015; Chirenje, 2017). Over the past three decades, thousands of case studies of ecotourism suggest that it contributes effectively both to local employment and incomes, but also that these contributions tend to benefit those who are better off and with the capacity to provide hospitality services to visitors. One example is a study of ecotourism around six Panda Reserves in China that found that ecotourism reduced poverty but increased income inequality, particularly for households residing within the reserves (Ma *et al.*, 2019). A number of other studies have similarly examined local effects of ecotourism and point to positive outcomes in relation to livelihoods, socio-economic development and poverty reduction (Simpson, 2012; Yi-Fong, 2012; Snyman, 2017; Lonn *et al.*, 2018).

5.5.4 Small and medium forest enterprises

Small and medium forest enterprises are small-scale forest-based businesses that generate income from a diversity of forest-related activities and products, including timber and fuelwood producers, carpentry shops, NTFP producers and ecotourism (Macqueen, 2008). Mayers *et al.* (2016) stated that about USD 125-130 billion of gross value-added may be contributed by SMFEs worldwide and 80-90% of all forestry enterprises in many countries are SMFEs. Employing at least 20 million people worldwide (FAO, 2013). SMFEs can play an important role in the reduction of poverty as they generate employment opportunities and spread wealth locally (Kozak, 2007; Tomaselli *et al.*, 2012; Sanchez Badini *et al.*, 2018). Positive evidence of this role comes from, *inter alia*, Bolivia, Brazil, Burkina Faso, Cameroon, China, The Gambia, Guatemala, Kenya, Mexico, Papua Guinea, Peru, Nepal and South Africa (Macqueen, 2008; Tomaselli *et al.*, 2012; Foundjem-Tita *et al.*, 2018). Among the factors that explain this role in poverty reduction, Kozak (2007) mentions that: i) SMFEs tend to be labour-intensive; ii) they may thrive and grow under favourable conditions; iii) they cater to local and domestic markets; iv) they empower local entrepreneurs; and v) they pursue other objectives that include the distribution

The transformation of forest products into consumer goods can support local economies (Oaxaca, Mexico)
Photo © Reem Hajjar

of earnings among stakeholders, the participation in policy dialogues and the contribution to community development. They also support decentralisation, tenure and access rights, and empowerment of vulnerable groups such as women and Indigenous communities (Sanchez Badini *et al.*, 2018). Yet, despite a strong theory of change and many case studies showing their positive contributions to local *prosperity* (Macqueen, 2008; Macqueen *et al.*, 2020), there have been limited impact assessments linking SMFEs directly to poverty reduction.

The difficulty in stating their impact in more generalisable terms is partly due to the diversity of contextual conditions in which they operate that may help or hinder their success (see Chapter 4). In a global literature review, Sanchez Badini *et al.* (2018) identified 12 critical success factors, essential for creating favourable enabling business environments for SMFEs to thrive and work towards poverty alleviation. These are: a stable and transparent macroeconomic setting; simplified and proportional regulatory frameworks; nuanced approaches to forest law enforcement; tenure security and clarity; devolved management and land use planning rights; appropriate and accessible markets; sufficient natural capital; available and accessible financial capital; sufficient forest management, business management and organisational capacities; and clustering through the creation of networks, associations, and cooperatives.

5.5.5 Market access

Improving market access in the context of poverty alleviation, narrowly defined, refers to interventions that enhance the physical (e.g. roads or infrastructure) and technical (e.g. intermediation networks, means of transportation) conditions for smallholders to access markets for selling their produce and/or to access inputs and services. In a wider sense, it refers to a disparate array of actions that affect the relationships of smallholders in the markets including actions for enhancing their capacities to engage in those markets and accrue benefits from market participation, such as reversing regulatory barriers, reducing market risks and transaction costs, and building capacities (Chamberlin and Jayne, 2013). While improving roads and infrastructure is often associated with development interventions, it may result from private investments (e.g. logging or plantation companies) that indirectly affect market access to local populations making use of those roads (Kleinschroth and Healey, 2017), stimulating as well the emergence of informal intermediation networks (Mejía and Pacheco, 2014).

The theory of change behind actions aimed at improving smallholders' access to markets assumes that enhanced market participation leads to positive impacts on household income and poverty alleviation (IFAD, 2015). Yet, greater market engagement may also increase risks or the ability for smallholders to capture economic rents, which may flow to actors better positioned in the value chain (Pacheco, 2012). For benefits to accrue to smallholders, several factors, processes and conditions shaping smallholders' market engagement have to be reversed or improved. These include technical, economic, policy and regulations, and institutional factors. Yet beyond markets, overall outcomes of market participation concern other conditions that facilitate access to other factors (e.g. technology, infrastructure, finance) (Torero, 2011). It is widely recognised that expanding market opportunities for smallholders, particularly in markets of high-value products, has positive impacts for smallholders (Russell and Franzel, 2004). While there is extensive evidence of how improving smallholders' access to agricultural markets affects livelihoods (IFAD, 2015), the evidence of this link for forests and trees is relatively slim.

Market access interventions can be traced back to rural development projects aimed at building farm-to-market roads, that evolved into integrated rural development programmes in the early 1970s (Ruttan, 1984), yet over time those evolved into programmes for enhancing agricultural competitiveness embracing the different market dimensions, and efforts to mainstream sustainable natural resources management. The latter included initiatives to enhance market access and competitiveness for smallholders to benefit from timber as well as NTFPs extraction, and tree-crops production in agroforestry systems. Market access is a key ingredient of rural development and poverty alleviation projects, and it has been widely embraced, with some variations, particularly across developing countries.

Clear evidence of the impacts that enhancing market access has on alleviating poverty of smallholders in forest landscapes is limited and context-dependent. In Ghana, improving roads may lead to better market integration and higher yields, and improved land use while reducing farm expansion into forests (Acheampong *et al.*, 2018). In Vietnam, enhancing access (through both physical and technical aspects) to markets (mainly international markets for timber and high-value products) may have had positive income benefits for smallholders

(Frey *et al.*, 2018). However, some studies show that economic returns to smallholders remained low even after the improvement of road infrastructure, such as in Brazil, suggesting that improving physical connectivity is not sufficient to increase rents of smallholders (Oliveira *et al.*, 2019).

The variation in outcomes suggests the importance of looking at the other factors and conditions explaining such variation. For example, outcomes may be defined by location, access to means of production transaction costs, access to infrastructure, technology, transportation and market/governmental institutional relationships (Torero, 2011). The poverty impacts of interventions aimed at improving market access, in the context of wider efforts for value chain development, often depend on the households' levels of pre-existing asset endowments (Donovan and Poole, 2013). When specifically considering smallholder forestry and tree-farmers, the most important variables may include clear ownership of trees, reliable markets, sympathetic legal and regulatory frameworks, and availability of technical options (Midgley *et al.*, 2017). Additional ingredients identified by comparative studies when assessing smallholder engagement in markets, particularly in agroforestry, are also access to information and contractual agreements (Russell and Franzel, 2004). In sum, multiple factors, processes and conditions can influence the benefits that smallholders may obtain from improved market participation, some of which are reviewed in this chapter.

The evidence provided here is comprised of different case studies, with a focus on small-scale timber *plantations*, NTFPs and some high-value agroforestry products. There is a need for more systematic assessments across a variety of situations of market engagement in order to further develop the evidence concerning the linkages between market access and poverty reduction, and to determine whether the outcomes in the forestry sector may differ from those in the agricultural sector.

5.5.6 Forest producer organisations

Forest producer organisations (FPOs) are any formal or informal group, association, cooperative or union of forest producers (Tirivayi *et al.*, 2018), with a purpose of producing, processing or marketing goods originating from forests, including timber and wood products as well as commercial NTFPs (Pasiecznik and Savenije, 2015). FPOs vary in size, composition and legal form (deMarsh *et al.*, 2014; Tirivayi *et al.*, 2018), and are found across the world (e.g. Pasiecznik and Savenije, 2015; FAO and AgriCord, 2016).

The theory of change linking FPOs to poverty alleviation holds that forest-based producers face a number of challenges that impede their abilities to benefit from economic opportunities provided by forests, including insecure tenure; disorganisation; poor access to markets, services and information; lack of capacity; and exploitation by more powerful actors (Macqueen, 2008). FPOs can help address these challenges by facilitating the aggregation of products; enhanced bargaining power; better access to capital, inputs, technical services and markets; as well as increased political power (deMarsh *et al.*, 2014; Pasiecznik and Savenije, 2015; Hajjar and Kozak, 2017; Tirivayi *et al.*, 2018). In turn, overcoming these challenges is expected to increase members' incomes (FAO and AgriCord, 2016).

A few studies explicitly assess the performance of producer organisations in terms of poverty alleviation specifically in a forest context. In Ethiopia, an econometric analysis of five forest-adjacent communities found that following the devolution of forest rights, local communities gained access to frankincense production and trading by organising themselves in cooperatives (Tilahun *et al.*, 2016). Cash income from frankincense cooperatives resulted in a 3.6% reduction in poverty rates among member households, as well as significantly higher incomes and lower poverty levels than non-members, though the authors also note that membership in cooperatives was biased towards relatively better-off households. In Côte d'Ivoire and Ghana, a study of 453 cacao producers across six sites found forest cooperative members to generate relatively higher incomes from cacao than non-members (Calkins and Ngo, 2010). And in Turkey, a study analyzed socio-economic household survey data from 203 small-scale timber producing villages, and also found cooperative members to have higher incomes in comparison to non-members – though wealthier households were significantly more likely to be members (World Bank, 2017).

A number of largely qualitative case studies across a range of forest commodities indicate that FPOs can contribute significantly to poor members' incomes (e.g. Tiveau, 2008; Pandit *et al.*, 2009; Pasiecznik and Savenije, 2015; Tieguhong and Schure, 2015; Humphries *et al.*, 2020). However, not all of these studies provided clear accounts of the data and methods used to calculate the claimed improvements in income (e.g. Pasiecznik and Savenije 2015; FAO and AgriCord, 2016). Tirivayi *et al.* (2018) also suggested that FPOs can play an important role in providing various social protection services, though noting that their study found no evidence on the effectiveness of those services.

Sharing knowledge to improve the chances of success of a cashew (Anacardium occidentale) plantation in Benin
Photo © Dan C. Miller

Positive effects on incomes or poverty alleviation were attributed particularly to improved access to more lucrative markets or buyers (Burke, 2010; Pasiecznik and Savenije, 2015), collective bargaining (Tiveau, 2008; Ahenkan and Boon, 2010) and collective ownership of productive resources (Dammert, 2019), facilitating access to training, technical assistance and credit (Birchall, 2003; Calkins and Ngo, 2010; Pasiecznik and Savenije, 2015; FAO and AgriCord 2016; World Bank, 2017), and targeted development interventions and livelihood-diversification interventions (World Bank, 2017). In Burkina Faso's largely female-dominated shea nut value chain, 76% of surveyed women noted improvements in their financial situation as a result of their participation in shea producer groups (Chen, 2017). Evidence from Latin America found that collective organisation was instrumental to obtaining certification for forest products (Duchelle, 2009; Dana and Mallet 2014), while Mala *et al.* (2012) found FPOs to be instrumental in strengthening the bargaining power of NTFP producers in Mali vis-à-vis traders. Even in instances where incomes are limited, cooperatives can provide employment to marginalised groups with limited alternatives (Burke, 2010; Shackleton *et al.*, 2011). Studies have also identified key enabling conditions, including: devolution of forest tenure or forest product user rights to cooperatives (Tilahun *et al.*, 2016; World Bank, 2017), technical and financial assistance from external actors (Brown *et al.*, 2011; FAO and AgriCord, 2016; Humphries *et al.*, 2020), as well as direct relationships between FPOs and international buyers, particularly with respect to niche markets (Elias and Carney, 2005; Lybbert *et al.*, 2011).

However, membership fees and other upfront investments associated with FPOs can effectively work to exclude the poorest community members (Kazoora *et al.*, 2006; Oduro and Osei-Akoto, 2008; Pandit *et al.*, 2009; Atmiș *et al.*, 2010; Shiferaw *et al.*, 2011). Exclusionary institutional arrangements, such as one-member-per-household rules, as well as time and labour requirements associated with participation, can serve to specifically exclude women from participating in FPOs (Stoian *et al.*, 2018). In addition, while Elias and Arora-Jonsson (2017) found the shea union in Burkina Faso to

build many members' social capital and strengthen cohesion, social divisions including along lines of gender, age and ethnicity often influenced processes of inclusion and exclusion.

A few studies (e.g. Atmiş *et al.*, 2010; le Polain de Waroux and Lambin, 2013) found that FPO membership had no or limited impacts on poverty alleviation; Markelova *et al.* (2009) cautioned against generalising from successful case studies since failures tend to receive less attention. Indeed, a number of studies highlighted challenges facing FPOs, including: poor tenure security; complex or weak regulatory environment; poor market access; limited scope and scale of operations; limited investment capital; price fluctuations; conflict and elite capture (Molnar *et al.*, 2007; Macqueen, 2008; le Polain de Waroux and Lambin, 2013; Schure *et al.*, 2013; Tirivayi *et al.*, 2018). Critically, such challenges may affect the financial viability of cooperatives over time (Dossa, 2012), particularly in instances where costs are subsidised by external donors (Humphries *et al.*, 2020). Indeed, members' poverty can constrain economic growth, if FPO members prioritise immediate needs over long-term investments (Atmis *et al.*, 2010).

5.5.7 Company-community partnerships

Forest-related company-community partnerships refer to the full range of formal and informal relationships, agreements, deals between communities and companies with the expectation of realising gains from sharing capacities and risks (Mayers, 2000; Ros-Tonen *et al.*, 2008; Le Tourneau and Greissing, 2010). The partnerships typically include contract production (discussed in Section 5.5.8), joint ventures and equity sharing agreements, farm forestry support, farm forestry crop-sharing, concessions leased from communities, and group certification with company-leased land from farms, among others (Andrew *et al.*, 2000; Mayers and Vermeulen, 2002; Ojwang, 2000). The products from these deals include timber products such as logs and wood fibre, and a variety of NTFPs such as nut oils, rubber, resins, juice pulp, and agricultural products for the cosmetic, food, automobile and pharmaceutical industries. Company-community partnerships are expected to result in the vertical integration of disconnected rural forest enterprises into global supply chains by providing rural producers with better access to markets and capacity (Mayers, 2006; Vermeulen *et al.*, 2008), improving incomes and net returns from land and labour (Brubacher, 1998; Ojwang, 2000; Mayers, 2006).

A number of case studies have described various company-community contracts, but few have carefully examined the explicit impacts of these contracts on poverty alleviation (Mayers, 2006). One study found that communities in the Brazilian Amazon engaged in logging contracts with a company saw increases in household incomes relative to communities not participating in such contracts, without compromising NTFP harvests (Menton *et al.*, 2009). The one-off income from timber sales was used for investing in agricultural production or household infrastructure. Other case studies describe benefits from company-community partnerships such as: increased incomes; access to markets and sometimes premium prices; employment opportunities; improving land use options; securing land rights; and upgrading social infrastructure (Le Tourneau and Greissing 2010; Mayers and Vermeulen, 2002; Menton *et al.*, 2009; Morsello *et al.*, 2012; Vermeulen *et al.*, 2008). Out-grower schemes for commercial forest products (further discussed in 5.5.8) have also improved human, physical, and financial capitals of organised smallholder producers in Ghana, Papua New Guinea and South Africa among other places, and improved their *resilience* to shocks and vulnerabilities (Warner and Bauer, 2002; Mayers, 2006; Ntisiful, 2010). In many cases, however, the inequitable distribution of benefits within communities can deepen social *inequity* and weaken social cohesion, while power imbalances between partnering communities and companies can increase community dependence on external actors and result in unfair or inequitable distribution of benefits in these partnerships (Mayers, 2006; Ros-Tonen *et al.*, 2008; Menton *et al.*, 2009; Le Tourneau and Greissing, 2010).

By building consensus on partnership aims, governance reforms that secure tenure and land rights for local communities, improving capacity of local communities to negotiate partnerships, equitable risk sharing, long-term commitment to the partnership, ethical business practices, and periodic evaluations, these partnerships can significantly contribute to poverty alleviation and environmental outcomes (Desmond and Race, 2000; Mayers and Vermeulen, 2002).

5.5.8 Contract production

Contract production, a type of company-community partnership, is a form of vertical coordination within value chains in which production is carried out through a fixed-term formal or informal sales agreement between a producer and a processing or marketing company (Little and Watts, 1994). While contractual attributes are

highly diverse (Bellemare and Lim, 2018), they often involve commitments by a company to provide inputs, credits, technical support, a guaranteed output market and/or fair offtake prices (Da Silva and Rankin, 2013). Producers in turn commit to fulfilling the company's process or product requirements, delivery schedules and exclusivity terms (Eaton and Shepherd, 2001).

While typically commercially driven, such arrangements are widely viewed by policymakers and development practitioners as a promising tool to overcoming the pervasive market imperfections that perpetuate rural poverty (Meemken and Bellemare, 2019). Companies can more effectively manage the high transaction costs associated with open market sourcing, while small producers gain access to new and often more secure (global) markets and the resources needed to produce marketable surplus (Ton *et al.*, 2018; Meemken and Bellemare, 2019). This has the potential to translate into higher incomes, more resilient livelihoods, competitiveness and total factor productivity gains.

Contract production in developing countries is especially prevalent in the agricultural sector (Grosh, 1994; Oya, 2012). In addition to traditional cash crops such as sugarcane, tobacco, cotton and tea, across much of the tropics, tree crops such as cacao and oil palm are also widely produced under production contracts. In countries such as India, Thailand and South Africa, timber species such as teak, pine, and eucalyptus are also commonly cultivated under such arrangements (Sartorius and Kirsten, 2002; Boulay and Tacconi, 2012). Since many NTFPs suffer from diseconomies of scale, and quantities and qualities can be difficult to control (Pierce *et al.*, 2008), few are harvested and/or processed under contract. Most documented cases come from the Amazon, typically involving some form of 'community-company partnership agreements' for comparatively high-value NTFPs such as Brazil nut, palm hearts and acai (van Andel, 2007; Morsello *et al.*, 2012).

Because many agribusinesses are often unable to achieve economies of scale through plantation production systems, labour conflicts and restrictive tenure regulations, supplementary smallholder sourcing is often an economic necessity (Vermeulen and Cotula, 2010; Ton *et al.*, 2018). While some critics contend that contract production can be an exploitative and extractive mode of production due to the inherent power imbalances and uneven dependency structures (Little and Watts, 1994; Oya, 2012), several empirical studies employing econometric techniques indicate that contract production has been widely associated with household income and farm profitability gains (Bolwig *et al.*, 2009; Miyata *et al.*, 2009; Bellemare, 2012; Narayanan, 2014; Girma and Gardebroek, 2015). However, some of these studies can be critiqued due to, *inter alia*, selection, publication and reporting biases and weak identification (Ton *et al.*, 2018; Bellemare and Bloem, 2018). Other dimensions of welfare are less addressed by this literature, but some studies do point to positive *food security,* gender *equality* and subjective well-being effects (Morsello *et al.*, 2012; Dedehouanou *et al.*, 2013; Bellemare and Novak, 2017). In demonstrating that participation may intensify environmentally unsustainable activities and household labour burdens, the study by Morsello *et al.* (2012) of Brazil nuts in Bolivia and Brazil does point to potential participation trade-offs.

Since most of these studies are based on case studies of specific contracting relations or are confined to specific geographic areas, findings do tend to suffer from a lack of external validity (Meemken and Bellemare, 2019). One of the few studies based on nationally-representative survey data suggests that the oft-cited income effect is likely overstated (Meemken and Bellemare, 2019). Furthermore, with the exception of Morsello *et al.* (2012) and Girma and Gardebroek (2015), much of the quasi-experimental literature is focused on agricultural (tree) crops. Despite the abundance of studies on timber contract production, such studies are largely qualitative, published as grey literature, reliant on descriptive statistics and/or do not consider counterfactuals (e.g. Cairns, 2000; Desmond and Race, 2000; Mayers and Vermeulen, 2002; Howard, 2005).

There is some evidence that contract production can exacerbate social differentiation. For example, most studies control for, and identify self-selection biases and processes of involuntary exclusion. They observe that contract production participants tend to be more affluent, educated and asset endowed (Miyata *et al.*, 2009; Bellemare, 2012; Narayanan, 2014). The participation of vulnerable and marginalised groups can be constrained by the perceived opportunity costs of allocating finite land and labour resources to the contracted commodity, reduced risk tolerance and companies imposing eligibility criteria to control transaction costs (Bellemare, 2012; Ton *et al.*, 2018). This calls into question whether contract farming – in the absence of additional institutional support and formal checks and balances – adequately serves as a tool for inclusive rural development. Positive spillover/contamination effects may nevertheless materialise through job creation, infrastructure investments, and technology/skill transfers (Ton

et al., 2018). However, few studies explicitly assess such externalities. Meemken and Bellemare (2019) found positive spillover effects onto local labour markets, but did not observe any positive welfare impacts on non-participant households.

5.5.9 Certification

Certification is "a procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards" (ISO, 1996). Certification relevant to forestry can take many forms, but has long been found in the form of voluntary sustainability standards in high forest-risk commodity sectors. This includes the Forestry Stewardship Council (FSC), the Roundtable on Sustainable Palm Oil (RSPO), Rainforest Alliance/UTZ, Fair Trade, and the Sustainable Agriculture Network (SAN), which certify forest-related commodities such as palm oil, timber, pulp and paper products, coffee and cacao, and a range of agricultural crops. Each of these systems has its own sustainability standards that include a wide range of social and environmental criteria that producers have to comply with to become certified. In some countries and sectors, producers and governments have also begun developing mandatory certification systems (e.g. palm oil in Indonesia) and national standards (e.g. the Programme for the Endorsement of Forest Certification (PEFC) (Overdevest, 2010; Schouten and Bitzer, 2015; Pacheco *et al.*, 2018). Public standards have been critiqued as being inferior to, and for undermining, private standards (Overdeveest, 2010; McCarthy, 2012; Hospes, 2014), while others suggest that they help prepare smaller producers for other standards (Higgins and Richards, 2018; Schoneveld *et al.*, 2019).

Certification by smallholders and community-based organisations is widely viewed as an important rural development mechanism. The theory of change holds that adoption of better practices can enhance productivity and resilience, and reduce production risks, while creating opportunities to sell to buyers that can offer improved terms of trade (e.g. price premiums, offtake guarantees, services). These could lead to higher and more stable income for smallholders, thus contributing to poverty reduction.

The evidence is mixed as to whether these benefits materialise in practice. Many certification systems were developed in response to, and accommodating the needs of, corporate producers, and therefore respond poorly to the interests of smaller producers (Brandi *et al.*, 2015). Smaller producers typically face comparatively high compliance barriers and are often not incentivised, or are unable, to adapt their production practices and strategies (Schoneveld *et al.*, 2019; Brandi *et al.*, 2015). They often lack the necessary resources to absorb certification costs, or the capacity to adopt prescribed practices and to manoeuvre the public bureaucracy in order to obtain the needed legal documentation (Brandi *et al.*, 2015; Schoneveld *et al.*, 2019). Furthermore, price premiums rarely suffice and access to alternative, oftentimes informal, market outlets reduce the certification imperative, especially in the timber and palm oil sector (Burivalova *et al.*, 2017).

FSC also certifies forests managed for NTFPs, but certification of NTFPs has proven to be especially problematic due to *inter alia* low profit margins, underdeveloped markets, and legality issues (Pierce *et al.*, 2008). For NTFPs, much of the existing literature has examined how and under what conditions they can be certified, but not their impacts. However, evidence from Brazil suggests that NTFPs serving large, mature markets can be successfully certified with the right government, donor and civil society support (Guedes Pinto *et al.*, 2008). One study on Brazil nuts suggested the economic impacts of NTFP certification is mixed and highly context-specific (Duchelle *et al.*, 2014). A study exploring the gendered impacts of organic certification of shea nuts similarly provided inconclusive evidence (Kent, 2018). Nevertheless, with the exception of the cacao and coffee sectors, certification rates remain low amongst small producers and community forest management units and enterprises.

Despite the systematic barriers to adoption, a multitude of studies on smallholder cacao certification in Ghana and Ivory Coast demonstrate that tangible social benefits can accrue. The adoption of better practices can increase agronomic capacity, yields and resilience to shocks; thereby positively impacting farm-level profitability, which often translates into improved household income and (financial) well-being (Krain *et al.*, 2011; Paschall and Seville, 2012; Gockowski *et al.*, 2013; Ingram *et al.*, 2014; Astrid Fenger *et al.*, 2017). Since certification typically demands improved farmer organisation, (support for) certification also contributes to the development of more professionalised producer associations (Ingram *et al.*, 2018a).

In the timber sector, the limited evidence on the impacts of community forest management certification suggests that certification is rarely financially attractive, but can help strengthen land tenure and community empowerment (Cerutti *et al.* 2014; Burivalova *et al.*, 2017). Because of high costs and market uncertainties, certification of

small-scale tree growing similarly rarely translates into net (economic) benefits (Maraseni *et al.*, 2017; Maryudi *et al.*, 2017; Ling *et al.*, 2018; Flanagan *et al.*, 2019). Nevertheless, there are some documented examples of community-based forest enterprises overcoming financial viability issues when partnering with social movements and government agencies (Macqueen *et al.*, 2015).

The scientific quality of existing studies is mixed. Many of the cacao impact studies are published as grey literature, with unclear methods and analytical rigour (Ingram *et al.*, 2018a). Similarly, few studies on certified community forest management conform with standards for impact assessment (Burivalova *et al.*, 2017) and neither do studies on palm oil, NTFPs or timber. Existing literature also tends to focus heavily on practices, productivity gains and income, but often neglects to critically interrogate other pertinent impacts such as effect on household labour burden, food security and portfolio composition, as well as broader societal effects. Where certification can become an important lever for poverty alleviation, it is usually when smallholders are more actively engaged or their needs considered in the design of standards (Loconto and Dankers, 2014).

5.5.10 Zero deforestation commitments

Supply chain initiatives are commitments made by private sector entities – either individual companies or groups of companies – to adopt more sustainable sourcing policies, in relation to one or more commodities (e.g. timber, soy, palm oil, beef), often by a specific date (Brown and Zarin, 2013; Lambin *et al.*, 2018). They include "aspirational goals by single companies or coalitions of actors, corporate codes of conduct and sustainability standards that, in some cases, are implemented through certification schemes and moratoria" (Lambin *et al.*, 2018). As they relate to forests, many of these supply chain initiatives are frequently referred to as "zero deforestation commitments" (ZDCs). Such ZDCs can be implemented at the property level or across larger jurisdictions and frequently apply to all producers within the adopting-company's supply chain (Meyer and Miller, 2015). As of March 2017, Lambin *et al.* (2018) noted that at least 447 producers, processors, traders, manufacturers and retailers had made at least 760 public ZDC commitments.

Many ZDCs and other supply chain initiatives contain criteria that relate to social dimensions of sustainability. Zero deforestation commitments frequently include guarantees to improve a company's conduct towards various groups of people, including Indigenous and other forest-dependent people who live in and around forests used for commodity production; labourers employed by commodity-producing or processing companies; and smallholders who produce commodities and sell them into larger supply chains (Newton and Benzeev, 2018). Therefore, if companies that adopt ZDCs honour their pledges, then poverty may be reduced in one or more ways. For example, if Indigenous and forest-dependent people are properly compensated for their land, or if they are given greater opportunities to retain control or ownership of, or access to, forested lands, they may be better off relative to a scenario in which land is 'grabbed' by commodity-producing companies (Liao *et al.*, 2016). If labourers are fairly compensated for their work, and if children are not exploited in commodity production but are rather free to pursue education, then levels of poverty may in time be reduced among communities of people employed in the commodity sector. And if smallholder commodity producers are fairly paid for their production, and are not excluded from supply chains by costly procedures, then they may be more likely to earn higher incomes. Many of these examples, and many of the environmental and social criteria contained within supply chain initiatives including ZDCs, refer to the elimination of worst-practices. Such initiatives often do not promote or strive for best-practices. But even the elimination of worst-practices might conceivably reduce poverty, if doing so removes barriers and constraints to individuals and communities.

A recent review of the impacts of ZDCs on social outcomes, including poverty, identified no evidence of a relationship between supply chain initiatives and poverty alleviation (Newton and Benzeev, 2018). Larson *et al.* (2018) reported a suggestion by a government official that the stringency of the Indonesian Palm Oil Pledge (a supply chain commitment by five major palm oil companies) may have negatively affected smallholder income by making it more difficult for them to sell their produce. In sum, we found no evidence that supply-chain commitments have reduced poverty or improved human well-being. In part, this could be due to the primacy of the environmental focus of many such pledges.

5.5.11 Boycotts

Consumer boycotts of timber from particular companies, countries or regions have been promoted as a mechanism by which to encourage more sustainable and more responsible timber production. The theory of change states that boy-

cotts will work if a firm's profit is sufficiently reduced to prompt it to adopt changes (Delacote, 2006). However, the likelihood of success of a boycott can be low, as a consequence of: a) the challenges of coordinating consumer behaviour, b) the allure of free-riding behaviour, c) the paradox that those consumers who have the greatest capacity to affect a firm's profits also have the highest opportunity cost of engaging in a boycott, and d) the challenge of only small numbers of consumers being sufficiently concerned (Delacote, 2009). If a boycott does overcome these challenges, the theory of change suggests that by being temporarily excluded from markets, economies and firms that depend on timber production are more likely to adopt more sustainable methods, including by becoming certified – for example, through FSC certification (see Section 5.5.9). In turn, FSC certification is theorised to result in economically just and equitable production standards, which may confer greater benefits on labourers, employees and communities living in and around timber-production areas. Thus, while timber boycotts have principally been motivated by environmental concerns, there is a plausible causal mechanism by which they could lead to social benefits, including poverty reduction. That said, if a boycott persisted for any length of time it could also plausibly exacerbate poverty locally if it were to damage the local market, jobs and income opportunities.

Various organisations have called for boycotts of non-certified timber (Damette and Delacote, 2011) and boycotts are reported to have been successful in catalyzing the cessation of logging old-growth forests and adopting more sustainable practices (Innes, 2006). For example, boycotts organised by the Rainforest Action Network and others have resulted in hundreds of timber retailers adopting FSC certification (Innes, 2006). Indeed, along with broader public concern about deforestation, boycotts are reported to have been responsible for the rise of FSC and other certification programmes (Putz and Viana, 1996).

Any impacts of boycotts on poverty are most likely to be manifested through the adoption of sustainability standards such as FSC certification. As such, we encountered no direct evidence that boycotts have led to measurable poverty reduction or to changes in other measures of human well-being. But to the extent that boycotts are effective in promoting the adoption of sustainability standards, and to the extent that the adoption of sustainability standards in turn leads to poverty reduction, there may be an indirect cause-and-effect connection between boycotts and poverty reduction.

5.6. Forest and Tree Management Levers

5.6.1. Agroforestry

Agroforestry refers to the intentional integration of trees and other woody perennials in crop and livestock systems. Agroforestry practices can improve farmer livelihoods and resilience through diversifying agricultural production and income sources. For example, a large-scale study of five countries in sub-Saharan Africa found that a third of rural smallholder households grow trees, which contribute an estimated 17% of total annual gross income for these households (Miller *et al.*, 2017). Several other levers can be used to support the more optimal integration of trees into farming systems. These include extension programmes, PES, certification schemes, linking producer organisations to out-grower schemes, strengthening seed delivery systems, improving tenure security, and addressing policy and institutional barriers, such as laws that prevent or overly regulate the harvesting of protected forest species on farm.

There have been a few notable impact evaluations of agroforestry interventions that evaluated economic, social and ecosystem services outcomes (Kuntashula and Mungatana, 2013; Bostedt *et al.*, 2016; Coulibaly *et al.*, 2017; Amadu *et al.*, 2020; Hughes *et al.*, 2020). These have shown that extension and training, coupled with the provision of tree germplasm in some cases, led to increased agroforestry adoption. This in turn led to increased yields, household income, food security and dietary diversity. For example, in Malawi, agroforestry adoption contributed to a 20-35% increase in yields, which provided increased income opportunities as well as better food security (Coulibaly *et al.*, 2017; Amadu *et al.*, 2020).

However, evidence on the linkages between agroforestry adoption and such impacts acquired through the use of rigorous impact evaluation methods such as randomised control trials and quality quasi-experimental studies, is extremely limited (Miller *et al.*, 2020). The few studies that have used impact evaluation methods tend to not directly assess poverty outcomes, but instead use proxies such as income, expenditure and food security. Additionally, existing impact evaluations often have a high risk of bias (Miller *et al.*, 2020).

Other studies that use non-randomised regression analysis provide evidence that agroforestry can contribute towards alleviating poverty, but these studies are also limited. In Bangladesh, a participatory agroforestry programme was associated with significant poverty reduction, measured

using the headcount index, poverty gap index and Foster-Greer-Thorbecke methods to assess levels of poverty and extreme poverty (Islam *et al.*, 2012). The programme improved the poverty situation of 33% of participating households, reduced the poverty gap of 10% of participating households, and reduced the severity of poverty of 5% of participating households. Agroforestry programmes like this enable farmers to diversify their production and increase their income sources, including through the sale of timber, fuelwood and tree crops, thereby contributing to poverty reduction. Dairy production and returns can also be enhanced among producers who make use of leguminous high protein fodder species (Place *et al.*, 2009).

In other contexts, trees are established to enhance the provisioning of ecosystem services, such as carbon sequestration. In these cases, incentive or market-based programmes (Section 5.5) are used to promote agroforestry (Hegde and Bull, 2011; Pagiola *et al.*, 2016; Haggar *et al.*, 2017). A common example is coffee agroforestry, where coffee trees are grown under the shade of other tree species. Certification schemes allowing farmers to certify that their products were sustainably produced, such as Fairtrade, Organic or Rainforest Alliance coffee certifications, enable a market-based approach for farmers to receive higher prices for their products for practising agroforestry (e.g. shade-grown coffee) and using other sustainable practices. The results of such schemes, however, are mixed, highlighting the importance of context-specific, evidence-based design of such programmes. There is also little evidence of their long-term effectiveness.

There is evidence of a difference in the labour burden between women and men in some agroforestry systems (Kiptot and Franzel, 2012). Typically, women tend to be burdened with much of the labour of planting and maintaining trees and are often excluded from the higher value agroforestry enterprises, such as timber and commodity crops. Women participate in the lower-value enterprises that men avoid, such as collection of fuelwood, fodder, mulch and indigenous fruits and vegetables. These lower-value enterprises can still contribute a significant portion of women's annual income (between USD 7 and USD 2,629 annual revenue from agroforestry products) (Kiptot and Franzel, 2012). Several impact evaluations of different agroforestry programmes found that women have lower participation in and benefits from agroforestry interventions (Place *et al.*, 2005; Hegde and Bull, 2011) due to different endowments, discrimination and exclusion, or inequitable programme design. Women's disproportionate tenure insecurity is another major disincentive that restricts their participation in agroforestry (Quisumbing *et al.*, 2014).

Along with improving incomes through increased yields or incentive provision, agroforestry can enhance resilience and support farmers to adapt to climate change (Verchot *et al.*, 2007; Thorlakson and Neufeldt, 2012; Quandt *et al.*, 2019). For example, agroforestry can diversify the products that farmers sell, providing additional sources of income, particularly in times of need. Similar to livestock, small-scale farmers often sell timber and other products on farm to meet a pressing expenditure need, such as school and hospital fees (Schreckenberg *et al.*, 2002; Place *et al.*, 2009; Kiptot and Franzel, 2011). Some agroforestry practices can also help farmers withstand climate-related shocks through preserving soil moisture during dry spells and by protecting crops from floods (Garrity *et al.*, 2010; Thorlakson and Neufeldt, 2012).

Overall, agroforestry programmes have the potential to contribute towards poverty alleviation, but additional research is necessary to understand how this potential can be better exploited across the planet's heterogenous landscapes and socio-economic contexts.

5.6.2 Forest restoration, reforestation and afforestation

The return or expansion of forest cover can be achieved in many different ways. Forest restoration refers to the return of a near to original *forest ecosystem* (Lamb and Gilmour, 2003). More commonly used terms refer to *ecological restoration*, ecosystem restoration or *forest landscape restoration* (FLR), although a recent review found at least 24 different terms associated with restoration (Mansourian, 2018). Widely used approaches to return trees to a landscape include *afforestation* (i.e., planting forests on land not classified as forests) and reforestation (i.e., planting trees on land classified as forests) (Stanturf *et al.*, 2014). Forest restoration activities are further differentiated by the amount of human involvement they require. Natural regeneration can improve the ecological function of degraded forests and return converted areas into forest land with minimal or no human involvement (Chazdon and Guariguata, 2016). Alternatively, forest restoration can also occur through human activities that prepare sites, remove unwanted species or individuals and plant trees (Le *et al.*, 2015). Though forest restoration has gained visibility as a cost-effective method for removing atmospheric carbon

(Stanturf *et al.*, 2015; Busch *et al.*, 2019; Bastin *et al.*, 2019; Brancalion *et al.*, 2019), its ability to promote livelihoods and well-being outcomes remains uncertain. Recognising this, FLR was defined in 2000 as an approach with the twin goals of enhancing ecological integrity and human well-being (Mansourian, 2005). A review of an FLR project in Madagascar, for example, found that 1,400 households were able to benefit from alternative income generating activities promoted under the project, including improved rice production, which led to a 2-4 fold increase in production (Mansourian *et al.*, 2018).

Forest restoration, reforestation or afforestation can produce livelihood impacts through direct and indirect benefits (Erbaugh and Oldekop, 2018). Direct benefits refer to what households receive from the implementation of forest restoration activities. They may include payments for tree planting activities, payments for ecosystem services that restored forests provide, the provision of land or resource rights, or the delivery of training to populations proximate to restored forest areas (Adams *et al.*, 2016). Indirect benefits refer to outcomes that occur as a result of having implemented restoration activities, and they are most likely to affect poverty over longer-time horizons. They include benefits from improved ecosystem function (e.g. greater NTFP availability, water quality and availability, soil fertility, carbon sequestration), strengthened resource rights for local populations and improvements in infrastructure (Adams *et al.*, 2016; Erbaugh and Oldekop, 2018). Though these pathways highlight many possible contributions forest restoration can make to livelihoods and well-being, research on forest restoration finds a mixed impact on poverty alleviation and livelihood benefits.

A growing body of evidence demonstrates how forest restoration, reforestation or afforestation provides direct livelihood benefits. A large-scale afforestation programme in China, the Sloping Land Conversion Project (see Box 5.2), provided subsidies for afforestation activities to low-income, rural households. The programme has demonstrated that afforestation programmes can incentivise the intensification of smallholder agriculture and increase off-farm labour earnings (Zhou *et al.*, 2007; Yin *et al.*, 2014). Small-scale projects have also had positive livelihood benefits. A social forestry programme in South Kalimantan increased farm-based income and natural forest cover (Hiratsuka *et al.*, 2019) and farmer-managed natural regeneration in Ghana increased asset ownership and income diversity (Weston *et al.*, 2015). Though these examples show how direct benefits from forest restoration projects and activities can produce livelihood benefits, assessing whether or not they reduce poverty is constrained by two barriers. First, restoration, reforestation or afforestation activities can lead to direct disadvantages, including the reduction of available agricultural land that decreases on-farm income or employment opportunities (Robbins and Harrell, 2014), the reduction of compensation or monetary benefits (Alix-Garcia and Wolff, 2014; Börner *et al.*, 2017) and the elimination of resource access rights (Barr and Sayer, 2012; Galudra *et al.*, 2014; Urgenson *et al.*, 2014). Second, direct economic benefits rarely (if ever) continue *ad infinitum*. Ensuring long-term benefits from restored forests complement direct and often short-term benefits may be important for lasting poverty reduction from forest restoration.

The ability of forest restoration to contribute indirect benefits that result in poverty alleviation is inconclusive. However, many studies find that restored forests contribute to a diversification of livelihood strategies and increases in income from timber and NTFPs (Aronson *et al.*, 2010; Le *et al.*, 2012; Adams *et al.*, 2016; Erbaugh and Oldekop, 2018; Ota *et al.*, 2018). For example, *secondary forest* regeneration coupled with the harvest of a local palm fruit in the coastal Atlantic forest region of southeastern Brazil improved farmer income, as well as soil quality and forest structure (de Souza *et al.*, 2016). Farmer-managed natural regeneration (FMNR), a practice where farmers actively manage and protect natural trees and shrubs to encourage an increase in woody vegetation, can also diversify incomes and improve livelihoods. For example, Haglund *et al.* (2011) estimated that FMNR contributed between USD 17 and 21 million to gross annual income of rural households (or between USD 46 and 56 per capita) in the region of Maradi, Niger, an 18-24% increase in income. Indirect benefits from forest restoration also accrued to households in central China as a result of the Mountain-River-Lake (MRL) Programme in the Poyang Basin. The MRL Programme is associated with lifting 9 million people out of poverty between 1983 and 2008. Though most of this poverty reduction is attributed to remuneration, improved credit from restoration activities, and access to agricultural technology, indirect benefits such as reduced flooding/soil erosion also contributed to reductions in poverty (Huang *et al.*, 2012). These examples are promising, but they do not rely on counterfactual analysis, and so may falsely attribute poverty reduction to restoration activities. Despite their limitations, these examples show that indirect well-being benefits from restored forests often ac-

crue over years or decades. Rights that ensure rural poor communities are able to use and manage restored forests are therefore key to reducing poverty through forest restoration (Nagendra, 2007; Mansourian and Vallauri, 2014).

Forest restoration can also deliver indirect institutional benefits to communities by providing improved clarity surrounding tenure or enhanced resource rights for newly restored forests (Le *et al.*, 2012; Erbaugh and Oldekop, 2018; Fox and Cundill, 2018). However, research more often finds that the success of restoration is predicated upon clear institutions for resource use (Galabuzi *et al.*, 2014; Call *et al.*, 2017; Legesse *et al.*, 2018). Thus, while the direction of benefits from forest restoration to ecological and economic benefits is clear though loosely substantiated, it remains less certain whether forest restoration tends to generate transparent tenure or vice-versa.

The impacts of forest restoration on poverty reduction are determined by interactions between the mechanism of governance used to implement restoration activities (e.g. CFM, PES), the process of implementation, and specific restoration goals. However, three general themes emerge from the relationship between forest restoration and poverty reduction. First, when forest restoration is associated with livelihood impacts, direct benefits often support the intensification of agriculture and/or the diversification of livelihoods to include more off-farm earnings and a greater number of products. Second, few studies have conclusively substantiated that livelihood benefits from services provided by restored forests meaningfully benefit proximate households to alleviate poverty. However, when poverty alleviation from restored forests seems likely, it occurs over years or decades. And third, forest restoration success and poverty alleviation from restored forests are closely associated with institutions for resource use.

5.7 Summary of Key Findings

We reviewed the evidence that forest-sector policies, programmes and strategies (i.e., levers) have alleviated poverty. We studied 21 different rights-based, regulatory, market and supply chain, and forest and tree management levers for which we could identify a plausible theory of change of how implementation of that lever might alleviate poverty (Table 5.1).

Overall, while we found substantial, varied, and context-dependent evidence of these levers being associated with mitigating poverty, including by supporting or improving well-being, we found limited evidence of these levers being associated with reducing poverty (i.e., moving people out of poverty). It is worth reiterating, however, that many of these levers were primarily set up for forest conservation or other non-poverty related objectives, rather than with the explicit aim to reduce poverty.

From the studies that specifically examined poverty reduction (i.e. moving people above a certain poverty-level threshold), some of the strongest evidence came from ecotourism, protected areas – particularly those associated with ecotourism (e.g. Naidoo *et al.*, 2019; Ma *et al.*, 2019), community forest management (e.g. Oldekop *et al.*, 2019) and agroforestry (e.g. Islam *et al.*, 2012). Rigorous studies on payments for ecosystem services show small, but statistically significant, decreases in poverty in some cases (e.g. Sims and Alix-Garcia, 2017).

Out of the studies that more generally examined *poverty mitigation* (i.e. increasing income, assets and other aspects of well-being), a multitude of cases showing positive outcomes came from community forest management (e.g. Rasolofoson *et al.*, 2017), forest producer organisations, (e.g., FAO and AgriCord, 2016), SMFEs (Macqueen, 2008), PES (e.g., Adjognon *et al.*, 2019), tree crop contract production (Morsello *et al.*, 2012) and, to a much lesser extent, REDD+ (in terms of its focus on tenure reforms – e.g. Lawlor *et al.*, 2013; Duchelle *et al.*, 2018).

5.7.1 Differentiated impacts

Few studies provided socially disaggregated information on poverty outcomes by showing how the levers included in the review affected different groups. However, a number of studies highlight the importance of social heterogeneity in the context of the assessed levers, including those levers with the strongest evidence of poverty alleviation. The assessed studies generally attributed socially differentiated outcomes, including differentiated opportunities, benefits, and trade-offs, to a combination of underlying material and sociocultural inequalities and the failure of a given lever to sufficiently account for and address those inequalities. For instance, insufficient financial resources may hinder the poorest producers from complying with formal standards (e.g. Obidzinski *et al.*, 2014) or paying the membership fees for producer organisations (e.g. Shiferaw *et al.*, 2011). While ecotourism may reduce poverty, it also risks increasing income inequality between households (Ma *et al.*, 2019). Gender differences (Stoian *et al.*, 2018), variations in ethnicity (Elias and Arora-Jonsson, 2017) or other axes of social differentiation often accentuate exclusionary outcomes. For instance, a number

of studies on ecotourism noted that women were typically relegated to lower-paying, gender-conforming jobs, while more remunerative positions were taken up by men (Gentry, 2007; Tran and Walter, 2014). Women also experienced a disproportionate loss of income due to forest exclosures associated with a PES programme (Tuijnman *et al.*, 2020), while many agroforestry practices increased women's labour burden, often without generating commensurate or accessible benefits (Kiptot and Franzel, 2012). Women's participation and benefits were lower than those of men in PES programmes in Kenya (Kariuki and Birner, 2016), while in a global comparative study on REDD+, women in project sites reported declines in subjective well-being in comparison to male-dominated groups within the same sites and women in control sites (Larson *et al.*, 2018).

5.7.2 Interpretation

An absence of clear and high quality evidence that forest-sector levers have moved people out of poverty does not necessarily constitute evidence that such levers cannot or even have not reduced poverty. Rather, it appears that relatively few researchers have explicitly explored poverty reduction, per se, through forest sector interventions. Many more studies have explored indicators of poverty mitigation, including impacts on income, assets and well-being. As an example of this distinction, there remains little concrete evidence of whether REDD+ has led to poverty reduction, but well-funded and coordinated efforts have systematically characterised REDD+'s contributions to livelihoods in cases globally. More studies are needed that explicitly speak about poverty reduction as an outcome variable of interest, rather than just poverty mitigation, in order to more fully assess forest-sector levers' impacts on poverty alleviation. Additionally, few studies have examined these phenomena at national or regional scales, instead typically examining impacts at the scale of a few communities or similar level administrative jurisdictions. Larger scale studies are needed to enable rigorous assessments of the role of these levers in relation to poverty.

The mixed conclusions on the efficacy of many of the levers is also an attestation to the importance of contextual differences, including the presence of enabling conditions and contemporaneous drivers of change (see Chapters 2 and 4, and Box 4.1 in Chapter 4), in shaping the effects of different levers. For several levers, we did not find generalisable, clear-cut evidence of impacts, positive or negative, given that conditions on the ground vary widely across the globe. But site-specific studies do show that several levers have contributed to poverty mitigation under certain circumstances and in the presence of key enabling factors, including in conjunction with other levers. For example, having clear and secure local tenure rights to land and forest resources is key to the success of SMFEs, CFM, PES, community-company partnerships and agroforestry. Many SMFEs are reliant on tenure reform, market access, forest producer organisations and formalisation policies, to name a few necessary enabling conditions for their success. Market access alone is an insufficient condition to ensure poverty reduction; other factors enhance the effects of market access – among them the presence of forest producer organisations, certification and contract production. Protected areas in Costa Rica and Thailand were most effective at alleviating poverty when ecotourism opportunities were available. As such, the likelihood of success of a number of levers is intertwined with the functional presence of other levers.

Finally, a number of cross-cutting tools that often support programmatic interventions were not discussed in this chapter, but are relevant to the success of many levers. For example, new and enhanced technologies including equipment upgrades, mechanisation and improved germplasm can be important components of SMFEs, CFM, reforestation and agroforestry (Burney *et al.*, 2015; Haase and Davis, 2017; Hansen *et al.*, 2019 see also Chapter 6, Box 6.2). Financial capital, in the form of credit, aid or subsidies, can be essential in implementing many of the reviewed levers (Macqueen *et al.*, 2008; Humphries *et al.*, 2012; Sanchez Badini *et al.*, 2018). Capacity building, including financial literacy, financial inclusion and improved management practices, often accompany interventions that bring new practices and ventures to producers (Pokorny *et al.*, 2010; Hajjar *et al.*, 2011; Elson, 2012). Safeguards such as free, prior and informed consent (FPIC) and participation in intervention design are increasingly recognised in a rights-based discourse as essential components of interventions aiming to improve the lives of forest-reliant people (Lawlor *et al.*, 2013; FAO, 2018). These supporting components of interventions may in and of themselves have poverty impacts, but we did not have the granularity to isolate and assess those outcomes.

We encountered significant variance in the methods used to study different forest-sector levers. The literature on some levers was dominated by econometric analyses (e.g. PES programmes, protected areas) while the literature on other levers was dominated by qualitative or mixed method

case-studies (e.g. timber contract production). Different methodologies offer competing advantages, including the degree to which one can offer reliable conclusions about the contribution of any given lever to poverty alleviation. For example, probably the most rigorous evidence, in terms of being able to isolate and quantify the impact of forest-sector levers on local people, comes from payments for ecosystem services programmes and protected areas analysis. Here, a number of controlled, econometric studies with large sample sizes found that PES programmes on the whole did no harm to participant households, and provided small increases in some cases to household incomes and assets, but also did not find support for a strong role in poverty reduction. Two recent randomised controlled trials found positive impacts on well-being measures (Jayachandran *et al.*, 2017; Adjognon *et al.*, 2019). Studies of protected areas have similarly utilised matching-based, quasi-experimental designs, and national and global datasets to show their positive impacts on poverty reduction, as well as the conditions that increase likelihood of impacts (namely, presence of ecotourism and locations at intermediate distances from major cities; Ferraro *et al.*, 2011; Naidoo *et al.*, 2019). For ecotourism, while not assessed through similarly rigorous study designs, evidence of impact has been tracked through the number of visitors and the benefits they bring in terms of expenditures in local and national economies. Meanwhile, several levers were predominately assessed using case studies in variable contexts (e.g. company-community partnerships, SMFEs). On their own these provide rich information on mechanisms and outcomes, but, in aggregate, the variability in case contexts makes it difficult to assess the specific contributions of the lever to poverty alleviation, and challenging to make any generalised assessments across contexts. The absence of such evidence should not be interpreted as the ineffectiveness of these levers in potentially addressing poverty.

Importantly, this chapter does not evaluate the poverty alleviation impacts of non-forest sector interventions. This includes programmes such as cash transfers, energy substitutions, education and infrastructure initiatives, non-tree related agriculture extension and other levers that are implemented both within but also outside of forested landscapes. Such levers are likely to have substantial impacts on the poverty status of forest-reliant people in rural areas. Indeed, many are more explicitly focused on dimensions of poverty alleviation as their primary objective. In contrast, many of the forest-sector interventions that we reviewed are focused primarily on forest conservation, and include social objectives only as a second-order concern. One example of a non-forest sector lever on poverty alleviation is the national cash-transfer programmes in Brazil that accounted for an average 54% of household income among agricultural households at the forest frontier (Dou *et al.*, 2017). Relatedly, Indonesia's national anti-poverty programme reduced village-level deforestation by 30% by reducing the reliance of rural households both on deforestation as a coping strategy and on forest products as an alternative to market-purchased goods (Ferraro and Simorangkir, 2020). Such programmes and impacts are not captured in this review and should be evaluated separately.

5.8 Knowledge Gaps and Future Research

We identified four ways in which the evidence base for how different forest-sector levers contribute to poverty alleviation could be strengthened. First, where appropriate, research designs could control for varying contextual conditions and isolate the mechanisms and levers in question to help illuminate the role of these levers in poverty alleviation. Second, more studies are needed that look at promising levers' contributions to moving people out of poverty rather than focusing on well-being contributions. Third, little research has examined the long-term poverty alleviation effects of forest-sector interventions. Fourth, our review does not explore the relative economic costs of alternative levers. In sum, a combination of more rigorous and long-term research designs, along with examinations of the cost-effectiveness of different levers, would go a long way to contributing to the design of effective interventions for poverty alleviation.

Future research could also address values and outcomes that are central to other Sustainable Development Goals. For example, reviews could examine how forest sector interventions affect rights, *equity*, *adaptation* and *resilience*, or carbon sequestration. The interactions among these additional outcomes and poverty alleviation is ripe for investigation; more broadly, future research might also ask, "[how] can inclusive, equitable and sustainable forest management contribute to poverty alleviation?"

5.9 Conclusions

Forest-reliant communities are variously (and sometimes simultaneously) affected by rights-based, regulatory, market and supply chain, and forest and tree management levers within com-

plex socio-environmental landscapes. Different actors, including governments, communities, private sector organisations and NGOs, variously develop, fund and implement these levers. Teasing apart and isolating the effects of any one lever on poverty alleviation is challenging given available evidence. That said, there is evidence to demonstrate that some interventions – including ecotourism and community forest management – can have detectable and significant impacts on poverty reduction, while many studies show that many of the reviewed levers have had positive impacts on poverty mitigation. To add to a rich body of case study research, further studies that explicitly focus on poverty reduction as an outcome of interest and that isolate causal mechanisms, including through quantitative methodologies with robust counterfactuals where appropriate, could help to extend this understanding of how forest-sector policies, programmes and strategies can help to alleviate poverty among the rural poor.

5.10 References

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Chapter 6

Global Forces of Change: Implications for Alleviating Poverty and Sustaining Forests

Coordinating Lead Authors: Priya Shyamsundar
Lead Authors: Jennifer Zavaleta Cheek, Laura Vang Rasmussen, Daniel C. Miller and Johan Oldekop
Contributing Authors: Laura Aileen Sauls, Kira A. Sullivan-Wiley, James T. Erbaugh, P.P. Krishnapriya, Pablo Pacheco, George Schoneveld, Conghe Song and Joleen Timko

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Abstract

This chapter examines six major global forces likely to influence forests and tree-based systems and considers their implications for poverty. The global trends discussed include: (i) growth in commodity markets, (ii) climatic impacts mediated through changes in forests, (iii) trends in private and public financing, (iv) technological advances and interconnectivity, (v) global socio-political movements, and (vi) emerging infectious diseases. These trends bring both opportunities and risks to the forest-reliant poor. In a business-as-usual scenario, the cumulative risks posed by global forces, in conjunction with limited rights, resources and skills required to prosper from global changes, are likely to place poor and transient poor households under additional stress. Global forces will also affect the non-poor, who may be able to better adapt to these changes. The chapter concludes with a discussion on how levers to better manage forests, combined with supportive conditions, can contribute to a different and more prosperous future for forests and people.

6.1 Introduction

Poverty[8] dynamics reflect the continuously shifting world that the world's poor face. While change is constant, some global forces may be particularly influential and important to understand. Global forces of change can be opaque at local or regional scales, but can create enormous shocks, impeding gains made in alleviating poverty or threatening the transient poor. These forces can also create uncertainty regarding the efficacy of existing policy levers (see Chapter 5) for alleviating forest poverty. On the other hand, they may also generate socio-economic opportunities that help move people out of poverty. Thus, it is useful to probe critical global forces of change to anticipate or forecast likely scenarios in *forest* poverty dynamics.

The COVID 19 pandemic has put a spotlight on global forces of change and their local costs. *Forest fragmentation* and the increase in zoonotic diseases, including COVID-19, underscore the need to attend to the linkages among forest cover change in distant places, health and sustainable development (Di Marco *et al.*, 2020; Dobson *et al.*, 2020). More broadly, these connected changes exemplify how global mechanisms can directly and indirectly affect communities living in, near or otherwise relying on forests. This chapter focuses on a subset of six major global changes that are likely to have wide-ranging influence on forest-poverty dynamics in the years ahead: (i) growth in commodity markets; (ii) climatic impacts mediated through changes in forests; (iii) trends in private and public financing; (iv) technological advances and interconnectivity; (v) global socio-political movements; and (vi) emerging infectious diseases (EIDs).

The global changes we examine in this chapter emerged from expert discussions through GFEP meetings during 2019-2020 and a review of the literature on global changes and forest interlinkages (Eakin *et al.*, 2014; Liu *et al.*, 2015; Oldekop *et al.*, 2017; Watts *et al.*, 2019; World Economic Forum, 2020). The identified global forces generally met three criteria: they are largely exogenously driven, but influence *forests and tree-based systems* in multiple regions; they are dynamic, reflecting shifting geo-political conditions; and they are likely to influence forest-poverty dynamics. Other trends such as urbanisation (Jiang and O'Neill, 2017), economic globalisation (Lambin and Meyfroidt, 2011) and demographic changes were excluded because of the rural focus of this analysis. However, we do reference some of these other trends in the discussion on forest commodity markets, and in the context of migration as a response to climate change (Cattaneo *et al.*, 2019).

In the sections that follow, we describe each global change and discuss its implications for forest-poverty dynamics based on available literature. The chapter concludes with an acknowledgement of the limitations of our analyses and a critical evaluation of conditions and strategies that may be needed to sustain forests and alleviate poverty, given global changes.

6.2 Growth in Commodity Markets

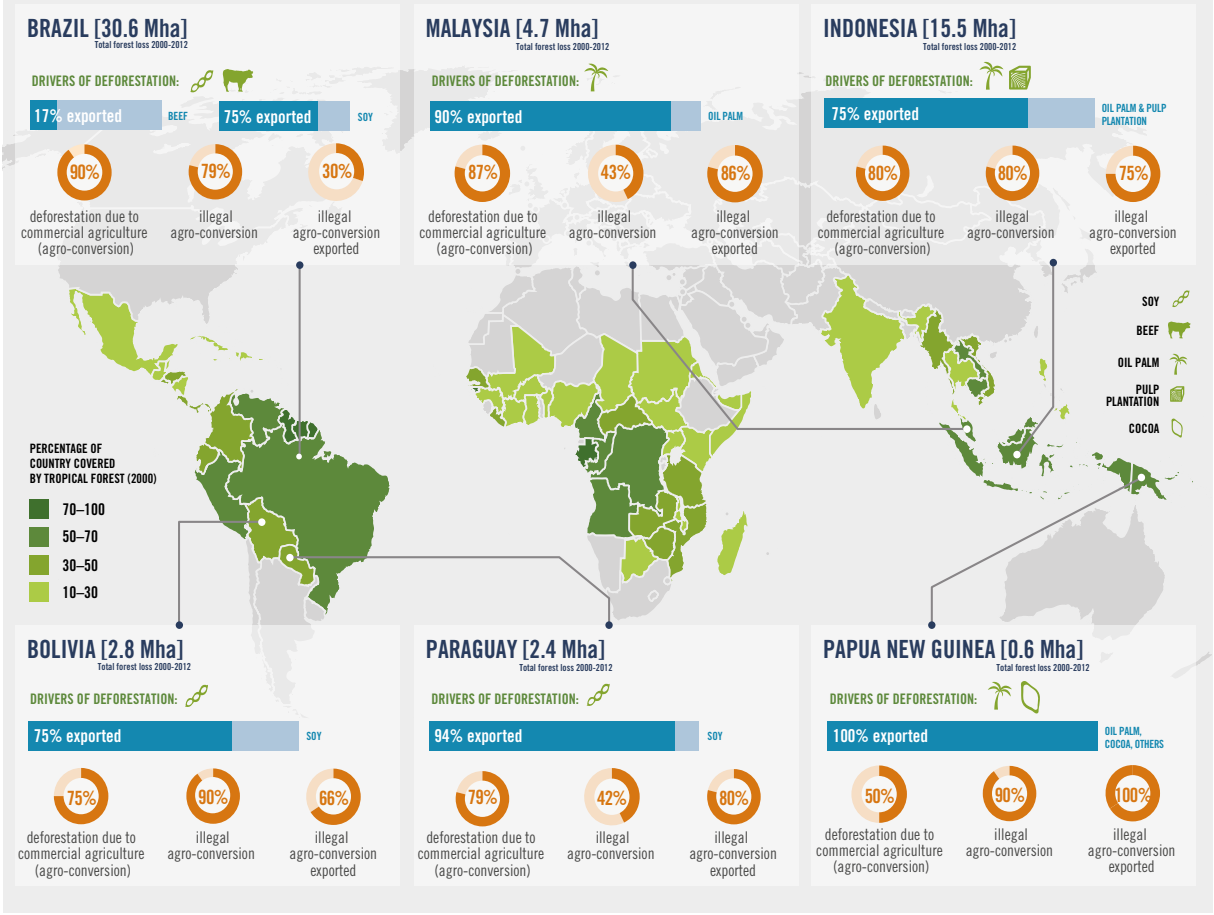
6.2.1 Introduction

Demand for commodities produced in the tropics plays an important role in *deforestation* and *degradation* (Curtis *et al.*, 2018; Seymour and Harris, 2019). Global commodity markets are likely to continue to contribute to land cover change and the levers

8 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

Figure **6.1**

Drivers of deforestation and carbon emissions (2000-2010, 2012)



Source: Lawson et al., 2014

launched to decouple market growth and forest loss are critical for influencing *poverty alleviation*.

6.2.2 Commodity demand and deforestation

Demand for four commodities – wood products, beef, soy, and palm oil – has significantly modified tropical forests (Newton *et al.*, 2013; Persson *et al.*, 2014; Curtis *et al.*, 2018; Henders *et al.*, 2018). Other commodities, such as coffee (Philpott *et al.*, 2008; Tadesse *et al.*, 2014), cacao, cassava (Gockowski and Sonwa, 2011) and illicit coca production (Armenteras *et al.*, 2013) also play an important role in varied geographies.

Demand for beef has had the biggest impact on deforestation (Henders *et al.*, 2015; World Economic Forum, 2020). In South America, 71% of deforested area during 1990-2005 was used for pasture creation (De Sy *et al.*, 2015). Brazil, China, the European Union (EU) and the United States (US) are major beef producers (Brack *et al.*, 2016), with Brazilian cattle production having the largest forest footprint (Henders *et al.*, 2015; Pendrill *et al.*, 2019). Soy, with cultivation in South America increasing by over 170% during 1990-2010 (WWF, 2014), also contributes to significant land use changes (le Polain de Waroux *et al.*, 2019). Brazil and the US are responsible for most global soybean exports (Gale, *et al.*, 2019), which are used mainly for meeting demand for animal feed (Brack *et al.*, 2016).

Indonesia and Malaysia produce about 80-90% of all palm oil (Henders *et al.*, 2015; Brack *et al.*, 2016). During 2000-16, oil palm cultivation contributed to 23% of deforestation in Indonesia, with the deforestation rate declining by 2014-16 to under 15% (Austin *et al.*, 2019).

Tropical timber is mainly produced in Brazil, Indonesia, Malaysia and Papua New Guinea (Persson *et al.*, 2014). During 2000-16, timber *plantations* contributed to 14% of deforestation in Indonesia, with

the rate peaking in 2010-12 (Austin *et al.*, 2019). Arguably, timber plantations play multiple roles: they can reduce pressure on natural forests (Bowyer *et al.*, 2005; Ainembabazi and Angelsen, 2014); contribute to restoring degraded lands (Bowyer *et al.*, 2005); and improve smallholders' *livelihoods* (Khamzina *et al.*, 2012; Roshetko *et al.*, 2013). In general, however, evidence on plantation-led improvements in livelihoods and poverty is both limited and mixed (Malkamäki *et al.*, 2018; Santika *et al.*, 2019).

Commodity growth is likely to continue. Beef production in developing countries is projected to be 17% higher in 2028 relative to the average of 2016 and 2018 (OECD and FAO, 2019). China's beef imports, in particular, have increased by 160% from the levels in 2011 and are projected to rise by another 55% by 2026 (World Economic Forum, 2017; 2020), with production responding in Argentina, Brazil, China, Mexico, Pakistan, South Africa, and the US. Soybean production is projected to increase to 390 million tonnes by 2050, increasing land under soy cultivation by some 30% between 2005-07 and 2050 (Alexandratos and Bruinsma, 2012). A smaller time-period projection suggests a 33% increase in soybean exports between 2028-29 and 2016-17 (Gale *et al.*, 2019), with growth in export demand led by China and supply led by Brazil and the US. Global palm oil production is also expected to increase by 1.8% per year between 2016-18 and 2028, with the production of palm oil in Indonesia and Malaysia likely to be affected by stricter environmental and agricultural policies (OECD and FAO, 2019). Demand for wood products is projected to increase three-fold (by volume) by 2050 relative to 2010 (WWF, 2012).

6.2.3 Decoupling commodity growth and deforestation

As demand for tropical commodities at the forest frontier continues to grow, there is pressure to decouple this growth from deforestation. Ten strategies rise to the top to achieve net zero deforestation commitments (ZDCs) rates, while maintaining or increasing production of commodities at the forest frontier (World Economic Forum, 2020). The strategies emphasise building on core principles of sustainable intensification (certification, pilot scaling), increased funding for sustainability (demand and financing) and improved *governance* (property rights, jurisdictional approaches, illegality/enforcement). These mechanisms (Table 6.1) are likely to impact the *forest-proximate* poor engaged in agricultural activities. Many governments, donor countries and non-profit and corporate agencies are aligning themselves around the strategies identified in Table 6.1. However, the

The transformation of forests into arid land endangers the long-term provision of critical resources (W National Park, Benin)
Photo © Dan C. Miller

Table **6.1**

Strategies for decoupling deforestation from commodity growth and poverty implications*

STRATEGIC ACTION	POSSIBLE MECHANISMS	POTENTIAL POVERTY IMPLICATIONS
Eliminate illegality from supply chains	◗ Align forest laws and codes ◗ Improve data and enforcement ◗ Strengthen voluntary commitments	◗ Secure property rights (+) ◗ Aligning laws may reduce smallholder agency (-) ◗ Strengthen Indigenous and community management (+) ◗ Compliance (-)
Certify palm oil	◗ Increase demand for certified products ◗ Support sustainable palm oil supply chains ◗ Improve/expand certification	◗ High certification costs (-) ◗ Better bargaining power with companies and/market access (+)
Scale up sustainable intensification of cattle	◗ Increase adoption ◗ Enforce to reduced extensification ◗ Increase credit and finance for intensification	◗ Productivity increases could help income (+) ◗ Co-benefits (+) ◗ Corporate preferential treatment (+) ◗ Tied to participation (?)
Increase smallholder yields for palm oil and cocoa	◗ Best management practices, input increases and replanting for oil palm ◗ Public and private credit, training, organisation and aggregation	◗ Productivity increases help as smallholders produce around 40% of global palm oil (+) (WEF, 2017) ◗ Average cacao bean yields (global) stable or decreased in last two decades (?)
Sustainable production of soy	◗ Build on the Amazon soy moratorium to strengthen public-private agreements ◗ Plant soy on land already cleared for cattle	◗ Integration into global markets (+) ◗ Reduced land grabbing (+)
Accelerate jurisdictional programmes	◗ Jurisdiction-level certification of ZDC commodities and sustainable intensification ◗ Public-private investment in enforcement, registration, planning and programmes for smallholders ◗ Include political support, private sector cooperation, collaborative planning, transparency and finance	◗ Integration into global markets (+) ◗ Reduced land grabbing (+)
Address land conflicts, tenure security and land rights	◗ Combine legal protection with land registries, especially for Indigenous and community lands ◗ Include conflict resolution mechanisms	◗ Reduced land grabbing (+) ◗ Secure access, esp. to Indigenous communities (+) ◗ Gender differences in tenure (-) ◗ Unresolved conflicts (-)
Mobilise demand for ZDC commodities	◗ Sustainable sourcing of soy and palm oil in consumer markets (China/India) ◗ Local companies brought into global discussions	◗ Increase in demand for sustainably sourced products leads to small holder integration into markets (+) ◗ Increase in land grabbing and loss of market access to smallholders (-)

STRATEGIC ACTION	POSSIBLE MECHANISMS	POTENTIAL POVERTY IMPLICATIONS
Redirect finance to deforestation-free supply chains	◗ Direct capital/finance to ZDC supply chains ◗ Increase smallholder access to finance ◗ Direct impact investing using public-private partnership platforms	◗ Unequal distributions of capital and finance (-) ◗ Support for smallholders – finance, cooperatives, training, insurance, certification, impact investment (+)
Improve quality and availability of deforestation and supply chain data	◗ Increase near real-time deforestation data/alerts ◗ Expand tools like the 'High Carbon Stock Approach' ◗ Improve geospatial information on land tenure, concessions, and licences ◗ Agreed definitions ("forest", "ZDC", and "high conservation area")	◗ Maps can legitimise claims by people in power and Indigenous and local communities (-/+) ◗ Tools that prioritise are only as good as the information fed to them (+/-)

* *Chapter 5 mainly reviews forest-related market levers of change, while the focus here is on agriculture-related actions affecting agricultural commodities primarily sourced at the forest frontier.*

Source: Adapted from priorities list for 'decoupling' discussed by the World Economic Forum. The poverty implications are based on a review of material presented in the same document (World Economic Forum 2017).

extent to which decoupling of commodity growth and deforestation occurs will, at least partly, depend on how well the mechanisms in Table 6.1 are implemented. In addition, the potential poverty outcomes detailed in the Table will likely vary, based on a confluence of local conditions (see Chapter 4).

6.2.4 Implications for forest poverty dynamics

Land use change can offer opportunities to smallholders who are able to take advantage of global markets. Evidence from Paraguay, for instance, suggests that farmers and Indigenous communities have improved incomes and livelihoods through soy cultivation (Cardozo *et al.*, 2016). Likewise, there is evidence that oil palm cultivation has increased smallholder incomes and rural employment in Asia, reducing poverty rates (Qaim *et al.*, 2020) and benefitting non-farm employment and income (Bou Dib *et al.*, 2018). In Brazil, soybean cultivation supports some 2.5 formal sector jobs outside of agriculture per square kilometre of production (Richards *et al.*, 2015).

Along with income and jobs, commodity markets also bring new risks. Box 6.1, drawing from Ingram (2014) and Ingram et al. (2017), illustrates the case of bush mango trade in West Africa which benefits many households. However, market supply chains ignore longer term considerations, and gains can be eroded if local institutions are unable to adjust rapidly to match market growth.

Shea butter fruit (Vitellaria paradoxa) recently collected in the forest
Photo © Daniel C. Miller

Box **6.1**

Understanding the short-term and longer term influence of global markets on forest use and local livelihoods by examining the bush mango supply chain

Global demand from distant markets is increasingly driving the profitability of many timber and *non-timber forest products* (NTFPs), with varied short and long term outcomes. In the case of bush mangoes, growing in several countries in Africa, global markets contribute to increased income for many poor households, while also increasing incentives to over-harvest, undermining long-term sustainability.

The bush mango (*Irvingia* spp.) is a popular commodity that is both traded and used domestically. The ground kernels of bush mangoes are used as a condiment and sauce thickener; and the kernels are increasingly processed in Europe and the US as an important ingredient in weight-loss aids, health supplements and cosmetics (Ingram, 2014). The seeds are used for cooking oil, the juice is used in cooking and wine, the pulp as a dye and the timber is used for construction. The growth in demand for bush mangoes has contributed to improving livelihoods. In Southern Cameroon for example, 5,200 people are directly employed in the bush mango value chain, contributing on average to 31% of total household incomes (Ingram *et al.*, 2017). For stakeholders located further away from the forest, the income gains are even more pronounced – contributing an average of 48% of exporters' annual income and 57% of retailers'.

Despite bush mangoes making substantial livelihood contributions, the value chain is increasingly becoming unsustainable because of: a) lack of consistent regulatory control and enforcement; b) continuing high demand; c) low levels of cultivation driven by alternate uses of agricultural land; d) declining wild resources evidenced by harvesters travelling longer distances; and e) clearance of the species' natural forest habitat. Customary tenure that seems to allow access to trees within common forests on a 'first-come, first-served' basis is not compatible with growing demand. Some combination of technical advice, formal and customary rule changes and improved monitoring is required to sustain this market.

Market growth can favour some stakeholders while dislodging others. In Brazil and Indonesia, lack of legal clarity on rights has made households vulnerable to land grabbing (FOE, 2008; Gabay and Alam, 2017). In Malaysia, expansion of oil palm cultivation brought in foreign workers and contributed to wage suppression (Abdullah *et al.* 2011). The Brazilian state has sought to counter smallholder displacement by resettling landless farmers from poor regions and connecting them directly to soy companies. However, rugged geography, small scale operations and high production costs have limited smallholder partnerships with companies (Lima *et al.* 2011). In general, certain characteristics of smallholder operations and high barriers to entry may result in their inability to capture market surplus.

Land speculation fuelled by demand for commodities often contributes to rural conflict, as has been the case in Brazil for example (Nepstad *et al.*, 2006; Nepstad and Stickler, 2008). Likewise in Indonesia, expansion of oil palm has led to community-firm conflicts, exacerbated by weak governance, ambiguous contracts with firms and the failure of firms to meet obligations (Rist *et al.*, 2010). Poverty alleviation requires strengthening of formal and informal governance arrangements that favour poor households and ensure resource use is sustainable (see Box 6.1).

Reforms to commodity markets (see Table 6.1) can change social and environmental outcomes. For instance, about 35-40% of palm oil is produced by small landholders (World Economic Forum, 2017). Thus, strengthening credit, training and technology access can significantly increase productivity and reduce deforestation (World Economic Forum, 2017; 2020). Additionally, buttressing rights can reduce land grabbing, with potential positive environmental outcomes, and jurisdictional approaches may be able to increase transparent decision-making. Smallholders will also need to be supported through institutional innovations that enable them to pool resources and increase market shares (Poole and de Frece, 2010). Additional research on the social dimensions of different supply chain reform initiatives would

help identify whether companies are adopting voluntary practices (Thorlakson *et al.*, 2018) and how they may mitigate poverty (Newton and Benzeev, 2018).

6.3 Climate Change

6.3.1 Introduction

Climate change increases risks to the lives and livelihoods of the *forest-reliant* poor and affects the forest *ecosystem services* on which they depend. These changes will worsen with deforestation, itself a major contributor to climate change (Lawrence and Vandecar, 2015; World Resources Institute, 2018), creating a positive feedback loop (Staal *et al.*, 2020). On the other hand, improved *forest management* offers potential opportunities to mitigate climate change (Griscom *et al.*, 2017) and enable forest and tree dependent households to better adapt to climatic variability (Pramova *et al.*, 2012; Mbow *et al.*, 2014).

6.3.2 Climate change, forests and feedback loops

Climate induced changes have varied effects on forests which also differ according to forest type and region. Changes in temperature, carbon dioxide and precipitation can increase the length of tree growing seasons (Walther *et al.*, 2002), alter the distribution of terrestrial vegetation (Bertin, 2008), shift species' geographic ranges (Hansen *et al.*, 2001; Ortega *et al.*, 2019), influence productivity (Vitasse *et al.*, 2009), increase the risk and intensity of natural disasters such as drought, fires, flooding and insect outbreaks (Seppälä *et al.*, 2009; Staal *et al.*, 2020), and affect *biodiversity* and ecosystem services (Seymour and Busch, 2016), among others. Two key climate effects - increased heat stress and increased frequency, intensity and/or amount of heavy precipitation (Mora *et al.*, 2017; Coffel *et al.*, 2018; Olsson, *et al.*, 2019; Prevedello *et al.*, 2019) – are likely to have direct and forest-induced effects on the lives and livelihoods of forest-proximate communities. Increased flooding (Zhu *et al.*, 2010; Neumann *et al.*, 2015), drought frequency and severity (Sheffield *et al.*, 2012; Steinkamp and Hickler, 2015; Staal *et al.*, 2020), intensified cyclones (Walsh, *et al.*, 2016; Bacmeister *et al.*, 2018) and increased coastal erosion (Alongi, 2015; Johnson *et al.*, 2015; Harley *et al.*, 2017) threaten existing forests and tree-based goods and services. In many locations extreme droughts are predicted to increase the number, intensity, length and severity of forest fires (Jolly *et al.*, 2015; Abatzoglou and Williams, 2016; Knorr *et al.*, 2016; Taufik *et al.*, 2017).

The release of sequestered forest carbon resulting from deforestation, degradation and forest fires produces a significant amount of greenhouse gases, creating a positive feedback loop that accelerates climate change. Averaged over 2015 – 2017, global loss of tropical forests contributed about 4.8 billion tonnes of carbon dioxide per year (or about 8-10% of annual human emissions of carbon dioxide) (World Resources Institute, 2018). Illustratively, on many days, the 127,000 fires that raged across Indonesia in 2015 generated more greenhouse gas emissions per day than daily average emissions from the entire economy of the United States that year (Harris *et al.*, 2015; Seymour and Busch, 2016). Conversely, improved forest management can also act as a natural climate solution (Griscom *et al.*, 2017). Reductions in deforestation and increasing *reforestation* in the tropics can cost-effectively provide some 10-20.9% of the reductions in emissions between 2020-2030 required to meet the Paris 2°C warming goal (Busch *et al.*, 2019).

6.3.3 Implications for forest-poverty dynamics

Climate change directly threatens the forest-reliant poor by destroying assets, impeding livelihoods and reducing ecosystem services (Hallegatte *et al.*, 2015; IPCC, 2018). As forests degrade, those that depend on forests and trees for income and subsistence may have to travel further or even migrate to maintain their livelihoods. Air pollution, water contamination, psycho-social harm and visibility impairment from wild fires can seriously harm human health (Fowler, 2003). Floods, tropical storms, degraded landscapes and landslides in forest landscapes can also lead to loss of human life, livestock and dwellings (Das and Vincent, 2009; Samir, 2013). Even though we do not know where the exact impacts of climate change will be felt most since other factors also impact on where different tree species will be more or less abundant, drier and hotter areas will most likely have negative impacts on livelihoods (Seymour and Busch 2016, Olsson *et al.*, 2019).

Increased drought and loss of evapotranspiration from forests pose threats to agriculture (Lawrence and Vandecar, 2015). Rain-dependent, small-scale farmers who are amongst the world's poorest are increasingly vulnerable to income loss and food insecurity (Damania *et al.*, 2017). Rainfed agriculture, accounting for up to 95% of cropped land in sub-Saharan Africa and 60% in South Asia

and producing most of the world's staple grains (Wani *et al.*, 2009), will likely be affected by increased drought (Cooper *et al.*, 2009). Increasing temperatures, exacerbated by forest loss (Cohn *et al.*, 2019), can also make outdoor labour more hazardous (Suter *et al.*, 2019) and increase mortality (Mora *et al.*, 2017).

Migration will likely be an important *adaptation* response to climate-induced extreme future events (Cattaneo *et al.*, 2019). Migration, as a global trend, is difficult to estimate, but the number of international migrants appears to have fluctuated between 2.7 and 3.3 percent of the world population between 1950 and 2017 (de Haas *et al.*, 2019). Data from 1970 onwards show a steady climb in the number of international migrants from 85 million people (2.3% of the global population) in 1970 to 272 million migrants (3.5% of the global population) in 2019 (International Organization for Migration, 2020). While climate change-induced migration is expected to increase in the future (Marchiori *et al.*, 2012; Missirian and Schlenker, 2017), peoples' movements will vary depending on the speed of climate events (slow or rapid onset), other available adaptation opportunities, household access resources, etc. (Cattaneo *et al.*, 2019). Notably, Rigaud *et al.*, (2018), taking into account demographic, socio-economic and climate scenarios, estimated that there will likely be 143 million 'within country' climate migrants by 2050. There are, however, many uncertainties in projecting future migration, making this a rich area for further research (Cattaneo *et al.*, 2019).

Improved forest management can also play an important role in climate change adaptation. Forest-based climate *mitigation* and adaptation (e.g. reforestation and *restoration* initiatives) can provide new income opportunities for *forest-dependent* communities (Ota *et al.*, 2020). While tree planting projects can have negative impacts on livelihoods if they compete for land used by the poor (Seppälä *et al.*, 2009; Smith *et al.*, 2019), they can also help secure land *tenure* (Guillerme *et al.*, 2011; Ota *et al.*, 2020), reduce soil erosion (Korkanç 2014) and associated flooding (Yin and Li, 2001) and landslides (Pradhan *et al.*, 2012), and potentially increase yields and reduce the risks associated with farming (Maas *et al.*, 2013; Brown *et al.*, 2018). The local (Prevedello *et al.*, 2019) and regional (Cohn *et al.*, 2019) heat-reducing effects of increased tree cover will be particularly important in tropical areas, which are expected to experience higher temperatures (Mora *et al.*, 2017; Coffel *et al.*, 2018). The choice of tree species and location of tree planting will have direct repercussions on poverty alleviation with, for example, some species more likely to provide income through the sale of non-timber forest products such as shea butter from shea nuts (see Chapter 3, Box 3.7). Chapter 5 discusses different levers such as REDD+ and *payments for ecosystem services* (PES) that can be used for improving forest management and conclude that the evidence on their poverty outcomes is somewhat unclear. That said, the body of research on PES is larger and suggests that these schemes are likely to reduce poverty slightly or be poverty neutral as they seem to cover the opportunity costs of conservation.

6.4 The Shifting Landscape of Forest Sector Financing

6.4.1 Introduction

Forest-related financing can be an important driver of poverty alleviation in forested landscapes. The forest sector is generally financed through budgetary allocations from domestic governments, international aid and, increasingly, private sources. The overall and relative amounts from different sources is changing with implications for *poverty reduction*.

6.4.2 Overseas development assistance

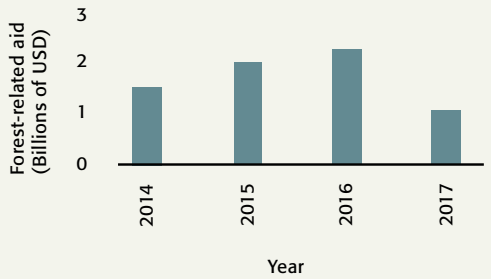
Overseas development assistance (ODA) for forestry generally supports forest protection and improvement, rural economic development and forest-related climate mitigation and adaptation (Environmental Defence Fund and Forest Trends, 2018). Building on previous work (Agrawal *et al.*, 2013), we undertook a review of multi-lateral international forestry aid. Data for this analysis came from the Organisation for Economic Cooperation and Development (OECD), World Bank, Global Environment Facility (GEF), Asian Development Bank, African Development Bank and Inter-American Development Bank databases. Forest-related aid projects in these databases were identified using the following keywords in titles or descriptions: "forest," *"agroforestry,"* "deforestation," or "tree". "Restoration" was not included because the associated projects extended well beyond forests, but *forest restoration* projects were otherwise included in the dataset. Data included forest-related climate financing (e.g. REDD+) to the extent that this was identified through the search terms. To eliminate duplicates, we removed projects with the same name, country and/or committed amount.

Our review suggests that nearly USD 7 billion in international and bilateral aid was allocated to

forest projects during 2014-2017. Average annual forest aid was roughly USD 1.7 billion, a reduction from USD 3.5 billion per year between 2000 and 2013. Not all data were available for 2018 and 2019, but trends at the World Bank and Inter-American Development Bank indicate that funding decreased during these years relative to 2017 by 77% and 53%, respectively. These figures suggest that international forestry aid may be showing a stagnant or declining trend. According to OECD, forest sector aid over the last five years represents 1% of official development aid across all sectors (USD 177.18 billion) (OECD, 2020).

Figure **6.2**

Forest-related international aid, 2014-2017



Source: Authors' assessment based on data from: Organisation for Economic Cooperation and Development (OECD), World Bank, Global Environment Facility (GEF), Asian Development Bank, African Development Bank and Inter-American Development Bank

The geographic allocation of international forest aid was uneven during the period reviewed. Most funding was directed to countries in Asia (USD 3.1 billion), with almost half as much to the Americas (USD 1.4 billion), and about a third as much to Africa (USD 1 billion). Forest-related aid projects cover a range of approaches, including *afforestation/reforestation*, payments for ecosystem services, alternative livelihood provision for forest-proximate people, consolidation of national parks, *sustainable forest management* and agroforestry, among others.

6.4.3 Growth in Private Investments

While systematic data on private financing of the forestry sector is limited and available evidence suggests that private financing falls significantly short of estimated needs (Castren *et al.*, 2014), private forestry impact investments are steadily increasing (Bass *et al.*, 2019; Ginn, 2020). Impact investments are carried out by companies or funds with the explicit goal of generating both private and social returns (Ginn, 2020). Impact investors include a range of investment firms, high net-worth individuals and ordinary, unaccredited individuals (e.g., through the Mosaic platform, people can invest as little as USD 25 in community solar projects (Global Impact Investing Network website; Rodin and Brandenburg, 2014)).

The Global Impact Investing Network (GIIN) estimates that over 1,720 organisations managed USD 715 billion in impact investment assets globally in 2019 (Hand *et al.*, Sunderji, 2020), with 37 funds in Canada, Oceania and the US managing at least USD 9.4 billion directly in forestry and related assets (Bass *et al.*, 2019). These funds represent investments that provide returns from forest products, including timber and forest carbon offsets, while also achieving environmental and social co-benefits (often pursued in part through the use of Forest Stewardship Council and Sustainable Forestry Initiative certifications). The majority of these funds focus on investments in Australia, Canada and the United States, though six of the 37 funds invest in projects in sub-Saharan Africa, Latin America and Southeast Asia (Bass *et al.*, 2019). One standout example is the European based Livelihoods Carbon Funds (not included in the GIIN analysis above), which invested EUR 40 million in forest-reliant livelihood projects in the developing world and plans on increasing investment in a second phase to EUR 100 million (Livelihoods Carbon Funds, 2020). Accurately identifying how much of the investment is directed toward forests is, however, difficult, both because these investments have dual- or triple-bottom lines and may be categorised within larger, less specific categories like conservation projects (Hand *et al.*, 2020), and because reliable data on foreign and domestic private investments in forestry are limited (Castren *et al.*, 2014).

Impact investing adds some of its greatest value when financing enterprises that have few alternative sources of funding and are likely to have long lags before seeing returns (Brest and Burn, 2013). Financing of nascent forestry enterprises and locally-owned small and medium forest enterprises (SMFEs) (see Chapter 5) can generate employment and spread *prosperity* to local forest-dependent communities (Kozak, 2007; MacQueen, 2008; Sanchez *et al.*, 2018; Macqueen *et al.*, 2020). Financing is also mounting in the agroforestry space, with some investors (e.g., Technoserve, 2020) combining business advice with capital investments. Growth in impact investments is

further fuelled through non-profit organisation-investor partnerships (for instance, the Nature Conservancy – Ginn, 2020) and its increasing recognition by multilateral organisations.

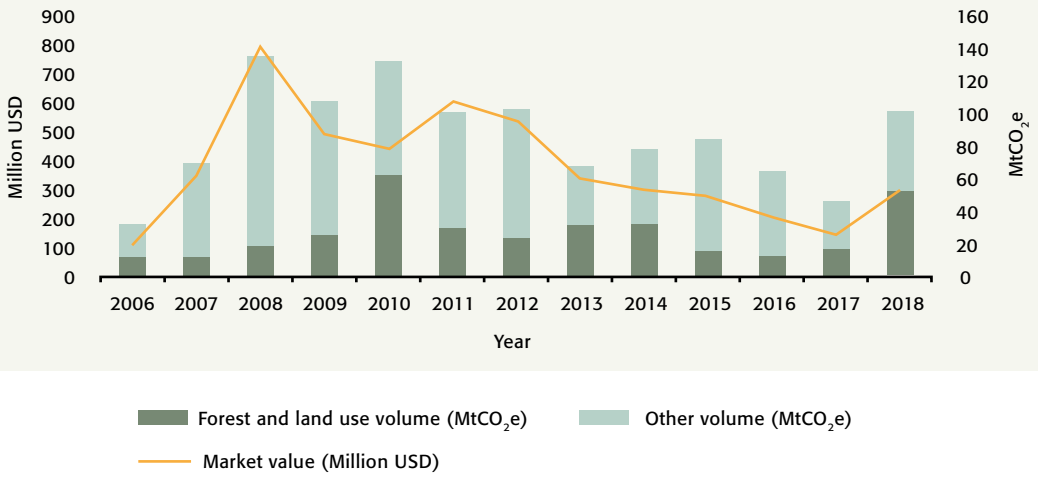
6.4.4 Carbon offsets financing through the voluntary market

Private sector interest in carbon offsets may be on the rise, offering some opportunities and potential pitfalls for addressing the forest-poverty relationship. The voluntary carbon offsets market typically brings private sector funding to Forest and other Land Use (FLU) projects related to afforestation/reforestation, avoided deforestation (e.g. REDD+), landscape management and agroforestry.

Forest fires endanger rural livelihoods and well-being (Galicia, Spain)
Photo © Nelson Grima

Figure **6.3**

Value of the voluntary carbon offsets market in metric tonnes of CO_2 equivalent and millions of US dollars



Source: Data drawn from multiple reports, Forest Trends, State of Voluntary Carbon Market reports (2007-2019)

In order to understand how voluntary carbon market investments have changed over time, we drew on annual data reported in each Forest Trends' State of the Voluntary Carbon Market report from when they began tracking markets in 2006 through 2019 (2006 data reported in the 2007 report, and 2017 and 2018 data reported in the 2019 report). Market value (in millions USD) and total transacted volume of offsets (metric tonnes CO_2 equivalent – $MtCO_2e$) were drawn from total values from the 2019 report (Forest Trends Ecosystems Marketplace, 2019) for all years from 2006 through 2018. Transacted volume of forest and land use (FLU) offsets (in $MtCO_2e$) were drawn from annual reports, which represent minimum estimates due to delays in reporting from surveyed respondents, while "other volume" was calculated as the remainder of total volume minus FLU volume. As such, the percentage of total offsets in each year from FLU presented in Figure 6.3 is likely an underestimate for each year.

As Figure 6.3 shows, the voluntary forest carbon market is still small (~ USD 300 million of financing for all offsets in 2018). However, FLU off-

sets increased by 264% between 2016 and 2018 (relative to a 21% growth in other offsets) (Forest Trends, 2020). The trend in FLU projects may reflect increased media reports on Natural Climate Solutions (Forest Trends Ecosystems Marketplace, 2019). Interest by several large corporations in natural climate solutions may further fuel this trend.

6.4.5 Implications for forest-poverty dynamics

Meticulous data-driven evaluations of the poverty outcomes of overseas forestry aid remain rare. A review of impact evaluation documents on the development impact website (DIME, 2020) of the World Bank, for instance, suggests that there are very few systematic evaluations of forest specific development aid. Public forestry interventions face the same challenges related to outcome attribution confronted by other development sectors. In addition, individual forest-focused public projects often have multiple objectives, making it difficult to identify poverty reduction outcomes that may be tied to one of many components. Large forestry programmes, with multiple investments over many years, can be reasonably assessed using a broad array of indicators and qualitative discussions, see for instance an evaluation of the Programme on Forests (Wells and Altman, 2011), but care needs to be taken to adequately address potential confounding factors (Ferraro, 2009).

An appraisal of the forestry portfolio of the largest donor in the sector, the World Bank, sheds some light on the poverty implications of forestry aid. Shyamsundar *et al.* (2020) show that the World Bank's forestry investments (worth over USD 1 billion and completed between 2002-2015) are mainly in middle-income countries, with low income countries accounting for only 10% of projects. Still, a majority of projects in the World Bank's forestry portfolio included poverty related components such as technical support and training to improve community forestry and/or smallholder plantations, support for nurseries and small-scale forest businesses, strengthening forest rights etc. (Shyamsundar *et al.*, 2020). In general, the limited evidence on poverty outcomes of forestry aid points to the need for careful evaluations, an area for further research. That said, poverty alleviation through forest-related aid is unlikely to increase given the stagnancy in overseas forestry assistance identified in Section 6.4.2.

Private sector financing in the form of impact investments usually complements public or private non-profit financing (see examples in Ginn, 2020). Consideration of co-benefits, including poverty reduction, by the carbon offsets market appears to be increasing. Over the 2016-2018 period, the volume of projects certified using a combination of Voluntary Carbon Standard (VCS) and Climate, Community and Biodiversity (CCB) offsets, both of which pay attention to social outcomes, increased by 325%, while total offsets only increased by 53%, indicating market preference for projects with social and biodiversity co-benefits (Forest Trends Ecosystems Marketplace, 2019). Currently 126 projects are under consideration with the CCB standard in *low- and middle-income countries* (Verra Registry Database, 2019).

Even though private sector forestry financing is steadily increasing, both public and private investments remain small relative to, for example, the financing required for large scale restoration (Castren *et al.*, 2014). Growing global social movements and attention to Indigenous communities and local peoples (Sauls, 2020) may nudge forest-related private investments toward social outcomes. However, to prevent worst case scenarios of land grabbing and corporate 'greenwashing', increases in impact investments would need to be matched by an equal empowerment of local communities and monitoring of social outcomes. Furthermore, to ensure that the voluntary carbon offsets market meets social objectives, standards need to pay better attention to issues such as income predictability, transaction costs and meaningful local participation, especially for and among smallholders (De La Fuente and Hajjar, 2013; Melo *et al.*, 2014).

6.5 Technological Change and Interconnectivity

6.5.1 Introduction

Pathways that link forests and livelihoods are moderated and mediated by material technology. These technologies affect forest-livelihood relationships by, for example, improving information available on forest resources, providing more accurate and scalable methods for forest monitoring and connecting forest proximate peoples.

6.5.2 The rise of geospatial data

Changes in bio-geophysical data availability, remote sensors and computational speed have improved the ability to monitor and study forest-livelihood relationships. Rapid advances over the past thirty years in computing and internet technology have contributed to publicly available, high-resolution earth observation data,

enabling reliable and replicable assessments of global land cover change (Loveland and Dwyer, 2012). Since 2008, a variety of products and new remote sensors have enhanced forest monitoring and evaluation, with high-resolution tree-cover maps produced from Landsat data beginning in 2000 (Hansen *et al.*, 2013) being the most widely utilised. The Hansen *et al.* (2013) dataset has since been used to identify a variety of forest-related trends such as intact *primary forest* landscapes (Potapov *et al.*, 2017) and drivers of tree-cover loss (Curtis *et al.*, 2018). Public and private satellites that provide higher-resolution imagery, LIDAR technology piloted on unmanned aerial vehicles (UAVs), and the use of artificial intelligence (AI) to analyse data, compose the newest frontier of spatial data and analysis. Satellite imagery at resolutions greater than 30 m per pixel help identify fine spatial patterns and changes in forest structure (Steven *et al.*, 2003; Kayitakire *et al.*, 2006). LIDAR imagery enables three-dimensional analyses of canopy height and density, facilitating assessments of tree diversity and forest structure (Ferraz *et al.*, 2016; Ganivet and Bloomberg, 2019). Real-time forest monitoring provides information on where and when forest cover change occurs, improving ability to track forest loss hotspots and forest fires (Davies *et al.*, 2009; Wheeler *et al.*, 2014; Hansen *et al.*, 2016). Enhanced availability of spatial data also generates novel ways to monitor forest ecosystem services. For example, Global Forest Watch provides a variety of publicly available spatial data on forest cover to aid in the analysis of when, where and why forest landscapes change (Global Forest Watch, 2014). Combining data from different sensors, which enables the estimation of above-ground forest carbon (Asner *et al.*, 2010; Le Toan *et al.*, 2011), with spatial data on the extent of forest cover, can help identify a suite of carbon-related services and other ecosystem services (Martínez-Harms *et al.*, 2016).

6.5.4 New technowlogies that affect monitoring and evaluation of forest products

Several new monitoring technologies improve the ability to monitor and regulate products provisioned by forest systems (Marvin *et al.*, 2016). These technologies include acoustic sensors and UAVs equipped with alternate sensors and biomonitoring. Acoustic sensors record and process sound to provide information about forest systems and biodiversity. Combining spatial data with bioacoustics data can test the assumption that forest conservation and regeneration lead to biodiversity conservation. Standard usage of UAVs for conservation include the use of high-resolution imagery and image classification to spot and count wildlife, map land cover and promote real-time monitoring of protected areas (Wich and Koh, 2018; Iacona *et al.*, 2019). UAVs are also able to detect poachers and poaching in real-time (Kamminga *et al.*, 2018). Forensic science uses visual, chemical and genetic techniques to determine the origin of a wood samples (Dormontt *et al.*, 2015). Combining rapidly advancing forensic technology to ascertain the origin of wood samples promises to reduce illegal logging and strengthen legally sourced supply chains (Tnah *et al.*, 2010; Sasaki *et al.*, 2016). Box 6.2 provides an example of how forest communities in Guatemala have been able to use UAVs to serve their needs.

Tree-based systems can help rural people meet their daily needs (Viñales Valley, Cuba)
Photo © Daniel C. Miller

Box **6.2**

Global norms and technology have shaped community forest management in Guatemala

The case of the Association of Forest Communities of Petén (ACOFOP) in northern Guatemala highlights the role of technology in increasing community decision-making over forest resources. Since 1995, ACOFOP has promoted a community forest concessions model that allows local communities in and around the Maya Biosphere Reserve the right to sustainably harvest timber and non-timber forest products like the xate palm, three species of the *Chamaedorea* genus and *ramón (Brosimum alicastrum)* nut. Through strengthened local governance, collaboration with international and local non-governmental organisations, community-led technical support and consistent funding over the start-up period, ACOFOP's member communities have achieved success in reducing deforestation, virtually stopping forest fires and increasing community well-being, through individual income and the expansion of community health and education services (Stoian *et al.*, 2018).

Two technical factors contribute to ACOFOP's success: i) enhanced affordability and accessibility of geospatial data, software and emerging technologies; and ii) the rise of hand-held communication technologies, particularly mobile phones with access to social media (Sauls, 2020). Since 2016, the international NGO Rainforest Foundation has trained community forest stewards in the use of UAVs and open-source GIS technologies to support their efforts to monitor forest fires and deforestation along their concession borders. With these tools in hand, in addition to now easy-to-access data from sources like NASA's Fire Information for Resource Management System, ACOFOP has been able to respond quickly to fire threats. Increased mobile phone ownership and broad access to social media also play a role in turning these successes into narratives that can reach a broad public, helping ACOFOP gain allies nationally and internationally. These allies in turn play an important role in advocating for the ACOFOP model. The two technology trends are increasingly important for ACOFOP's current struggle to renew community concessions, which will expire over the 2021-2025 period. As of January 2020, the first community organisation to receive its concession, Carmelita, had just received approval of its request for renewal.

Increasingly, private-sector actors are also using enhanced technology to provide goods and services that will affect forest-poverty pathways. In 2017, Microsoft began a USD 50 million project to spur innovation and application of AI for the monitoring, modelling and management of environmental resources (Joppa, 2017). This project partners with organisations to use AI to better interpret and analyze data on ecological systems.

6.5.5 Social media, networks and the rise in user-group connectivity

Mobile phone accessibility can enhance access to market information, facilitate peer-to-peer learning, and ease logistics planning for smallholders. However, the impact of these innovations for forest-dependent communities is unclear (Duncombe, 2016), with mobile phones, thus far, playing a limited role in directly contributing to increased income (Sife *et al.*, 2010; Baird and Hartter, 2017). That said, mobile phones as a vehicle for access to social media show much promise. Social media engagement enables knowledge exchange, network building and political claims-making for communities whose livelihoods depend significantly on forest resources (see Box 6.3 on the use of social media by Guardians of the Forest Alliance). It also serves as an additional way to interface with official accounts about forest resources and governance. Indigenous and forest community groups connect through applications such as Facebook and Twitter in order to develop alliances in favour of community forest rights, pursue 'boomerang effects' (galvanising international attention and support) that pressure national governments to respect or support local management of forests and to share news about specific phenomena (Keck and Sikkink, 1998; Sauls, 2020). Mobile phones and more accessible photovideo technology also enable forest communities to capture and share their own narratives (e.g. see "If not us,

then who", 2020) (Mitchell-Walthour, 2020). Members who engage in international trainings or exchanges use social media to maintain networks, which serve to disseminate best practices around sustainable forestry and effective advocacy (Bebbington *et al.*, 2018a; Sauls, 2020).

Box **6.3**

Indigenous and local communities and the boomerang effect of social media

In 2019, members of the Guardians of the Forest Alliance (composed of Indigenous and forest community groups from the Amazon, Central America and Mexico, the Congo Basin and Indonesia) used social media (primarily Facebook) to share news ranging from the case of a municipal (non-Indigenous) government chopping down peri-urban trees in the Honduran Muskitia to first-person alerts about major forest fires in the Brazilian Amazon. Groups from disparate regions shared and re-Tweeted news using tags such as "#landrightsnow", "#GuardiansoftheForest", "#AmazonFire" and versions in local languages, amplifying the voices of specific forest peoples and the Alliance's common cause of enhancing Indigenous and community forest rights, especially in the face of climate change. The interconnection between Indigenous groups, bolstered through social media connections, has enabled a consolidation of core discourses and claims, creating a cohesive agenda on Indigenous forest rights at the international level, even while local conditions vary greatly (Sauls, 2020). For forest groups, social media provides an explicit tool for 'boomerang effect' politics as well as a platform for mutual support, advice and visibility (Virtanen, 2015).

6.5.6 Implications for forest poverty dynamics

Spatial data provides a way to identify and monitor forest resources that is replicable, reliable and low-cost. In addition, use of spatial data can be helpful in designing mechanisms such as payments for ecosystem services (Mitchell *et al.*, 2017; Curtis *et al.*, 2018; World Bank Ecofys, 2018), which may bring forest-reliant communities additional financing, strengthen the argument for community-based forest management (Blackman *et al.*, 2017; Santika *et al.*, 2019) and facilitate the mapping and monitoring of Indigenous territories, thereby reducing risks from external threats (Paneque-Gálvez *et al.*, 2017). In general, however, enhanced availability of material technologies improves the detection of forest cover change, but does not provide immediate solutions to address the complexities of forest-related policies, land tenure, monitoring and enforcement challenges (Gaveau *et al.*, 2017; Erbaugh and Nurrochmat, 2019).

Through advances in acoustic sensors, data from UAVs and forensic timber science promise to improve forest management, use and regulation. Such technologies provide new opportunities for employment for technologically literate forest proximate people, advance opportunities for research on forest areas, strengthen sustainable supply chains and can contribute to community-based management or co-management of forest areas (Bellfield *et al.*, 2015; Marvin *et al.*, 2016; Iacona *et al.*, 2019). They may also help curtail human-wildlife conflict, a major cause of crop raiding, injury and even death in many tropical forests (Nyhus, 2016).

Improved technologies commonly reinforce regulations that limit extra-legal benefits enjoyed by forest proximate people, with governments tracking illegal expansion of commodity agriculture or of local populations into state forests (Musinsky *et al.*, 2018). Thus, technology-assisted monitoring can reduce benefits to forest proximate people who do not hold secure forest management or access rights.

Advanced technology generally remains the purview of experts (states, researchers and NGOs). This exclusivity means that many communities rarely use it in their own interests. Thus, unless capacity building is included in rolling out such technologies, the ability of rural communities to use these tools to support and enhance their own livelihoods may be limited. New Apps such as TIMBY (This Is My Backyard) that allow communities to monitor illegal logging (The Goldman Environmental Prize) and technology-wielding associations such as ACOFOP in Guatemala (Box 6.2) provide counter examples. Even in the case of ACOFOP, however, the deployment of LIDAR, contributing to the 'discovery' of additional Mayan ruins, has catalysed new interest in displacing forest communities (Devine, 2018).

Social media connects forest proximate people and appears to be increasingly important as a tool for sharing information, spurring innovation and garnering attention. Democratising the use of ma-

terial technology and the interpretation of data is a critical next step in empowering communities to manage forest resources and directly alleviate poverty.

6.6 Global Socio-Political Movements

6.6.1 Introduction

Climate and biodiversity loss have transitioned from topics primarily discussed by biophysical scientists to issues of widespread public concern backed by international efforts to synthesise scientific evidence (Díaz *et al.*, 2018; IPBES, 2019; IPCC, 2019). A range of global social movements, including the spread of protests against *inequality* and racism and in support of Indigenous peoples' rights and climate change action, and countervailing forces, including anti-environmental populism, shape contemporary politics around forests and the forest-reliant poor.

6.6.2 Changing political and civic landscapes

The last few years have seen changes in global discourses, as well as political priorities relating to forests and the environment. In several countries, governments are rejecting climate mitigation policies and other associated environmental priorities that require leaders to use short-term political capital for long-term economic and environmental gains. The United States' withdrawal from the 2015 Paris Agreement exemplifies this trend; however, it finds resonance in the re-positioning of several other governments, including countries such as Brazil, with significant forests upon which minority people rely (Fearnside, 2018; McCarthy, 2019).

The changing political landscape portends potential conflicts between priorities at national and international scales, particularly real and perceived trade-offs between conservation and forest-based economic development. It has brought renewed attention to frontier resources and the opportunities they offer (Rasmussen and Lund, 2018) contributing, in some cases, to a call for reducing environmental and social protections for the peoples and ecosystems in frontiers (de la Vega-Leinert and Schönenberg, 2020). An ongoing, and potentially deepening, commitment to extractivism as the basis of development, especially in contexts of resurgent populism on both the right and left, may pose a renewed threat to forests and their inhabitants as political shifts erode human and environmental rights (Bebbington *et al.*, 2018a; 2018b; 2018c).

The contemporary moment also features a major counter-current to national anti-environmental political shifts. Public awareness of the threat posed to *human well-being* from environmental change and the nexus between unjust practices and governance structures, and unsustainable practices is at an all-time high (Lee *et al.*, 2015; Fagan and Huang, 2019). The climate youth movement, for example, has become increasingly popular and inspired by youth activists such as Greta Thunberg, Autumn Peltier, Bruno Rodriguez, and many others. In September of 2019 alone, there were over 2,500 events scheduled in over 150 countries to sound the alarm about the climate crisis (Tollefson, 2019). Other movements such as the Extinction Rebellion call for nonviolent civil disobedience to compel governments to act before biodiversity loss and rising temperatures reach a tipping point. Forests – and other 'natural climate solutions' (Griscom *et al.*, 2017) – are central to the demands made by these movements, which are occurring simultaneously with other mass movements demanding political accountability (e.g. Brazil, Chile, France, Hong Kong and the US) and the fusing of environmental and social justice concerns (e.g. Green New Deal in the US or the European Green Deal) (Wright, 2019).

6.6.3 Indigenous rights and social justice movements

Since the 1980s, Indigenous Peoples and forest communities' historic rights over global forest lands have slowly gained recognition. Indigenous Peoples and local communities are estimated to have legal rights to over 15.3% of forestland in the 58 most forested countries in the world (Rights and Resources Initiative, 2018), although the actual figure is likely to be much higher. The growing recognition of Indigenous and community rights over forests reflects shifts in development and environmental conservation theory, as well as self-identified and well organised forest-dependent communities staking their ancestral claims to land and resources. When faced with local protest while implementing reforms to decentralise forest governance and regularise landholding, major development donors, such as the World Bank, increasingly supported formalised, collective land rights arrangements (Jackson and Warren, 2005; Bryan, 2012; Anthias and Radcliffe, 2015). Since the 1990s, the failure of exclusionary models to achieve biodiversity and forest conservation has also led to the inclusion of Indigenous and local communities via extractive reserves, Indigenous and Afro-descendent territories, and

Deforestation can affect the livelihoods of millions of people. Two men are preparing lunch in the forests of Lao PDR. Photo © Nelson Grima

co-management arrangements. Whether rights to forests support ecological and social well-being depends partially on the institutions and practices of Indigenous Peoples and local communities, especially as they interact with dominant economic forces and external institutions (Robinson *et al.* 2014; Bebbington *et al.*, 2018a). It also depends on the degree to which governments continue to respect and uphold the rights of forest groups or use force, increasingly prevalent, to suppress civic action to achieve social and environmental *equity* (Middeldorp and Le Billon, 2019; Scheidel *et al.*, 2020).

In the middle of the COVID-19 pandemic, 2020 has also seen a reckoning related to discrimination, especially anti-Black racism, and injustice based on racial, ethnic, and religious identity in many countries around the world. Building from previous protest waves in the UK, South Africa, Brazil, and the US in particular, this emerging international movement has raised awareness of institutionalised racism across many countries and sectors, including the environment (Finney, 2014; Knudsen and Andersen, 2019; Miles, 2019). While these protests have, on the one hand, highlighted how marginalised groups are harmed by policies of the state, they have also underscored how excluding diverse voices in professionalised forestry, conservation and development organisations may lead to an undervaluation of the lived experiences of minority groups and their experiences in nature (Finney, 2014; Kloek *et al.*, 2017; Hays, 2019). The current movement is already spurring reflection on how forest conservation and management might become more inclusive, including by directly grappling with legacies of colonialism and dispossession that have disproportionately affected Indigenous people and people of colour (Mollett and Kepe, 2018).

6.6.4 Implications for forest-poverty dynamics

New environmental movements, including youth protests, are pushing governments toward action on climate change, often rallying around visible threats like forest fires. These efforts, reinforced by global dissatisfaction with increasing inequality, and layered onto ongoing Indigenous rights' movements, often view social and environmental justice as paired goals. This combined set of priorities could substantively address poverty in forested areas; however, whether attention translates into action – and whether actions to address climate change and forest loss are inclusive of the needs of forest-proximate and dependent communities – depends on broader political conditions.

The concurrent rise of governments that are promoting extractivism as a mode of economic development, exemplified in 2020 by Brazil and the US, provides a direct challenge to environmental movements. The anti-environmental perspectives held by these governments, and other business leaders, may sacrifice forests and the environment for economic growth, but with potentially limited poverty alleviation impacts.

Many of the world's Indigenous communities depend on forests for their livelihoods, making land rights and secure access to forests a priority for these groups (Rights and Resources Initiative, 2018). Additional major challenges to the social well-being of forest-reliant peoples relate directly to political conditions, including extractivism, the roll back of social protection, illicit activities (such as illegal mining, poaching and narco-trafficking) and corruption across scales (Devine, 2014; McSweeney *et al.*, 2014; Yagoub, 2014; Tollefson, 2016). While the causal link between Indigenous and community forest rights and poverty alleviation is mixed and systematic data are lacking, case study-based evidence (identified in previous chapters) suggests that income and community-provided social services increase with greater control of forest resources (Bocci *et al.*, 2018). The many institutional and contextual factors that can influence community-forest relations, as well as the range of land rights typologies, definitions of poverty and methodologies for assessment, make comparative analyses difficult (Fisher *et al.*, 2008; Hajjar *et al.*, 2016; Cheng *et al.*, 2019).

How the world's forests and tree-based land uses serve as a sustainable means for people to move out of poverty will at least partly be shaped by interactions between, and the combined consequences of, global anti- and pro-environmental forces. Emerging social trends against racism and inequality may also lead to a more pro-poor environmentalism, which could bring additional support to Indigenous communities and local peoples.

6.7 The Spread of Infectious Diseases

6.7.1 Introduction

Infectious diseases are an important cause of global morbidity and mortality, responsible for some 10 million deaths or 1/5th of all deaths worldwide in 2016 (Hay *et al.*, 2017). The past two decades have seen a rise in emerging infectious diseases (EIDs), such as Ebola, SARS, MERS, the novel Coronavirus (COVID-19) and others, which is likely to continue (Centers for Disease Control, 2020; Allen *et al.*, 2017). Some 70% of EIDs originate from interactions among wild and/or domestic animals and humans (Morse *et al.*, 2012).

6.7.2 Zoonoses and anthropogenic changes

Research over the past several decades has documented the importance of forest loss and increasing forest edge for established vector-borne diseases such as dengue and malaria (Husnina *et al.*, 2019; MacDonald and Mordecai, 2019; Chaves *et al.*, 2020). However, zoonoses, or diseases that spread from vertebrate animals to humans (WHO, 2020a), have received relatively less widespread global attention until COVID-19 (Di Marco *et al.*, 2020).

Anthropogenic changes, including deforestation and expansion of agricultural land that increase contact between humans and wildlife, intensification of livestock production near wildlife areas, and increases in hunting and trading of wildlife all contribute to zoonoses (Allen *et al.*, 2017; Dobson *et al.*, 2020). Deforestation and biodiversity disruption can create new breeding habitats for disease vectors by changing the ecological conditions that regulate predator-prey relationships and make wildlife more vulnerable to disease (Pongsiri *et al.*, 2009; Keesing *et al.*, 2010). Climatic changes, such as increases in temperature and changes in precipitation patterns in forested areas, can also change the geographic range, population density, prevalence of infection by zoonotic pathogens and the pathogen load in individual hosts and vectors (Mills *et al.*, 2010). Trade in wildlife and wet markets contribute to zoonoses by increasing contact between animals and humans (Bell *et al.*, 2004; Wolfe *et al.*, 2005; Dobson *et al.*, 2020). This may have been the case with the COVID-19 virus (Sohrabi *et al.*, 2020), though there are some prevailing uncertainties (Zhang and Holmes, 2020), particularly because the emergence and spread of zoonoses can take different complex pathways (Epstein *et al.*, 2006; Altizer *et al.*, 2011).

6.7.3 Implications for forest-poverty dynamics

The reduction of infectious disease is directly tied to SDG 3 on health, which aims to "ensure healthy lives and promote wellbeing for all at all ages." Health pandemics also bring enormous economic disruptions, eroding capacity to meet SDG 1.

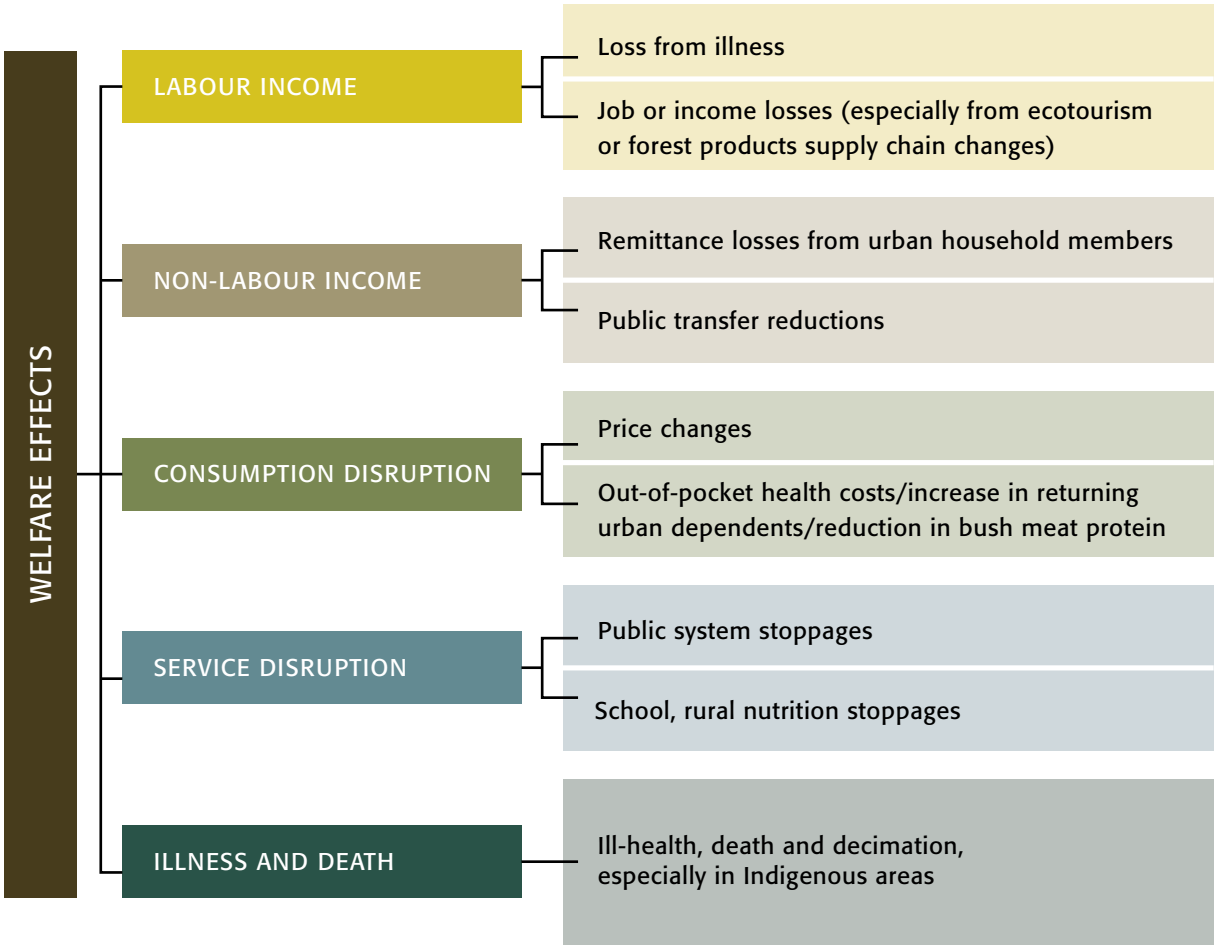
The Ebola outbreak (which had killed more than 11,000 people in West Africa by 2016 (Centers for Disease Control, Ebola, 2019) may have contributed to a 12% reduction in the combined GDP of Guinea, Liberia and Sierra Leone relative to pre-Ebola expectations, and changes in economic

transactions across several other countries in Africa (World Bank, 2015). COVID-19 as of 5 October 2020 had affected over 35 million people, resulting in over one million deaths worldwide (WHO, 2020b). Varying estimates suggest that the global economy may contract by 3% (I.M.F., 2020) to 5% (World Bank, 2020) in 2020. Assuming a 5% contraction of the global economy, rural populations in extreme poverty are expected to increase by 15% globally (Laborde *et al.*, 2020). Notably, in many parts of the world, COVID-19 is occurring where the background rate of malaria, dengue and other infectious diseases already take a huge health toll (Lorenz *et al.*, 2020; Saavedra-Velasco *et al.*, 2020).

The pathways through which the welfare effects of COVID-19 will manifest are identified in Figure 6.4, with implications for many other EIDs. For the forest-reliant poor, changes in labour and non-labour income are likely, especially if their work is tied to forest-related tourism or disrupted global forestry supply chains. The implications of the complete stoppage of ecotourism, identified as a critical lever for poverty reduction in Chapter 5, is particularly dire. Household consumption can decline as dependents increase, with urban members returning, laws against bushmeat hunting are strengthened and, public services drop (CIFOR, 2020; Shyamsundar, 2020; World Bank, 2020). In remote Indigenous territories, EIDs can pose a serious existential threat because of limited access to immediate health care and ability to reduce spread, once exposed (Conde, 2020; Taylor, 2020).

Figure **6.4**

COVID-19 Implications for the forest-reliant poor



Source: Adapted from Fig. 1 in World Bank (2020): Poverty and Distributional Impacts of COVID-19: Potential Channels of Impact and Mitigating Policies and TNC Internal Brief on Rural Communities (2020)

There are potential positive feedback loops between health shocks and rural poverty (Rohr *et al.*, 2019). Forests tend to act as a safety net when rural communities face covariate shocks (Wunder *et al.*, 2014). Thus, pandemic-related economic shocks may lead rural communities to increase their extraction from forests, contributing to deforestation and degradation, with additional indirect negative effects on household welfare (Shyamsundar, 2020). Initial findings from Madagascar, for instance, note an increase in fires and forest clearing near protected areas as people who normally relied on tourism income prepare to invest more in agriculture (Eklund *et al.*, 2020). In addition, macro-policy responses to the economic contractions resulting from COVID-19 may lead to a reduction in ODA, including funding for forests, and incentivise governments to loosen regulations around forest protection, potentially undermining subsistence and forest-based income and forest rights (Bebbington *et al.*, 2018b; Gonzales, 2020; Vila Benites and Bebbington, 2020).

Policies to deal with risks associated with zoonoses have so far been largely reactive, focusing on disease investigation and vaccine development. Moving forward, options for public investments such as the OneHealth approach, which seek to integrate ecological and human health considerations, offer an integrated model to tackle zoonoses (Centers for Disease Control, 2020; Di Marco *et al.*, 2020). Given the enormous costs and welfare implications of the COVID-19 pandemic, it would be cost-effective to invest in 'preventive' policies (Dobson *et al.*, 2020). These may include a range of strategies: reduction in forest fragmentation and livestock and agricultural production in proximity to wildlife, increase in forest buffer areas, rural health clinics, and wildlife trade restrictions, improved wildlife and livestock disease surveillance etc. (Bloomfield *et al.*, 2020; Di Marco *et al.*, 2020; Dobson *et al.*, 2020). To the extent that the forest-reliant poor may be involved in the pathways leading to zoonotic epidemics, public investments that strengthen food supply chains, provide alternatives to illegal wildlife use and trade, and reduce unmanaged encroachment of natural areas may offer triple win opportunities.

6.8 Conclusions: Global Forces of Change and Poverty Alleviation

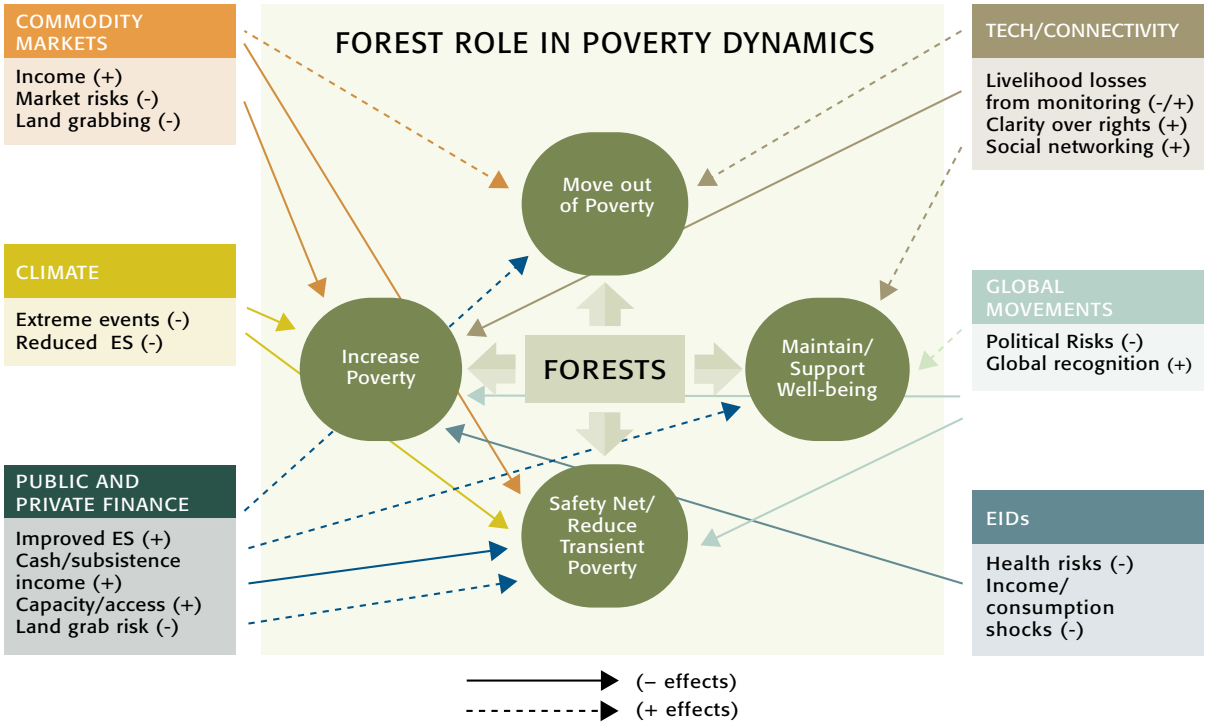
This chapter discussed six major global forces that are likely to influence forest-poverty dynamics. While these forces are not entirely new, they are growing in significance. It is likely that their impact on the forest-reliant poor will increase because of the precarity and *vulnerability* of the poor. However, these global forces also present opportunities for poverty alleviation. Changes in forest cover and global and local responses to these changes will influence how forest-poverty dynamics are affected. These considerations are discussed below and illustrated in Figure 6.5 (see also Table 6.2).

As discussed in Chapter 2, forests play an important role in poverty alleviation. They can help maintain peoples' well-being by supporting subsistence needs, act as a safety net by helping to reduce risk by smoothing consumption, and can be a source of prosperity if people can add value to forest resources. Forests can also have negative impacts on well-being, such as through land use and wildlife conflicts that can push people further into poverty. As illustrated in Figure 6.5, the simultaneous occurrence of multiple global forces has implications for forest-poverty dynamics. For example, as previously discussed, climate change and EIDs pose health and economic risks to the forest-reliant poor that may together push larger numbers of households into transient or extreme poverty. At the same time, some of these global forces may prove to be powerful counter-measures. For example, public finance can help people move out of poverty (e.g. through capacity building or access to credit) and support well-being by strengthening ecosystem services (e.g. reforesting watersheds to improve water quality and reduce flooding). Private financing can increase cash income flows (through payments for carbon, for example), enabling smallholders to build assets to move out of poverty and better adapt to climate change. Advanced technology, wielded well, can clarify rights, reduce land conflicts and help poor communities access markets. Interconnectivity is also a powerful tool for social networking, helping Indigenous communities, for instance, to maintain their traditional uses of forests. However, rapidly emerging technologies can also increase poverty in cases where technical forest monitoring reduces subsistence forest uses.

The futuristic review undertaken in this chapter suggests that global changes offer both opportunities and risks to the forest-reliant poor. However, as Figure 6.6 shows, in a 'business as usual' scenario, the multiple risks posed by global changes to the forest-reliant poor may well overshadow any opportunities for poverty alleviation. This is largely because poor households have limited capacity or resources to take advantage of new opportunities. Nevertheless, strategies exist to reduce risks and improve conditions that would allow the poor households to be pushed out of poverty by these

Figure **6.5**

Global forces and implications for forest poverty dynamics



Note: ES = Ecosystem services, EIDs = Emerging infectious diseases

global forces (see Table 6.2). Cross-sectoral strategies, such as OneHealth, that transcend the silos of health, biodiversity conservation and poverty alleviation, for instance, may mitigate risks and lead to alternative models of development for forest landscapes.

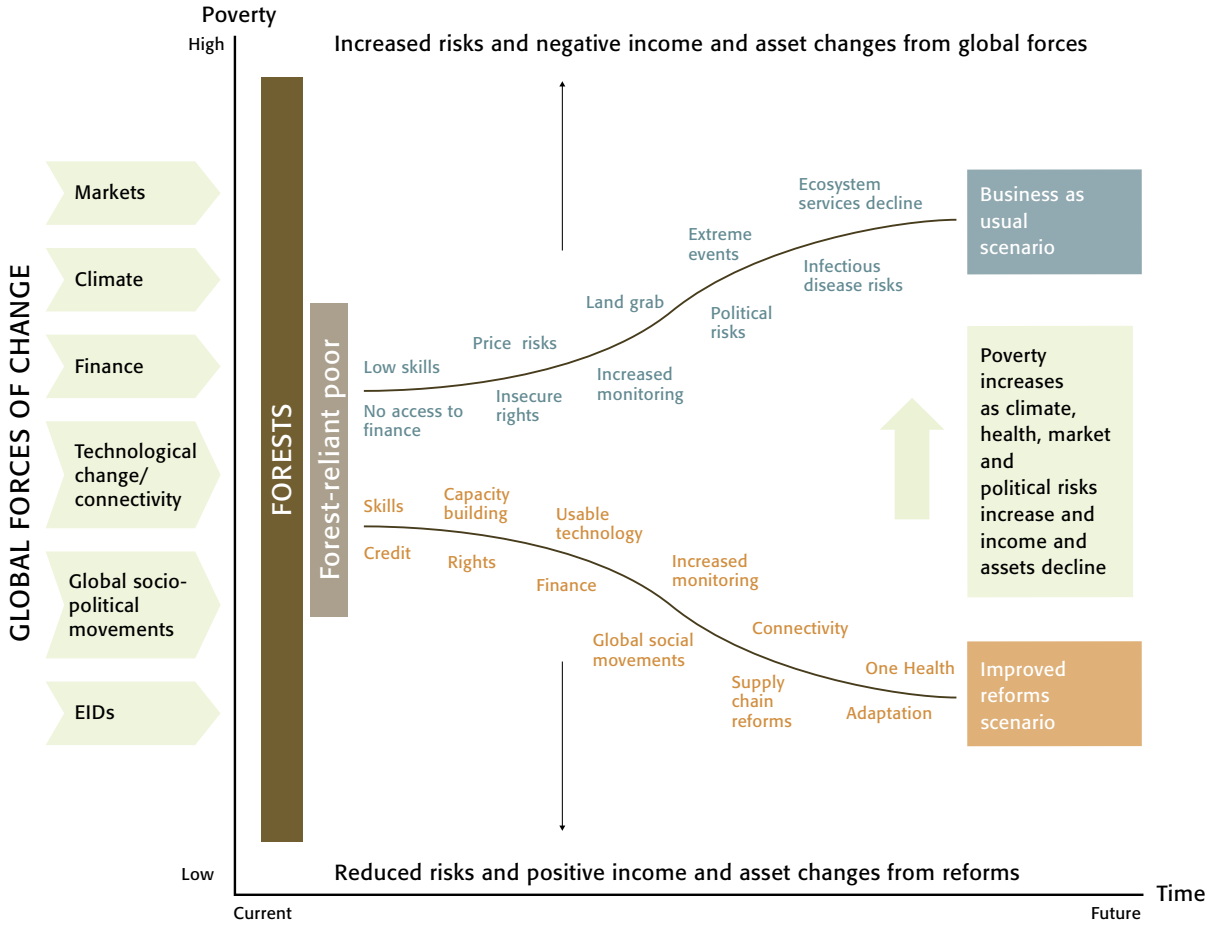
Figure 6.6. identifies a potential 'improved' future scenario for the forest-reliant poor with measures undertaken to reduce global risks and strengthen capacity to manage risks and opportunities. Specific measures may include:

- financing of commodity supply chain reforms (strengthening transparency, training, skills and resources for smallholders to access global value chains);
- technologies that work for the poor (including those that enable monitoring of investments and commodity flows);
- strengthened land rights, particularly of Indigenous peoples;
- OneHealth actions (buffer areas between agriculture and livestock production and forests, wildstock and human disease surveillance, alternatives to wildlife trade);
- investments in climate adaptation that reduce exposure to natural disasters and stabilise ecosystem services; and
- global social movements that boost the voice of forest-reliant peoples.

Many of these strategies can work in concert with, and build the enabling environment for promising levers of change, such as community forest management, ecotourism, agroforestry, and small and medium forest enterprises, discussed in Chapter 5.

Figure **6.6**

Business as usual versus improved scenarios where the net effect of the risks and opportunities posed by global forces are positive for poverty alleviation



Many of the global changes discussed in this chapter act as shocks to households – they manifest as negative health impacts, land losses, land-use conflicts, loss of resource access and political support, among others. However, they may also open up new opportunities, contributing to income and employment and enhancing remote people's ability to connect to the rest of the world. Empowering the forest-reliant poor with strengthened self-governance and technical skills represents an opportunity. Democratising the use of technology and data interpretation will further help to empower forest communities. Capacity building and support contribute to facilitating the use of these technologies and to build the *resilience* of the poor in the face of climate change impacts. The role of private financing in forest management and its increasing recognition of the importance of social and environmental outcomes can also be a welcome development.

There are large gaps in knowledge related to both global trends and forest-poverty dynamics. The written literature on varying effects of climate change on the forest proximate poor or of market supply chains on human welfare, for instance, is limited. Thus, our analyses related to global changes depend, in part, on historical evidence or conceptual theories of change. Furthermore, the analysis in this chapter does not address meta trends such as urbanisation or economic globalisation that have indirect, but potentially large, though uncertain, effects on the forest-reliant poor. It is also unable to do justice to the uncertainties related to available projections in future global changes. For instance, while at least one major study projects the likelihood of 143 million 'internal' climate

migrants by 2050 (Rigaud *et al.*, 2018), many uncertainties regarding migration projections prevail (Cattaneo *et al.*, 2019). Climate-induced local and global migration are rich areas for future research.

The net effects of global forces of change on forest-poverty dynamics will vary across local contexts based on the enabling conditions discussed in Chapter 4, and the effects of global forces on the levers identified in Chapter 5 warrant further study. Research into measures across sectors that account for the combined strength of these (and other) global forces may serve to improve outcomes on forest-poverty dynamics and lead to alternative models of development for forest landscapes.

Agroforestry systems provide a wide range of direct and indirect ecological and socioeconomic benefits
Photo © Daniel C. Miller

Table **6.2**

Global forces: First order effects

GLOBAL FORCES	FIRST ORDER DIRECT EFFECTS				
	Cash Income	**Contributions to Subsistence Income**	**Ecosystem Services**	**Non-material Well-being**	**Critical Insights**
Commodity growth	+ Increased incomes for farmers + New employment opportunities for rural labourers + Increase in income, capital accumulation, and higher expenditures on food, health, education, and durable consumer goods in smallholder farm households + Benefit non-farm households through gains in employment and income + Supports formal sector jobs outside of agriculture – Wage income may decrease if outsiders migrate into region – Land speculation may make it costly for smallholders to acquire land assets	– Land grabbing and land use conflicts can reduce subsistence income + Increased yields and income may occur through agroforestry	– Deforestation associated with commodity markets may reduce ecosystem services (e.g. clean water), increase disease vectors (e.g. malaria) + Deforestation may also reduce some negative externalities (e.g. human-wildlife conflicts)	– Land use conflicts may reduce well-being, particularly of Indigenous communities	◗ Governance and security of tenure critical for reducing land grabbing and deforestation ◗ Commodity markets have multiplier economic effects that go beyond local communities; labour movements may suppress wages in local areas ◗ Market and price risks prevail ◗ Characteristics of smallholders (small scale, limited knowledge and networks, power imbalances when partnering with large corporations, lack of access to credit etc.) may make it difficult for poor to gain from commodity markets
Climate change	– Assets lost to natural disasters could limit earning potential +/– Unclear how shifts in tree composition/range may change abundance of species of value	– Changes in forest composition may increase time costs of forest product collection	– Loss of forests from phenological changes, natural disasters, and pest outbreaks would reduce the availability and quality of ecosystem services	– Increased disease and insect outbreaks may expose people to zoonotic diseases	◗ The impact of changes in range and composition may or may not be positive based on wether forest biodiversity of value becomes more or less abundant

	– Exposure to insect and pest spread in forest can have negative consequences for crops adjacent to forest + new economic opportunities linked to REDD+	– Increased climatic shocks from wildfires, floods, and other natural disasters may reduce the amount and quality of forest products			◗ Increased disturbance through natural disasters will only have negative or neutral effects on the poor ◗ Forest loss and degradation from climate change will reduce the availability and quality of ecosystem services, which has negative impacts for the forest-dependent ◗ With careful design that recognises local rights and implementation with appropriate safeguards, forest-related climate mitigation strategies can be pro-poor
Public and private financing for forests	+ Pro-poor private sector investments will likely increase cash income + Some public investments in forestry couple poverty reduction goals with income generating projects (e.g. small-scale forest businesses and nurseries) + Public programmes such as REDD+ are designed specifically to increase incomes to conserve forests + Voluntary carbon offset markets may grow to provide more cash income	– Projects that seek to reforest and reduce deforestation may reduce subsistence uses if forests become more strictly managed for conservation or carbon	+ Public investments in forest management will likely enhance ecosystem services +/– Private investments in forest management may improve some services, but may also negatively affect biodiversity (and associated ecosystem services) depending on what types of trees and activities are supported	+ Forestry projects that build capacity and human capital often focus on improving management of community forest and forest access. + Some impact investment firms combine financing with business and technical training	◗ COVID-19 and the economic downturn may reduce financing for the forestry sector ◗ As environmental organisations and movements gain more international traction, there is pressure to invest in Indigenous communities' ownership and access to land and their poverty reduction

GLOBAL FORCES	FIRST ORDER DIRECT EFFECTS				
	Cash Income	Contributions to Subsistence Income	Ecosystem Services	Non-material Well-being	Critical Insights
Technology and Interconnectivity	+ Improvements in monitoring accuracy and availability improve monitoring for forestry and NTFPs + Technological improvements create new opportunities to connect buyers/sellers of forest products – Improvements in monitoring reduce informal/illegal cash income	– Improvements in monitoring may reduce forest management, use and access where rights are contested	+ More consistent and temporally extensive monitoring/data enable better characterisation of ecosystem services and their losses	+ Greater access to information enhances decision-making and autonomy + Connectivity and social media strengthens rights, draws attention to injustice – Increasingly easy surveillance can challenge local rights and decision-making	◗ Who has access and the ability to use new forest management technology determines whether it is used to surveil or empower forest proximate people ◗ Indigenous people and local communities often rely on experts to access technological advances ◗ Connectivity through social media and virtual marketplaces can generate livelihood benefits ◗ Technological capacity building coupled with rights for forest management promise long-term benefits for poverty reduction
Global Social and Political Movements	+/– Environmental movements pushing for forest/climate action could enhance or decrease forest-based income +/– Indigenous and community land rights impact on cash income depend on model employed (e.g. community forest concessions/REDD+ may be positive, while Indigenous territories rights may be neutral)	– Populist, extractivist political conditions push the agricultural frontier further into forests, reducing access to subsistence goods and services + Stronger indigenous forest rights should lead to greater ease of access to subsistence zones and products	– Populist, extractivist political conditions push the agricultural frontier further into forests, reducing ecosystem services (e.g. provisioning, regulating) + Greater environmental protections from new environmental movements lead to climate action that preserves vital services	+ New social/land rights enhance autonomy, self-determination and protect Indigenous socio-cultural systems – Populist, nationalist movements undermine previous forest rights and social gains, destabilising marginalised groups' access to resources and rights	◗ Because these are political trends, their impacts will vary based on specific local conditions ◗ Securing Indigenous territorial rights may or may not lead to greater integration into markets, depending on other factors

Emerging Infectious Diseases	– Economic lock down leads to urban-to-rural migration, loss of employment and cash income for millions – Forest-related tourism sector specific employment and income losses are likely to be significant – Morbidity/mortality effects	– Morbidity/mortality effects + Forest products and services may serve as a safety net for communities who have lost formal employment and cash income	– Where cash income is lost and communities must resort to forest services for survival, additional stress may reduce ecosystem health	– Emotional, psychological, physical well-being reduced due to disease burden and stresses associated with economic woes	◗ Poverty impacts more likely in urban areas relative to rural areas ◗ Indirect effects on rural communities through reductions in consumption (as a result of returning migrants, reduction in remittances, supply chain and public service bottlenecks) ◗ Direct losses in income and employment in some critical forest dependent sectors such as tourism ◗ The role of macro-economic and political forces may mediate some of these effects

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Chapter 7

Conclusion: Forests, Trees and the Eradication of Poverty

Coordinating Lead Authors: Daniel C. Miller
Lead Authors: Stephanie Mansourian, Jennifer Zavaleta Cheek, Mónica Gabay, Reem Hajjar, Pamela A. Jagger, Judith Kamoto, Peter Newton, Johan A. Oldekop, Onja H. Razafindratsima, Priya Shyamsundar and Christoph Wildburger

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7.1 Overview

This Global Forest Expert Panel has assessed the scientific evidence on how *forests and tree-based systems*[9] affect *poverty*. Our focus has been on the dynamic relationship between *forests* and poverty, seeking to understand the complexities inherent to this relationship. We considered the multiple dimensions of poverty and the extent to which forests and trees can contribute to its alleviation and, ultimately, eradication (Chapters 2 and 3). In Chapter 4, we explored contextual dimensions that frame forest-poverty dynamics and in Chapter 5 we identified policy and management measures ('levers') that influence how this relationship may evolve. By exploring some of the major global changes now shaping our world (Chapter 6), we also identified key opportunities and challenges for forests and tree-based systems in addressing poverty.

In this chapter, we summarise the key findings that have emerged from our assessment and discuss their implications for decision-makers (Table 7.1). We also identify critical gaps in knowledge (Table 7.2) and then conclude by reflecting on the future for forests, trees and poverty in light of contemporary challenges and opportunities created by the 2020 global pandemic, and major social and political changes taking place in countries around the world. The findings and discussion distilled in this chapter can help inform relevant national and international policy processes, including efforts to achieve the first goal of the 2030 Agenda for Sustainable Development: "End poverty in all its forms everywhere" (UN, 2020). They are also relevant to civil society actors, donor organisations, the private sector and the research community.

7.2 Key Messages and Implications for Decision-Makers

Key Message 1
Forests and trees are critical to global efforts to end poverty

Forests and tree-based systems are essential to global efforts to alleviate and ultimately eradicate poverty as embodied in the United Nations Sustainable Development Goals. Globally, more than 1.6 billion people live within 5 km of a forest, more than two-thirds of whom reside in *low- and middle-income countries* (LMICs; Newton *et al.*, 2020). This population includes approximately 250 million of the world's extreme poor, who often rely directly on the goods and services that forests and trees provide. For forest-adjacent communities in many tropical countries, forests contribute 20-25% of household income – roughly the same amount as agriculture (Angelsen *et al.*, 2014). Trees outside forests managed in a range of *agroforestry* systems also contribute substantially to income and other aspects of *human well-being* in contexts around the world (Waldron *et al.*, 2017; Miller *et al.*, 2020).

In addition to the current contribution of forests and tree-based systems to global *poverty alleviation* efforts, their continued existence and health is crucial to retaining future options to support human well-being. Simply put, the loss of forests and trees threatens our planet and our ability to end poverty - and undermines efforts to ensure that poverty does not re-emerge.

The role of forests and tree-based systems in achieving Sustainable Development Goal 1 is multifaceted. Forest and tree-related resources are especially important in supporting the well-being of people in rural communities and in allowing them to manage risk. However, these resources can also help people move out of poverty in some circumstances, including directly through the sale of forest and tree products, and indirectly through the enhancement of soil fertility, water regulation and the provision of other *ecosystem services* supporting food production and other *livelihoods* needs.

Human well-being (and its converse, poverty) is now widely understood as a complex, multidimensional state that goes beyond income measures (Alkire and Santos, 2014; UN, 2015; World Bank, 2018). This broader understanding of poverty means forests and trees are important in addressing SDG 1 beyond income-based measures. Forests and tree-based systems provide both tangible and intangible inputs to household well-being, including the material aspects of people's lives such as energy, health, housing, income and *nutrition* and non-material aspects such as community relations and trust and those relating to culture and spirituality. These manifold contributions often occur outside formal markets and so are excluded from national income accounts. As a result they are frequently overlooked in development policy discussions, a missed opportunity at best and a reason for disastrous policy outcomes at worst (Scott, 1998; Seymour and Busch, 2016).

Forests and trees also play a crucial role in risk management such that the poor do not sink even

9 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

deeper into poverty and the non-poor avoid impoverishment. They perform this function by smoothing consumption and income across seasons and years through the provision of food, fodder, fuel and other products that may be consumed at home or sold. This role for forests and trees is especially relevant to the rural poor because they often do not have access to other forms of insurance and rely on livelihood activities that are subject to external shocks such as crop-raiding or variable weather (Noack *et al.,* 2019). Risk management is becoming even more critical in the face of the growing impact of climate change and other global shocks such as the COVID-19 pandemic.

The extent to which forests and trees can spur movement out of poverty and the conditions under which this role is possible, including in relation to other poverty alleviation measures, are not yet sufficiently researched (see Chapters 2 and 3, and below). Understanding the pathways that guide these forest-poverty dynamics is necessary for future interventions that consider forests as a tool for poverty alleviation.

Key Message 2
Benefits from forests and trees to human well-being are unevenly distributed

Although forests and tree-based landscapes are generally important to poverty alleviation, the benefits they bring are not distributed evenly and are shaped by many factors that vary according to time, geography, and social, economic and political contexts. These factors may constrain or enable the ability of forests and trees to alleviate poverty in a way that is effective, just and sustainable. Understanding these differences ensures that the role of forests in poverty alleviation can be better tailored to a given situation. Unless such distinctions are taken into account, forests and trees risk being ignored as assets that can contribute to poverty alleviation, thereby increasing the risk that they will be further degraded or destroyed.

There are fundamental temporal dimensions to the relationship between forests and poverty alleviation. Trees take a long time to grow and yield benefits for people. Yet, mature forests can quickly be lost through logging or fire. There are trade-offs between short-term livelihood imperatives and the long timescales intrinsic to forest growth. Trade-offs also exist related to the provision of different goods and services over time (e.g. the choice of tree species may determine whether short term soil benefits for agriculture are provided or long-term climate benefits). Trade-offs may also exist between near-term poverty alleviation goals and eradicating poverty over the long term, which implies a need for sustainable management so that forests and trees are able to provide ecosystem goods and services into the future to help prevent the recurrence of poverty. Who defines these trade-offs and the mechanisms through which they are adjudicated are fundamentally political decisions.

Although there is evidence that forests support poor people to improve their well-being or mitigate risks, the role of forests to move people permanently out of poverty is much less well documented. For example, evidence to date on *non-timber forest products* (NTFPs) suggests that they can contribute to poverty alleviation, but the impacts have largely been at small scales and questions remain about whether they can persist over time.

The contribution of forests and tree-based landscapes also varies across space. Forests and trees matter differently in different places and scales within and across countries. For example, the role of forests in energy for heating and building materials is increasingly prioritised as 'green' in Europe, but in Africa and many LMICs, discussion of this aspect of forests often focuses on negative impacts on human health and the environment. This variation in the real and perceived role of forests differs widely within countries as well. While the overall contribution of forests or trees on farms to household incomes may be relatively small at a national scale, it can be very significant to households in more forested regions of countries. There are also important instances where the converse is true. In many forest and wildlife-rich countries in Africa, timber and tourism are major contributors to national accounts but the benefits may not accrue at the local level – and, worse, local communities may bear the cost of these activities through environmental degradation and restricted access to forest protected areas (see Key Message 4 below). In general, the evidence suggests that the poor are rarely able to capture the bulk of benefits from forests even as forest and trees are vital to them in terms of subsistence and *food security*.

This *inequality* extends to relations between the wealthy, mostly northern countries and LMICs. Historically, the timber sector contributed to the economic development of many countries in northern Europe and North America that are now among the world's wealthiest nations. These same countries continue to benefit from the trade in timber harvested in the LMICs. Power imbalances within and between countries constrain the ability of the poor to leverage forest resources to exit poverty. Indeed, investment by major financial actors based in high income countries is a major driver

of *deforestation* in LMICs, further fuelling inequalities (Galaz *et al.*, 2018). Markets for commodities such as timber, beef, soy and palm oil will continue to grow and, in principle, could offer potential for poverty alleviation at the forest agricultural frontier. Available evidence, however, suggests that income flows tend to favour owners of land and capital, including large corporations, without reaching the poor – or, worse, coming at the expense of their livelihoods through dispossession. Further, production of these commodities may lead to deforestation, limiting future contributions of forests.

Beyond time and geography, context also matters to the distribution of benefits and costs from forests and tree-based landscapes. Gender, race[10] and economic class, among other social differences, shape forest and tree use. So, too, does political context, with processes and outcomes varying in different national political systems. Political institutions and land use policies have been shown to be key factors when forests and trees produce negative externalities, such as crop-raiding, livestock predation and infectious disease transmission from wildlife to humans. More generally, *governance* factors play a decisive role in forest-poverty dynamics and the effectiveness of forest and tree-based poverty alleviation interventions (see Key Message 5).

Key Message 3
Forests and trees can contribute to the well-being of the poor as they face profound global changes

Our world is in the throes of profound global challenges, which are affecting the most vulnerable and poorest members of society in the harshest ways. More extreme and frequent weather events associated with climate change, widening inequality, concentration of political power in fewer hands and the spread of infectious diseases, among others, exacerbate an already tenuous situation for the poor. Given these threats, forests and trees can be a lifeline. While forests and trees do not offer a 'silver bullet' for securing or stabilising well-being, the poor have been able to harness forest goods and services to manage and mitigate risk, particularly where market access and public service provision is limited.

The multiple risks posed by global changes to the *forest-reliant* poor threaten opportunities for poverty alleviation as poor households have limited capacity or resources to tackle new challenges or take advantage of new opportunities. Forests and trees may play an important role in strategies to reduce risks and improve conditions that would allow poor households to move out of poverty. As such, they merit special attention from policymakers concerned with poverty alleviation.

Several avenues exist for decision-makers to enhance use of forests and trees for risk management. Financing reforms in the commodity supply chain can help to strengthen transparency and develop capacity for smallholders to access global value chains, thus redressing much of the inequality inherent to the current systems. Investments in climate *adaptation* can contribute to reducing exposure to natural disasters and stabilising ecosystem services for the benefit of the rural poor. Strengthening rights to land and political participation – particularly of indigenous peoples – is a priority in many parts of the globe. There are also opportunities for integrated actions that can address health and environmental change such as buffer areas between agriculture and livestock production and forests, wildlife and human disease surveillance, and alternatives to wildlife trade.

Key message 4
Uninformed and poorly aligned forest and land use policies and programmes may lead to excessive costs being borne by the poor

Forest and land use policies and programmes can impose particular costs on the rural poor who may rely on forests and trees to support their well-being and mitigate risk. Exploitation of these natural assets can have direct repercussions on the livelihoods of the poor. For example, timber extraction and forest-based tourism are major contributors to national economies in many countries, but local communities may bear the cost of these activities through degradation of their environment and restricted access to valuable forest area. Measures such as *tenure* reforms may help the rural poor to secure access to forest resources. However, such reforms have also been found to increase conflicts and tension in cases where market forces have supported elite capture of forest resources. In some instances, more stringent procurement policies may have served to squeeze out smallholders, thus leading to an increase in their poverty levels. Finally, while tree planting may bring many benefits, it may also affect the rural poor by reducing available agricultural land.

As illustrated in the examples above, the evidence suggests that the poor are rarely able to cap-

10 This term is used here as per the Universal Declaration of Human Rights.

ture the bulk of benefits from forests even as forest and trees are vital to them in terms of subsistence and food security. That the impacts of many forest and tree-based interventions have been unequal may help to explain why they have had limited effects in alleviating poverty.

Key Message 5
Policy and management measures exist to enable forests and trees to effectively address poverty goals even as there is no 'one size fits all' solution

Nobel Prize-winning economist Elinor Ostrom (2007) famously stated that "there are no panaceas" to address the world's sustainability challenges. We confirm this observation for the role of forests and trees in poverty alleviation, finding that numerous natural resource and forest sector policies, programmes, technologies and strategies contribute to addressing poverty. For example, strong evidence exists of a role for forests in poverty alleviation with respect to ecotourism, protected areas – particularly those with ecotourism opportunities – community *forest management* and agroforestry. Together, such interventions can help to maximise benefits while minimising costs to the poor and other segments of society. Yet, until the forest sector is recognised as a sector that plays a positive role in poverty alleviation, these 'levers' will remain under-utilised.

The review carried out through this GFEP revealed much more evidence on the effect of different forest policy levers on poverty mitigation (i.e., supporting or improving well-being) than on *poverty eradication*. Evidence on the contribution of interventions related to community forest management, forest producer organisations, small and medium scale forest enterprises, *payments for ecosystem services*, and tree crop production was especially positive. Evidence also suggests that interventions supporting stronger tenure and property rights over forest and tree resources are especially important for addressing different dimensions of poverty and support the effectiveness of other levers.

Overall though, the evidence for the impact of the various forest and tree-related levers was mixed, highlighting the importance of contextual differences. Further, many studies show that several levers have contributed to poverty alleviation under specific circumstances and in the presence of key enabling factors, including in conjunction with other levers. This implies that multiple interventions both within and outside the forest sector are needed in tandem, with individual measures alone often likely to struggle to effectively alleviate poverty (Shyamsundar *et al.*, 2020).

Multi-pronged approaches need to pay special attention to inequalities. A number of reviewed studies highlighted the importance of social heterogeneity in the context of the levers that most strongly favour poverty alleviation. Socially differentiated outcomes, including variable opportunities, benefits and trade-offs, result from a combination of underlying material and sociocultural inequalities, and the failure of a given lever to sufficiently account for and address those inequalities. Decision-makers must therefore embrace complexity and carefully consider the context when designing, funding and implementing policies and programmes related to forests and tree-based systems. Learning lessons from prior interventions in contexts of interest may be especially instructive. Special attention is needed to consider those who bear the cost or may be left behind in certain policy choices (see Key Message 4).

Tree-based landscapes are sources of socio-economic and ecological benefits (Kenya)
Photo © Jennifer Zavaleta Cheek

Table **7.1**

Summary table of conclusions and implications for decision-makers

KEY MESSAGE	IMPLICATIONS FOR DECISION-MAKERS	CHAPTER REFERENCE
1. **Forests and trees are critical to global efforts to end poverty**	Recognise the important contribution that forests and trees do and can make to the well-being of hundreds of millions of people around the world, particularly those in rural contexts. The role of forests and tree-based systems is especially crucial for ensuring progress in reducing poverty and in stopping its long-term persistence.	Chapters 2, 3 and 6
2. **Benefits from forests and trees to human well-being are unevenly distributed**	Differential benefits of forest management must be recognised and steps taken to mitigate patterns of inequality. In particular, forest-related poverty interventions should be carefully designed to try to ensure more equitable impacts across social groups and geographic areas. There is a particular need to consider inequalities at multiple scales, including within communities, within countries and across countries. Priority should be given to the forest-reliant poor in such policies, including strengthened self-governance and technical skills.	Chapters 2-5
3. **Forests and trees can contribute to the well-being of the poor as they face profound global changes**	Recognise forests and trees as a valuable yet often overlooked asset for the poor. Prioritise policies to conserve and sustainably manage forests so they can benefit the poor. Supporting more secure property rights for the forest-reliant poor is especially important.	Chapters 3, 5 and 6
4. **Uninformed and poorly aligned forest and land use policies and programmes may lead to excessive costs being borne by the poor**	The same policies and programmes that can contribute to poverty alleviation may, if poorly designed or mis-aligned with other measures, exacerbate poverty. Decision-makers need to ensure that policies and programmes in the land use and forest sectors explicitly consider poverty alleviation. Alignment between sectoral policies and programmes can improve the application of multiple levers in tandem, thus increasing their efficiency in alleviating poverty.	Chapters 3-6
5. **Policy and management measures exist to enable forests and trees to effectively address poverty goals even as there is no 'one size fits all' solution**	There are several measures in the forest sector that can contribute to optimising the role that forests and tree-based systems play in alleviating poverty. Different measures will apply in different contexts and may need to be adapted over time. The combination of multiple measures is likely to yield better results.	Chapters 5 and 6

7.3 Knowledge Gaps and Research Priorities

This report has addressed the need for a global synthesis on contributions of forests and tree-based landscapes to alleviating poverty. It has summarised the best available scientific evidence on forests, trees, and poverty dynamics and outcomes. In so doing, it reveals several important gaps in knowledge. Based on these gaps, we highlight **five major research priorities that require urgent attention if forests and tree-based systems are to realise their potential in the struggle to end poverty.**

Research priority 1
Examine forest-poverty dynamics, especially over the long term

Knowledge of how, and the extent to which, forests and trees can help the poor to permanently escape poverty – and those who are not poor to avoid slipping into poverty – stands as a particularly acute research need.

The literature on the relationship between forests, trees and poverty has focused on cross-sectional analyses or snapshots in time. Relatively few studies examine the dynamics of this relationship, particularly over long time periods (e.g. beyond at least 5 years) and across different contexts and spatial scales. Studies examining forests or trees as a primary *pathway out of poverty* or, conversely, as generating significant negative externalities are especially rare, limiting our ability to draw general conclusions about forest-poverty dynamics. This gap may reflect a lack of attention to both the influence of international investment and trade on the allocation of benefits from forests and the influence of rules governing access to forests on the global distribution of *prosperity*. More research on the relationship between forests and inequality within and across settings is therefore needed.

New data sources, including satellite imagery of land use and land cover change and spatially explicit socio-economic datasets, present promising opportunities to address current knowledge gaps on forest-poverty dynamics. Research using these and other data is crucial to allow decision-makers to compare the poverty alleviation aspects of forests and trees with their other benefits, such as *biodiversity* conservation and climate change *mitigation*, and to consider trade-offs between different land use policies. Such research can also inform policymakers of the potential for forests and trees to provide goods and services, manage risk and provide a pathway out of poverty compared with other levers for poverty alleviation.

Research priority 2
Expand the evidence base to cover under-represented geographies and contexts

Major geographic limits exist in our knowledge of the contribution of forests and tree-based landscapes to poverty alleviation. Nearly half of the current evidence base on forests-poverty linkages comes from just five countries: Bangladesh, Brazil, China, India and Nepal (Cheng *et al.*, 2019). Evidence on agroforestry and poverty also exhibits geographical bias (Miller *et al.*, 2020). Our understanding of forest-livelihood linkages in Europe, North America, and West and Central Africa are especially limited.

Three other dimensions of geography stand out as particularly important to advancing our knowledge of forest-poverty dynamics. First, the majority of our knowledge is based on studies of forests and poverty in tropical *forest ecosystems*. Woodlands, dryland and boreal forests have received less attention in scholarly and policy debates. Second, forests and trees are not only important in rural contexts, but also in urban landscapes, which are rapidly expanding. Attention to forest poverty dynamics in urban settings is critical given demographic trends towards urbanisation in many LMICs. Finally, there is a need to investigate the contribution of forests and trees to poverty alleviation at spatial scales beyond the site or community level giving more attention to landscape, sub-regional, national and regional scales. Moreover, multi-scale analysis is critically important for understanding spillovers and the aggregate effects of policies and programmes.

Beyond new empirical work to address these knowledge gaps, we highlight the general need to update data collection done in recent systematic maps and reviews on this topic (e.g. Cheng *et al.*, 2019; Miller *et al.*, 2020). Ideally, cost-effective means of ensuring regular updates to data repositories can be developed and implemented so that decision-makers have access to the latest relevant evidence.

Research priority 3
Bring to light the 'hidden dimensions' of forest contributions to poverty alleviation

The role that forests and trees play in supporting human well-being and addressing poverty is often indirect, intangible or otherwise not captured in markets or official statistics. For example, there is

a great deal of domestic and international trade in NTFPs, but statistics to quantify the economic contribution, value addition and supply chains related to these goods are largely absent. Further, trade in timber and non-timber forest products that is either illegal or moving into markets through informal channels means that the full economic contribution of forests is not recorded in government statistics used for designing policy. Beyond marketed goods provided by forests and trees, there is growing evidence that forests and trees on farms provide ecosystem services that increase agricultural productivity, a benefit rarely entering into policy discussions or national accounts.

There is a need to both improve the evidence base on this topic and to better communicate current knowledge about these positive, yet often hidden, dimensions of forests and tree-based systems.

Research priority 4
Assess the relative effectiveness of different forest-related policy and management interventions for poverty alleviation

This report consolidates current evidence on the effectiveness of different forest- and tree-related policies and programmes in addressing the challenge of poverty. However, major gaps in our knowledge remain. Foremost among these is knowledge of which kinds of levers are likely to be most effective in which contexts and why. We know that, regardless of context, forest policy effectiveness hinges on factors such as responsive macro-institutional frameworks, collaborative processes, clear performance indicators and monitoring systems, and adaptive management and learning (Agrawal *et al.*, 2018). Yet, we lack clear guidance on which, among the range of policy choices, from incentive-based mechanisms like payments for ecosystem services to regulatory mechanisms like strict protected areas, may be most appropriate for a given situation. Research is beginning to address this topic (e.g. Sims and Alix-Garcia, 2017), but more work is needed to build evidence, advance theory and inform policy.

Policy and programme development is increasingly evidence-based, raising demand for research that analyses causal impact. The broad field of environmental and natural resource policy continues to lag behind other policy fields (e.g. education, health, social policy) in building a rigorous evidence base that sheds light on the impact and cost-effectiveness of various policy options (Ferraro and Pattanayak, 2006; Börner et al., 2020). Rigorous studies on the poverty impacts of forest (Cheng *et al.*, 2019) and agroforestry (Miller et al., 2020) interventions remain relatively uncommon, with randomised control trials especially rare. Studies that use methods with high potential for establishing causal linkages between interventions and outcomes for forests and poverty typically include baseline or pre-intervention and endline data, collection of data over time, and collection of data for control or comparison groups. Impact evaluation studies that draw on well informed theories of change, use qualitative and quantitative data, give focused attention to heterogeneous impacts across different social groups, geographies and contexts, and provide a cost-effectiveness analysis, are of highest value to decision-makers.

Research priority 5
Identify key barriers to more equitable, just and sustainable use of forests and trees, and ways to overcome them

This report has highlighted that forests and tree-based systems provide many benefits to different social groups, but that benefits and costs are frequently unequally distributed. There is an urgent need to rigorously synthesise available evidence and then conduct new empirical investigation into barriers to a more just, equitable and sustainable distribution of benefits and costs. Doing so will require analysis of the political economy of forest and land use policies within and across countries. More generally, research must seek to illuminate how policies that contribute to deforestation and *forest degradation*, limiting the poverty alleviation potential of forests and trees persist, or are prioritised. Research focused on uncovering the underlying causes preventing the full potential of forests and trees to contribute to poverty alleviation is called for together with efforts to understand how these causes may be effectively addressed to support better outcomes, especially for financially poor and politically and socially marginalised populations.

Forests are intimately linked to the culture and daily life of millions of people, including this Kayapó boy in the Brazilian Amazon Photo © Peter Newton

Table **7.2**

Research priorities and key questions

RESEARCH PRIORITY	KEY QUESTIONS
1. Examine forest-poverty dynamics, especially over the long term	◗ Under what circumstances can forests and tree-based systems provide a pathway out of poverty? ◗ How do different types of forests and tree-based systems affect poverty outcomes over time? And across different spatial scales? ◗ How do these outcomes compare with other outcomes, like biodiversity conservation and climate change mitigation? ◗ What are the trade-offs and synergies over time and across space for these different outcomes?
2. Expand the evidence base to cover under-represented geographies and contexts	◗ What contributions do forests and tree-based systems make to poverty in comparatively understudied regions like Europe, North America and West Africa? What is their contribution in urban contexts? ◗ What insights might we gain from investigating this topic in both low- and middle-income countries and high-income countries? ◗ What cost-effective means can be developed to ensure an updated, easily accessible evidence base for decision-makers, researchers and the public?
3. Bring to light the 'hidden dimensions' of forest contributions to poverty alleviation	◗ What is the contribution of NTFPs to poverty alleviation? Can more accurate estimates of the contribution of informal and illegal trade in timber and other forest products be made? ◗ What is the contribution of forests and trees on farms to agriculture? ◗ How do intact forests affect human health?
4. Assess the relative effectiveness of different forest-related policy and management interventions for poverty alleviation	◗ Which interventions are most effective in alleviating poverty, in which contexts? ◗ What trade-offs do they imply? ◗ How do different factors mediate and moderate impacts? ◗ What explains heterogeneity of impacts? How can costs and benefits of different policy options be more equitably distributed?
5. Identify key barriers to more equitable, just and sustainable use of forests and trees, and ways to overcome them	◗ How do forest and tree-related market supply chains affect the poorest? ◗ What are the barriers to more equitable, just and sustainable distribution of the benefits and costs of forests and tree-based systems? What are the opportunities for overcoming them and how?

7.4 Transformation toward Sustainability and the Eradication of Poverty

Forests and tree-based systems have an important role to play in contributing to one of the greatest challenges of our time: alleviating poverty in a way that is just and sustainable over long periods. Yet, forests and trees are often overlooked in policy debates and action relating to poverty in all its various dimensions. The findings of this report suggest that the relative neglect of these natural resources must change to make enduring progress toward the ambitious targets articulated under SDG 1. It is now time for forests and tree-based systems to take a more central role, particularly in relation to poverty indicators that go beyond the minimum international *poverty line*. As governments around the world seek to develop responses to the COVID-19 pandemic and retool their economies in the face of climate change and widening inequality, forests and trees are a foundational asset. This report clarifies the multifaceted ways in which this is so.

The importance of forests and tree-based systems to rural livelihoods and poverty alleviation means that their conservation, sustainable management and restoration are paramount. Eliminating extreme poverty while preventing people from falling into poverty will require sustainable management of the resources and services that forests and tree-based systems provide. Development policies intended to alleviate poverty must therefore consider their effects on forests and tree-based systems. Such policies should seek to mitigate damage to forests and trees while taking advantage of the opportunities that forests and tree-based systems present for advancing poverty alleviation goals.

This time of tumult and change presents major challenges for poverty and sustainability goals but it also opens up opportunities to revitalise existing and develop new approaches to make progress toward the SDGs. In this context, forests and tree-based systems are one important building block to support transformational change. Responses to the COVID-19 pandemic, in particular, will shape options for forests to sustainably contribute to poverty alleviation and human well-being, as well as deliver other benefits such as biodiversity conservation, climate change mitigation and adaptation, and reduction of threats from infectious disease.

Future major shocks such as regional or global pandemics and natural disasters are to be expected, and integrating natural assets such as forests into an enduring response to these shocks should be a priority. Such a response will require transformational change that includes a marked increase in our understanding and capacity to manage forests and tree-based systems for the benefit of all so that they may contribute to the global challenge of eradicating poverty.

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Appendix I
Glossary of Terms and Definitions Used in the Assessment Report

Absolute poverty: A measure of poverty based on a fixed amount of money needed to meet basic needs such as food, clothing, and shelter (Haughton and Khandker, 2009).

Adaptation (climate): Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (Seppälä *et al.*, 2009)

Afforestation: Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest (FAO, 2010). According to the definition used by the UNFCCC, afforestation can take place on land that has not been covered by forest for at least 50 years (see also '*Reforestation*').

Agroforestry: A collective name for land use systems and practices in which woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in a spatial mixture or in a temporal sequence (World Agroforestry Centre, 2017).

Alleviation: *See 'Poverty alleviation'*

Biodiversity (Biological diversity): The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (CBD, Article 2).

Capabilities: The substantive freedoms a person enjoys to lead the kind of life he or she has reason to value (Sen, 1999). This concept merges the idea of freedom to do and achieve with functionings understood as what a given individual may value doing or being.

Deforestation: The conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10% threshold (FAO, 2010). Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically *excludes* areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Deforestation also includes areas where, for example, the impact of disturbance, overutilisation or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10% threshold (FAO, 2001).

Ecological restoration: Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SER, 2004).

Ecological resilience: The ability of a system to absorb impacts before a threshold is reached where the system changes into a different state (Gunderson, 2000).

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (CBD).

Ecosystem services: Ecological processes or functions having monetary or non-monetary value to individuals or society at large. There are: (i) supporting services such as productivity or biodiversity maintenance, (ii) provisioning services such as food, fibre, or fish, (iii) regulating services such as climate regulation or carbon sequestration, and (iv) cultural services such as tourism or spiritual and aesthetic appreciation (MEA, 2005).

Equity (also its opposite: 'Inequity'): Refers to how *capabilities* (e.g. access to health, education and good nutrition) are distributed within a certain group of individuals (Mora and Muro, 2018). **Inequity** is the unequal distribution of capabilities (Sen, 1999).

Equality (also its opposite: 'Inequality'): The 'sameness' of a distribution of attributes, such as income or consumption, across a whole population (i.e. the state of being equal) (Haughton and Khandker, 2009; Harris and Nisbett, 2018). A popular measure of (in)equality is the Gini coefficient, which ranges from 0 (perfect equality) to 1 (perfect inequality), but is typically in the range of 0.3 to 0.5 for per capita expenditures.

Food security: A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time (FAO *et al.*, 2014). **Food insecurity**, by contrast, exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. Food insecurity may be chronic, seasonal or transitory (FAO *et al.*, 2014).

Forest: Land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use (FAO, 2010). Forests include both *natural forests* (sensu CPF, 2005) and *planted forests* (sensu FAO, see below). It also includes areas temporarily unstocked, e.g. after disturbance, that are expected to revert back to forest.

Forest-based poverty alleviation: Use of resources from forests and trees for the purpose of lessening deprivation of well-being on either a temporary or lasting basis (Sunderlin *et al.,* 2005).

Forest-based livelihood: For the purposes of this report, defined as "Deriving all or part of one's *livelihood* from the use of resources from forests and trees".

Forest-dependent (-reliant) people: For the purposes of this report, defined as "People that have a direct relationship with forests and trees, and live within or adjacent to forested areas, and rely on them for their subsistence and/or income".

Forest-proximate people: Refers to people who live in and around forests. The term captures the spatial relationship between people and forests without additional assumptions about the nature of the relationship between them as implied by the related term 'forest-dependent' people. (Newton *et al.*, 2020).

Forest ecosystem: A forest ecosystem can be defined at a range of scales. It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems. (CBD: http://www.cbd.int/forest/definitions.shtml).

Forest degradation: The reduction of the capacity of a forest to provide goods and services. A degraded forest delivers a reduced supply of goods and services from a given site and maintains only limited biological diversity. It has lost the structure, function, species composition and/or productivity normally associated with the natural forest type expected at that site (ITTO, 2002).

Forest fragmentation (also 'habitat fragmentation'): Any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands. (CBD: http://www.cbd.int/forest/definitions.shtml).

Forest landscape restoration: A planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded landscapes (WWF and IUCN, 2000; Mansourian *et al.*, 2005).

Forest management: The processes of planning and implementing practices for the stewardship and use of forests and other wooded land aimed at achieving specific environmental, economic, social and/or cultural objectives. Includes management at all scales such as normative, strategic, tactical and operational level management (FAO, 2004).

***Forest restoration* (see also 'Ecological *restoration*' and 'Forest *landscape restoration*'):** The process of restoring a forest to its original state before degradation (same functions, same structure, same composition) (CPF, 2005).

Forests and tree-based systems: For the purposes of this report, this includes the spectrum from natural old-growth forests, to those managed to optimise resource yields, to the broad spectrum of agroforestry practices and to single-species tree crop management.

Governance: Interactive processes through which society, the economy, and the environment are steered towards collectively negotiated objectives (Ansell and Torfing, 2016). The concept includes both formal and informal rules and the public, private, and civil society actors that make and implement them (Hydén and Mease, 2004).

Habitat fragmentation: *See 'Forest fragmentation'*

High-Income Countries (HIC): A group of countries classified as high income based on gross national income per capita estimates using the World Bank Atlas method (World Bank, 2020). High-income economies are currently defined as those with a GNI per capita of USD 12,536 or more in 2019 (see also *Low- and Middle-Income Countries)*.

Human well-being (also 'well-being'): A multidimensional concept capturing diverse ideas about what constitutes a 'good life' (McKinnon *et al.*, 2016). It can be defined simply as a positive physical, social and mental state (Summers *et al.*, 2012). Human well-being comprises the objective material circumstances of people's lives such as health, housing and income, social aspects such as community relations and trust, and a subjective dimension relating to how individuals view their own circumstances (OECD, 2017).

Livelihood: The assets (natural, physical, human, financial and social capital), activities and access to them (mediated by institutional and social relations) that together determine how an individual or household makes a living (Scoones, 1998). This definition emphasises means rather than outcomes of making a living whereas poverty is typically an outcome measure of livelihood performance (Sunderlin *et al.*, 2005).

Low- and Middle-Income Countries (LMIC; see also 'High -Income Countries'): A group of countries classified as low-income or middle-income based on gross national income per capita estimates using the World Bank Atlas method (World Bank, 2020). Low-income economies are currently defined as those with a GNI per capita of USD 1,035 or less in 2019. Middle-income countries consist of two groups: lower middle-income economies with a GNI per capita between USD 1,036 and USD 4,045 and upper middle-income countries with a GNI per capita between USD 4,046 and USD 12,535. In this report, classifications of countries by income is the preferred form to identify different country groupings, though other terms such as 'Global South' are sometimes used.

Mitigation (climate): An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks (IPCC, 2007).

***Non-timber forest products* (NTFP):** All biological materials other than timber, which are extracted from forests for human use. In addition to trees, forest products are derived from all plants, fungi and animals (including fish) for which the forest ecosystem provides habitat (IUFRO, 2005).

Nutrition: The consequence of the intake of food and the utilisation of nutrients by the body (CFS, 2012).

Nutrition security: A situation that exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life for all household members. Nutrition security differs from food security in that it also considers the aspects of adequate caring practices, health and hygiene in addition to dietary adequacy (FAO *et al.*, 2014).

***Pathway out of poverty*:** People are often considered to have moved out of poverty when they surpass a certain level of income or consumption (World Bank, 2018) or move beyond a certain locally defined state of poverty (Krishna, 2011). Pathways out of poverty are the means or mechanisms by which people surpass such locally, nationally or internationally defined poverty thresholds.

Payments for Ecosystem (or Environmental) Services (PES): A type of economic incentive offered for those that manage ecosystems (including agricultural lands) to improve the flow of environmental services that they provide. More formally, PES are "Voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services" (Wunder, 2015). These transactions (viz., payments) incentives can be provided by anyone at local, regional, and global scales who benefits from the environmental services provided.

Planted forest: Forest predominantly composed of trees established through planting and/or deliberate seeding (FAO, 2010). Includes forests resulting from afforestation, reforestation and some forms of forest restoration (see also '*Afforestation*', '*Ecological restoration*', '*Forest restoration*', '*Forest landscape restoration*', '*Reforestation*').

Plantation forests (also 'forest plantation'): Planted forests that have been established and are (intensively) managed for commercial production of wood and non-wood forest products, or to provide a specific environmental service (e.g. erosion control, landslide stabilisation, windbreaks, etc.) (Carle and Holmgren, 2003).

Policy instruments (measures): Set of techniques used by governmental and other authorities to try to ensure support and effect social change (Bemelmans-Videc *et al.*, 2010). Such instruments are designed to shape human behaviour and define people's legal rights through regulatory (e.g. prescriptions, proscriptions), financial (e.g. subsidies, taxation) and informational (e.g. education) means. A set of procedural policy instruments act to affect the policy process indirectly through institutional or organisational means (IUFRO, 2005).

Poverty: Deprivation or disadvantage that prevents an individual or group from attaining a certain level of well-being and participating fully in society (Smeeding, 2016; World Bank, 2001). This definition encompasses not only commonly used income or consumption measures of poverty but also a range of non-monetary attributes that directly affect people's capabilities and overall well-being and allow human capabilities to go unrealised (Sen, 1999; Alkire, 2002; World Bank, 2018).

Poverty alleviation: A lessening of deprivation or disadvantage such that well-being is improved. This lessening may include movement above a certain income or consumption threshold, such as international or country-specific poverty lines (termed ***'poverty reduction'*** or ***'poverty elimination'***). It may also include a lessening in the degree of poverty experienced or avoiding falling into poverty (termed ***'poverty mitigation'***) (World Bank, 2001; Sunderlin *et al.,* 2005).

Poverty eradication (also 'elimination'): The complete or near absence of people or households in poverty, indicated by the international poverty line or other measures. Implies permanent movement out of poverty by addressing the root causes of why people are impoverished (UN, 2020).

Poverty line: The minimum level of welfare before a person is no longer deemed to be 'poor' (Ravallion, 1998). This level of welfare is often defined in monetary terms, but can also be defined in other ways (e.g. caloric intake, happiness, etc.). There can be different poverty lines for different levels and measures of poverty, internationally and within countries which set their own poverty lines. As of October 2015, the ***international poverty line* is** USD 1.90 per day (World Bank, 2018).

Poverty reduction: Lessening the number of people who are considered to be poor. This reduction is typically measured as movement above a given poverty line defined in monetary terms (World Bank, 2001), but it could be tracked using measures of other dimensions of poverty. Often understood as a situation in which the poverty rate falls, more or less permanently, based on economic growth (World Bank, 2018).

Poverty trap: Any self-reinforcing mechanism that causes poverty to persist (Azariadis and Stachurski, 2005).

Primary forest: Naturally regenerated forest of native species, where there are no clearly visible indications of human activities [including commercial logging] and the ecological processes are not significantly disturbed (FAO, 2010).

Prosperity: The opposite of poverty. This concept includes multiple dimensions of individual human well-being but is also relational, implying concern for other people and species, now and in the future (Miller and Hajjar, 2020). It is similar to Sen's (1993) notion of 'capabilities for flourishing' with the addition that it includes explicit consideration of environmental sustainability "to flourish as human beings – within the ecological limits of a finite planet" (Jackson, 2009). It also encompasses views about equitable economic growth such as the World Bank's goal of "boosting shared prosperity in a sustainable manner" within each of its partner countries (World Bank, 2018).

Reforestation: Re-establishment of forest through planting and/or deliberate seeding on land classified as forest after a temporary period (<10 years) during which there was less than 10% canopy cover due to human-induced or natural perturbations (adapted from FAO, 2010). According to the definition used by the UNFCCC, reforestation can occur on land that was forested but that has been converted to non-forested land.

Relative poverty: A measure of poverty in relation to the economic status of other members of society using a cutoff point (Haughton and Khandker, 2009).

Resilience: The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change (IPCC, 2007). See also *Ecological resilience*.

Restoration: *See 'Ecological restoration'; 'Forest restoration'; 'Forest landscape restoration'*

Secondary forest: Forests regenerating largely through natural processes after significant removal or disturbance of the original forest vegetation by human or natural causes at a single point in time or over an extended period, and displaying a major difference in forest structure and/or canopy species composition with respect to pristine primary forests (FAO, 2003).

Shifting cultivation: Also referred to as *slash-and-burn cultivation* or *swidden agriculture*. A land use system that employs a natural or improved fallow phase, which is longer than the cultivation phase of annual crops, sufficiently long to be dominated by woody vegetation, and cleared by means of fire (Mertz *et al.,* 2009)

Sustainable forest management: A dynamic and evolving concept, aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations. The seven thematic elements of sustainable forest management are: (a) extent of forest resources; (b) forest biological diversity; (c) forest health and vitality; (d) productive functions of forest resources; (e) protective functions of forest resources; (f) socio-economic functions of forests; and (g) legal, policy and institutional framework. The thematic elements are drawn from the criteria identified by existing criteria and indicators processes, as a reference framework for sustainable forest management (UN, 2007).

Sustainable Livelihood: A *livelihood* that can cope with and recover from stresses and shocks, maintain or enhance its *capabilities* and assets, and provide net benefits to other livelihoods locally and more widely, both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1991; Scoones, 1998).

Swidden cultivation: See '*Shifting cultivation*'

Tenure: Systems of tenure define and regulate how people, communities and others gain access to land, fisheries and forests. These tenure systems determine who can use which resources, for how long and under what conditions. The systems may be based on written policies and laws, as well as on unwritten customs and practices (FAO, 2012).

Vulnerability (to poverty): The risk of a given person or group falling into poverty in the future, even if they are not necessarily poor now. This risk is often associated with the effects of 'shocks' such as a drought, a drop in farm prices or a financial crisis. Vulnerability is a key dimension of well-being since it affects individual behaviour in terms of investment, production patterns, and coping strategies, and in terms of the perceptions of their own situation (Haughton, and Khandker, 2009).

Well-being: *See 'Human well-being'*

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Appendix II
List of Panel Members, Authors and Reviewers

Panel Members and Authors

Arun Agrawal
University of Michigan
Ann Arbor, Michigan, USA
E-mail: arunagra@umich.edu

Jennifer Alix-Garcia
Oregon State University
Corvallis, Oregon, USA
E-mail: jennifer.alix-garcia@oregonstate.edu

Maria Brockhaus
University of Helsinki
Helsinki, Finland
E-mail: maria.brockhaus@helsinki.fi

Sarah E. Brown
University of Illinois at Urbana-Champaign
Urbana, Illinois, USA
E-mail: saraheb3@illinois.edu

James T. Erbaugh
Dartmouth College
Hanover, New Hampshire, USA
E-mail: J.T.Erbaugh@dartmouth.edu

Dikshya Devkota
University of Illinois at Urbana-Champaign
Urbana, Illinois, USA
Email: Dikshya.Devkota39@gmail.com

Mónica Gabay
National University of San Martin
Buenos Aires, Argentina
E-mail: monagabay@yahoo.com

Reem Hajjar
Oregon State University
Corvallis, Oregon, USA
E-mail: reem.hajjar@oregonstate.edu

Karl Hughes
World Agroforestry (ICRAF)
Nairobi, Kenya
E-mail: K.Hughes@cgiar.org

David Humphreys
The Open University
Milton Keynes, UK
E-mail: david.humphreys@open.ac.uk

Markus Ihalainen
Center for International Forestry Research (CIFOR)
Dakar, Senegal
E-mail: M.Ihalainen@cgiar.org

Pamela A. Jagger
University of Michigan
Ann Arbor, Michigan, USA
E-mail: pjagger@umich.edu

Gillian Kabwe
The Copperbelt University
Kitwe, Zambia
E-mail: gillian.kabwe@cbu.ac.zm

Judith Kamoto
Lilongwe University of Agriculture and Natural Resources Lilongwe, Malawi
E-mail: jkamoto@luanar.ac.mw

P.P. Krishnapriya
Duke University
Durham, North Carolina, USA
E-mail: krishnapriya.perumbillissery@duke.edu

Patricia M. Kristjanson
Consultant, World Bank and CGIAR
Washington, D.C., USA
E-mail: pkristjanson@worldbank.org

Patrice Bigombe Logo
University of Yaoundé II
Soa, Cameroon
E-mail: patricebigombe@hotmail.com

Stephanie Mansourian
Consultant, Environment and Development
Gingins, Switzerland
E-mail: smansourian@infomaniak.ch

Samuel Mawutor
Oregon State University
Corvallis, Oregon, USA
E-mail: samuel.mawutor@oregonstate.edu

Blaise-Pascal Ntirumenyerwa Mihigo
University of Kinshasa
Kinshasa, Democratic Republic of Congo
E-mail: blaisepascalmihigo@gmail.com

Daniel C. Miller
University of Illinois at Urbana-Champaign
Urbana, Illinois, USA
E-mail: dcmiller@illinois.edu

Doris N. Mutta
The African Forest Forum (AFF)
Nairobi, Kenya
E-mail: D.Mutta@cgiar.org

Peter Newton
University of Colorado Boulder
Boulder, Colorado, USA
E-mail: peter.newton@colorado.edu

Johan A. Oldekop
University of Manchester
Manchester, UK
E-mail: Johan.Oldekop@manchester.ac.uk

Symphorien Ongolo
University of Göttingen
Göttingen, Germany
E-mail: songolo@uni-goettingen.de

Pablo Pacheco
WWF and CIFOR
Washington, D.C., USA
E-mail: p.pacheco@cgiar.org

Nitin D. Rai
Ashoka Trust for Research in Ecology and the Environment (ATREE)
Bangalore, India
E-mail: nitinrai@atree.org

Laura Vang Rasmussen
University of Copenhagen
Copenhagen, Denmark
E-mail: lr@ign.ku.dk

Onja H. Razafindratsima
South Dakota State University
Brookings, South Dakota, USA
E-mail: onja.razafindratsima@sdstate.edu

Casey Ryan
University of Edinburgh
Edinburgh, UK
E-mail: casey.ryan@ed.ac.uk

Laura Aileen Sauls
University of Sheffield
Sheffield, UK
E-mail: l.a.sauls@sheffield.ac.uk

George Schoneveld
Center for International Forestry Research (CIFOR)
Nairobi, Kenya
E-mail: G.Schoneveld@cgiar.org

Priya Shyamsundar
The Nature Conservancy
Arlington, Virginia, USA
E-mail: priya.shyamsundar@tnc.org

Erin O. Sills
North Carolina State University
Raleigh, North Carolina, USA
E-mail: sills@ncsu.edu

Conghe Song
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina, USA
E-mail: csong@email.unc.edu

Dietmar Stoian
World Agroforestry (ICRAF)
Bonn, Germany
E-mail: d.stoian@cgiar.org

Kira A. Sullivan-Wiley
Boston University
Boston, Massachusetts, USA
E-mail: kswiley@bu.edu

Terry Sunderland
University of British Columbia
Vancouver, British Columbia, Canada
E-mail: terry.sunderland@ubc.ca

Joleen Timko
Sylvae Research & Consulting
Vancouver, British Columbia, Canada
E-mail: joleen.timko@me.com

Christoph Wildburger
International Union of Forest Research Organizations (IUFRO)
Vienna, Austria
E-mail: wildburger@iufro.org

Jianmin Xiao
Chinese Academy of Forestry
Beijing, China
E-mail: xiaojm@caf.ac.cn

Jennifer Zavaleta Cheek
University of Illinois at Urbana-Champaign
Urbana, Illinois, USA
E-mail: jzcheek@illinois.edu

Yue Zhao
University of Göttingen
Göttingen, Germany
E-mail: yzhao1@uni-goettingen.de

2nd meeting of the GFEP Expert Panel on Forests and Poverty in Nairobi, Kenya
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Reviewers

Sofia Ahlroth
World Bank Group, PROFOR
Washington, D.C., USA
E-mail: sahlroth@worldbank.org

William L. Ascher
Claremont McKenna College
Claremont, California, USA
E-Mail: william.ascher@cmc.edu

David Conte
Food and Agriculture Organization (FAO)
Rome, Italy
E-Mail: David.Conte@fao.org

Julia P. G. Jones
Bangor University
Gwynedd, Wales, UK
E-mail: julia.jones@bangor.ac.uk

Thais Linhares-Juvenal
Food and Agriculture Organization (FAO)
Rome, Italy
E-mail: Thais.LinharesJuvenal@fao.org

Adrian Martin
University of East Anglia
Norwich, UK
E-mail: adrian.martin@uea.ac.uk

Alexandre Meybeck
Center for International Forestry Research
(CIFOR-ICRAF)
Rome, Italy
E-mail: A.Meybeck@cgiar.org

Sheona Shackleton
University of Cape Town
Cape Town, South Africa
E-mail: sheona.shackleton@uct.ac.za

Carsten Smith-Hall
University of Copenhagen
Copenhagen, Denmark
E-mail: cso@ifro.ku.dk

Andrew Taber
Food and Agriculture Organization (FAO)
Rome, Italy
E-mail: Andrew.Taber@fao.org

Bhaskar Vira
University of Cambridge
Cambridge, UK
E-mail: bv101@cam.ac.uk

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CITES

ITTO

IUFRO Headquarters
Marxergasse 2
1030 Vienna, Austria
Tel + 43 (0)1 877 01 51-0
Fax +43 (0)1 877 01 51-50
Email office@iufro.org
www.iufro.org