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Background Paper 3:

CHANGING FUTURES, SOCIAL CHOICES, AND FOREST CONTRIBUTIONS

By

John Hudson
Arun Agrawal
Daniel C. Miller

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Executive Summary
Changing Futures, Choices, and Contributions of Forests

Planetary changes are occurring at such vast scales and rapid pace that their observers struggle to find the right terms and adjectives to describe them. Whether it is the economy, the climate, ecosystems, technologies, or social and human relationships, what we are witnessing today is so unprecedented that even the implications are not easy to imagine. The ways in which these changes will affect forests – among the most ancient of landscapes in human experience and memory – are monumental. Describing how global changes may unfold and affect forests and the resulting challenges and opportunities for decision makers is particularly difficult given the extent to which humans bear the responsibility for the changes that are occurring, and the considerable obstacles to the collective action needed to alter the course of more as well as less predictable trajectories of change. This paper thus constitutes an initial and necessarily partial step toward such description.

The paper focuses on demographic, climatic, and economic changes and their implications for forests in the coming decades. The vast increase in global population over the past half century and the recent slowing down of the rates of growth are associated as well with changes in the demographic structure in terms of age and class, along with settlement and migration patterns that directly affect forests. Most of these changes mean a tremendous increase in demand for forest products and for agricultural output for which forest lands may well have to be cleared.

The global population is expected to increase by up to three billion in the next three decades with much of this increase occurring in emerging economies. Even more consequential will be the implications of an increasingly assertive middle class in emerging economies which may have lower purchasing power than its counterpart in Northern countries to begin with, but which will be on the upswing for much of the twenty-first century. The combined effects of a 3 billion larger population and a 3 billion larger middle class whose purchasing power is more than twice as high as that of the current global middle class could be devastating for the world's forests and ecosystems. Tremendous policy adjustments and decision-making imagination will be necessary. This prospect provides some cause for pessimism because current political structures and decision makers have demonstrated little appetite or aptitude for far-sighted choices when it comes to environmental issues in general, forests being no exception.

Particularly intense pressures on land will result from expanding production of agricultural commodities, especially soybean, oil palm, cattle, and cocoa. Agricultural commodities account for more than 30 million hectares of new land under cultivation since the 1990s, much of the expansion occurring on forested areas. How governments, producers, and consumers manage and affect the future expansion of commodity agriculture will in large measure influence the sustainability of forests and the economic viability of a sustainable supply of forest products.

It is worth mentioning, however, that a larger, richer, more highly educated, and more environmentally aware global population creates new opportunities for environmental entrepreneurs. Tomorrow's consumers and producers, buyers and sellers, decision makers and stakeholders are likely to be even more sophisticated than those today. Their greater knowledge and stronger social connections mean that efforts to influence their consumption patterns will have to be based on more sophisticated, peer-to-peer, subtle strategies than have been deployed by marketers and media outlets till now. The direct regulatory and incentives-based approaches that continue to hold sway today may become less effective as consumers learn about ways to respond to negative and positive incentives based levers such as rules, fines, rewards, and payments.

Climate change, gathering pace at a rate faster than the more aggressive scenarios entertained in the early reports of the Inter-Governmental Panel of Climate Change (IPCC), will exacerbate the consumption impacts of a larger and richer population on forests and on the environment more generally. Higher temperatures, increasing water scarcity, and greater frequency of extreme events will adversely affect the productivity of land- and water resources, particularly in the tropical world. These climate-related shifts may lead to changes in the relative importance of tropical and temperate regions as centers for the production and processing of forest products. These changes will certainly intensify greatly the competition for land in the coming decades.

The need for more food, more proteins, more renewable fuels, and more fiber is occurring and will continue to occur in the same landscapes in many countries. It is already leading to a change in the ownership and control of massive areas of land – close to perhaps 100 million hectares – in developing countries, especially in Sub-Saharan Africa. Despite provoking a backlash in some countries, "land grabbing" will continue if substantial changes in rights regimes, land policies, and decision makers' attitudes do not occur. The tradeoffs involved in such rights and policy regimes are directly about higher productivity and larger harvests of resources vs. higher levels of substitution of needed forest products with more sustainable alternatives or more sustainable and efficient production processes.

Scientific and technological changes—in the creation, management and sharing of information about forests and forest products, in the development of new climate resistant species, and in developing more efficient production and distribution processes including those yielding higher employment—hold great promise. But they need more research investments than are occurring in most of the world. Total public expenditures on forests (likely less than US$ 25 billion) are higher than gross public revenues (around US$ 15 billion) but much lower than formal sector revenues from forests (upwards of US$ 250 billion). These differences suggest the existence of enormous resource subsidies from governments to the private sector. But even the existing public expenditures are mostly for operational expenses rather than for investments in scientific and technological breakthroughs.

Governance options towards greater stakeholder consultation and involvement, broader incorporation of diverse interests in decision making, choices that include civil society, market-based, and hybrid instruments rather than regulations alone, and attention to attitudinal, behavioral, and institutional interventions also present substantial promise for enhancing the efficiency and sustainability of forests and forest management. Such governance options must also cover trees outside forests, and address patch-to-landscape level forest areas. But research in the domain of forest governance is itself patchy, and for the most part in early phases. Far more work is necessary to identify the right mix of governance arrangements to address the incredible diversity of social, political, and biophysical configurations in which forests are embedded.

Despite challenges and obstacles associated with an uncertain future, *at least five directions for no-regrets actions exist*. They will contribute to making forests more economically productive and sustainable in the face of mounting future challenges:

> Investments to identify and develop more sustainable agricultural commodity supply chains and the mix of information, incentive, and institutional arrangements that will be conducive to their sustainability;
>
> Crafting of media strategies that recognize the increasingly sophisticated nature of consumption and the greater environmental awareness of a richer class of consumers to take advantage of peer-to-peer social media relationships;
>
> Changes in property and rights regimes that constrain rapid shift in land ownership and encourage broader public comment and involvement in large scale land transfers, infrastructure development, and extractive activities;
>
> Scaling up of support for research on the production and distribution of forest products, creation of employment intensive processing methods, and development of climate resistant tree species and forest restoration;
>
> Deployment of hybrid governance approaches for forests from patch- to-landscape scale, and attention to attitudinal, behavioral, and institutional dimensions of forest management.

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CHANGING FUTURES, CHOICES, AND IMPACTS ON FORESTS

1. INTRODUCTION

Every generation believes itself to be experiencing momentous changes that are without parallel. But it is safe to say that human capacity at the beginning of the 21st century to transform the world is at a level that is beyond any point in the past. At the same time, the transformations currently taking place in the world are a consequence of human actions to a degree that has never been true historically. These twin facets of global transformations mean both extraordinary responsibility and unprecedented possibilities for human beings to influence what they do to themselves and to the planet.

This paper outlines and summarizes some of the most important of these trends, their implications for forests, and the nature of the resulting action space for forest decision makers. Because the future is always uncertain, even if the inertial force of existing trends makes some outcomes more likely than others, the role of human actions and choices assumes greater importance in creating a livable context for forest-dependent peoples and economies.

The most important trends affecting the future of forests obviously concern the vast demographic and climate changes that are unfolding slowly. Another substantial change that concerns the subsequent discussion is the economic and related social shifts that go sometimes by the name of globalization. This paper also examines some key technological challenges and opportunities, but to a lesser extent, focusing primarily on how they are shaping the thinking, connections, and actions of humans.

Demographic and climatic changes are more predictable in their broad outlines than are economic shifts and technological transformations. Their predictability and slowness allow more time to prepare for their impacts. But for all their slowness, they are also more ineluctable with options more limited to alter specific impacts. Globalization is faster moving and less predictable. For these reasons it may appear somewhat more directly related and amenable to human influence and policy choices, but there is less clarity about the ways in which to exercise influence.

2. KEY TRENDS AND THEIR ASSOCIATION WITH HUMAN WELFARE

Each of the three global forces mentioned above – demography, climate, and globalization – are themselves complex, comprising numerous strands and dynamics. Demography is not just about changes in numbers of people, but also about migration, shifts between rural vs. urban location of social groups, and the age and class composition of an increasing or declining population. Climate change includes both the impacts of rapid and slow onset changes in temperature and precipitation on forests and extreme events, but also how forests affect emissions and the pace of climate change. Globalization stands for rapidity of economic changes and movement of capital and labor across boundaries, but also for changes in economic prospects, the ever-increasing interconnectedness of the planet, development of infrastructure and extractive industries in remote areas hitherto untouched by capital and technology, and changing patterns of supply and demand, consumption and production. In addition, technological changes and innovations in digital, medical, genetic, and social media hold major implications for forests, both because of their promise to help mobilize new resources as also the possibility of continued distancing of forests from people.

A consideration of some of these major global trends and processes helps identify key areas in which further analysis and knowledge can help enhance forests and their economic contributions. It also provides some important hints about the kinds of decisions that will likely leverage ongoing changes and where they might be working against overwhelming forces. But very importantly, a review of these trends highlights areas in which absence of knowledge hinders effective decision making.

2.1 Demographic dynamics

2.1.1 Population growth

Changes in population levels and composition are well documented (Standard Chartered 2010, UNFPA 2011). According to the United Nations, global population will grow to 8.3 billion in 2030. Almost all of this growth - 98% - will occur in the developing world, and

half of that in Asia. By 2030, the rate of growth of population will decline to less than 0.7% a year from the current 1.1%. But population will continue to grow at a rapid pace in both Africa and in Middle-East and North African (MENA) countries. The largest countries will be roughly the same as today with some minor changes in ranking. The table below provides a rough estimate of how different countries will be ranked in terms of population by the 2030s.

Table 1: Top ten countries by population

Rank	Country	2010	Country	2030
1	China	1,354.2	India	1,484.8
2	India	1,214.5	China	1,462.0
3	EU-27	497.3	EU-27	505.7
4	United States	317.7	United States	370.0
5	Indonesia	234.6	Indonesia	284.5
6	Brazil	193.3	Pakistan	244.1
7	Bangladesh	167.7	Nigeria	231.0
8	Pakistan	166.6	Brazil	222.8
9	Nigeria	156.1	Bangladesh	219.6
10	Russia	140.4	Mexico	135.2

Sources: UN, Standard Chartered Research

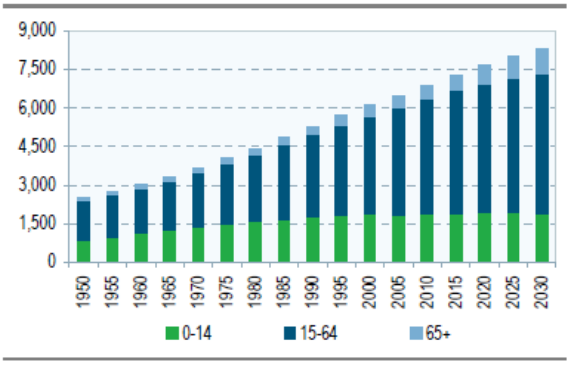
The growing population means that overall demand for goods will increase, including the goods that forests provide. This demand can be met either by increasing the output from forests or through substitutes for the most common goods that forests provide – timber, firewood, fodder, and non-timber forest products, or both. For forests to keep up with the increasing demand, either a larger proportion of existing forests will need to be used for human needs or existing forests will need to be used more intensively and efficiently. Both of these changes require improved technologies.

What is more important and interesting than these aggregate numbers, however, are the accompanying changes in the regional distribution of population growth, variations in the growth of different segments of the population, and declines in population.

2.1.2 The changing age composition of the global population

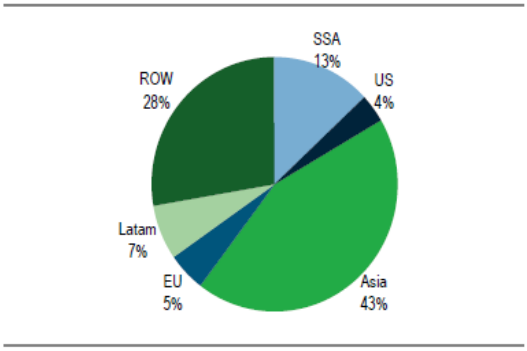
Even as it is growing, the global population is also aging. This aging is producing two distinct effects. First, the aging population is resulting in an increase in the number of

working age individuals compared to the number of dependents. This trend is particularly salient in many emerging economies. Figures 1 and 2 below provide a rough sense of how this ratio has been changing since 1950 and how that basic pattern will continue until 2030.



Sources: UN, Standard Chartered Research

Figure 1: Working age global population



Sources: US Census Bureau, Standard Chartered Research

Figure 2: Expected Working age population in 2030

Figure 2 indicates how the working age population will be distributed regionally by 2030. The figure also represents the other effect of an aging population, mostly being felt in developed countries: the graying of the population as the number of older dependents increases. Together with the increase in the number of working age individuals, the numbers of older dependents is also increasing. The aging of the global population on the higher end is occurring at its fastest in the developed world. Life expectancy at birth is above 80 in more than 30 countries today as compared to less than 20 countries just five years ago. Thirty percent of Japan's population is older than 80 years. Although this is only true of Japan today, sixty-four countries will have joined Japan by 2050 (UNFPA and Helpage International 2012: 12).

As the population ages, its growth is slowing. In a number of countries, particularly in the developed world, population growth is negative. Thus, several Eastern European and ex-Soviet state countries such as Estonia, Latvia, Lithuania, Poland, Russia, and Ukraine, but also some developed world nations, such as Germany, Italy, Japan, and Portugal have seen declining populations. An aging and falling population has profound

implications for the world – but it is also consequential for forests in the medium to long run.

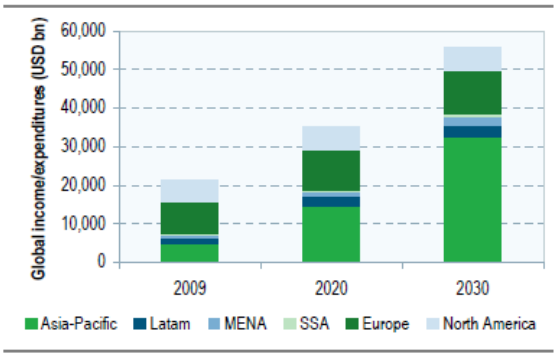
The exact implications of an aging and declining population have yet to be spelled out for forests. But the factors that will generate substantial effects as a result of the changing age composition of the population include the decline in the size of the labor force, a rising dependency ratio with the working age population declining in comparison to dependents, and changes in the availability of disposable incomes at different points in the aging process.

As a contrasting set of examples regarding the effects of a declining population and country-level forest endowments, consider Japan and Russia. The effects of a declining population and high labor costs in Japan, coupled with difficulties in mechanization owing to the topography, mean that it is very hard to make forestry more competitive. In the case of Russia, however, forests will continue to be important as population declines both because of their size and because of the greater potential of more mechanized forms of management and harvesting. However, the success of greater mechanization will depend on both enterprise level management improvements and a better policy environment. The implications for forests of changes in population structure have to be considered in the wider context of governance and market changes.

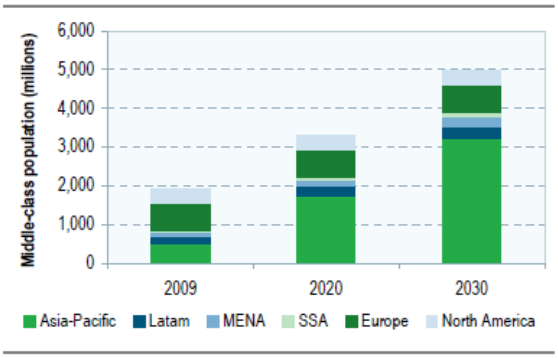
2.1.3 The changing class composition of an aging population

If many of the demographic changes above are familiar, even more interesting are projections regarding the changing global distribution of the middle class. The future will have an older population, but also a far richer one with a middle class that will be substantially larger than today. If the middle class is defined as households spending $10-100 per capita per day, globally there are about 1.9 billion people today in this class (Kharas 2010). These numbers are expected to rise to close to 5 billion by 2030 – a rapid and massive increase. Figures 3 and 4 below indicates how the numbers of people in the middle class and their regional distribution are likely to change in the next twenty years.

Particularly notable is Asia's share of the middle class, which is predicted to grow from the current 28% to 66% (Standard Chartered 2012: 59).



Sources: OECD, Standard Chartered Research



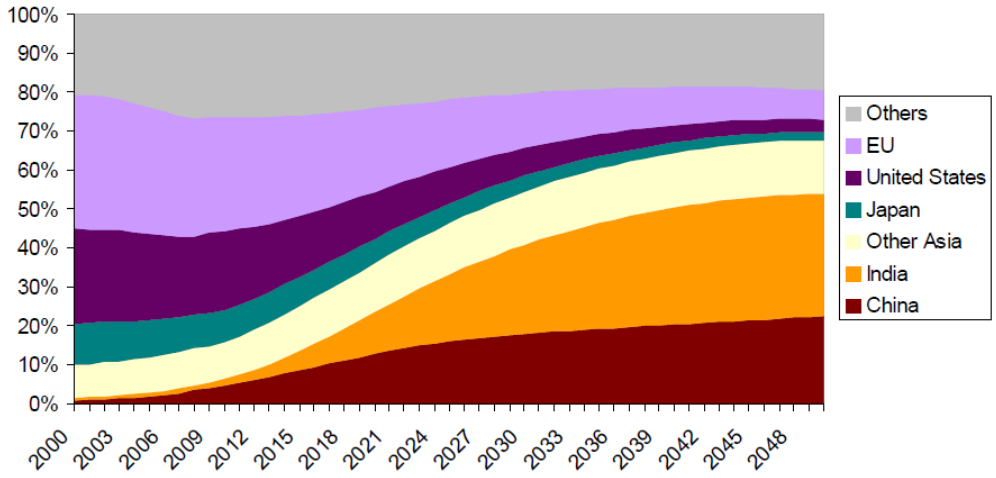
Sources: OECD, Standard Chartered Research

Figures 3 and 4: Distribution of global income and expenditure and middle class population in 2030

Different researchers have recognized the middle class as being linked to economic growth and democracy (Banerjee and Duflo 2007), as being a source of entrepreneurs (Acemoglu and Zilibotti 1997), as being the basis of savings and greater human capital (Doepke and Zilibotti 2007), and as the key source of consumption (Murphy et al. 1989). In terms of its relevance for forests, the increasing size of the middle class is important for at least three reasons: 1) its demand for consumption goods and forest products, 2) its influence on global trade through the demand for forest products, and 3) its views about the environment.

Although the income and purchasing power of the new middle class in Asia will be lower than that of its counterparts in Europe and North America, this increase in numbers of the middle class still represents a tectonic shift in purchasing power, demand, and global consumption. And over time, the change in numbers will also be reflected in purchasing power. As figure 4 below suggests, middle class consumers in China and India alone are projected to spend close to 50% of all middle class spending by 2050 (Kharas 2010: 29).

Figure 5: Shares of Global Middle Class Consumption, 2000-2050 (Kharas 2010)



A critically important issue is whether and to what extent the new consuming classes in Asia will be attentive to environmental concerns and whether companies producing, trading in, and selling forest products in Asian countries will be responsive to their concerns. On the one hand, there is a large literature on changing values with incomes that shows increasing interest in consumers with higher incomes and prosperity to represent pro-environmental attitudes in their actions and purchasing patterns (Cameron et al. 1998, Mainieri et al. 1997). Much of this literature can be referenced as subscribing to the "Environmental Kuznets' Curve (EKC)" hypothesis (Andreoni and Levinson 2001, Dinda 2004). But the empirical evidence on the subject remains divided with a fair number of scholars also finding that the evidence for the EKC is mixed at best and highly sensitive to context, time scale, and types of pollutants and resource extraction being considered (Dietz et al. 2007, Stern 2004).

Thus, it cannot be taken for granted that as incomes increase globally and as the strength of the middle class increases, there will also be a concurrent automatic shift in the spending habits of consumers towards greener products. Some of this shift is attributable to higher education, development of new environmental norms as a result of education and peer exchanges, and stricter governmental controls over pollution rather than a change in incomes alone. Consumers are also more likely to be environmentally conscious about foods and articles that are consumed and that directly

influence the body compared to those that are more or less sustainably harvested (Gilg et al. 2005, Hobson 2002). At the same time, a number of civil society organizations such as Greenpeace have launched major campaigns to increase the awareness of consumers and to mobilize them against unsustainably harvested products (Fabig and Boele 1999, Sonnenfield 2002). The links between a concern for the body and for sustainability more generally need to better understood, as do the conditions under which consumers are willing to express their environmental attitudes in their purchasing behaviors.

Whether belonging to the middle class goes together with actions promoting sustainability remains an open question. But the increasing consumption expenditures of the middle class need little additional evidence. In two to three decades, the middle class of India alone may be consuming 5 times as much as the combined middle class of the USA and EU consumes today. India's consumption will continue growing for longer than that of China because of the different demographics of those two countries (Kharas 2010). What this means for consumption of forest products, water, food, and energy is perhaps enough to boggle the imagination. Without substitutes for current forest products, and their contributions towards human livelihoods, such a massive expansion in demand would create intolerably high pressures for further deforestation, particularly for timber and construction materials, land for commodity production, and exotic products for new tastes.

2.1.4 Migration:

In addition to changes in population levels, shift in the age structure, and increase in the numbers of the middle class, migration is another trend that will shape how the global population lives. Migration is at one level a loose term. It refers to movement of people. But people move for many reasons and migrations caused by different factors may have quite variable implications for forests. Migration includes international movement of people in search of jobs and better economic prospects; movements across national borders owing to political reasons or conflicts, migration within a country for wage labor or for more permanent resettlement; rural to urban migration; or movement of

refugees.

Perhaps the forms of migration that have the most direct implications for forests are those involving relatively permanent movement of younger populations from rural to urban areas, or from rural areas in developing countries across national borders for jobs or other economic gains. These forms of migration mean there is less labor available to cultivate agricultural land, leading initially to fallow agricultural plots, and over time perhaps to a return of woody vegetation. Rural migrants, even if they return home, may not return to farming. And in most such cases, collective forms of forest governance predating migration may become less resilient with loss of human capital. Clearly, migration is another form of demographic change that poses key questions for forest governance and changes in forest cover whose answers are not well understood.

2.1.5 Urbanization

Urbanization occurs because of both pull and push factors as rural economies do not provide sufficient income opportunities to a rising population and cities beckon with a promise of new jobs, more prosperous and improved lifestyles, and a more cosmopolitan culture. Urbanization is a result of economic growth, job opportunities, and stalled rural development. It has the potential to drive economic growth because it creates commercial and industrial centers, presents a concentrated source of demand for agricultural products and consumer goods, provides cheap labor for urban-based industries and service centers, and enables economies of scale. These factors can, in turn, push up incomes and speed up the rise of the middle class. The number of people living in cities has been increasing by an average of about 46mn per year since 1950. This is expected to rise to an average of 70mn a year by 2030 (Standard and Chartered Research 2010).

In 2009, the number of people living in cities edged above the rural population for the first time in human history. By 2030, 60% of the world's population will live in urban areas, compared with less than 30% in 1950. This phenomenal shift – by which more than 5 billion people will live in cities by 2030 – means that the world will have

new opportunities to redefine the use of land and ecosystems as some occupied rural areas become less populated. Most of the urban growth will occur in Asia and Africa. By 2025, there are likely to be 16 cities with a population of 10mn or more, compared with 11 now and one in 1950 (Standard and Chartered Research, 2011).

2.1.6: Implications of changing demographic patterns for forests

This section has discussed some of the most visible and high likelihood demographic changes in the coming two to three decades. An increasing population translates into increasing demand for forest and wood products. Although demand will increase globally, it will increase especially quickly in several producing countries that today witness low effective demand, particularly in Africa. The combination of increasing urbanization, a large and growing middle class, and a relatively young population mean that demand will increase relatively rapidly in Asia and Africa, which will in turn result in a change in trading patterns globally. Instead of large amounts of tropical timber being exported to North America and Europe, changes in regional demand patterns will lead to far more of tropical wood being consumed locally than is the case today, and to far more of the trade in tropical wood products having a south-south orientation.

Anywhere between 1 and 2 billion people are estimated to depend on forests for some part of their livelihood and incomes (Chao 2012). The absence of reliable figures on different aspects of forest dependence is testimony to the immense need to develop better data on how and to what extent forests are contributing to meeting the needs of those that depend on forests. But what is certain is that the numbers of people that rely on forests economically is only likely to increase in the next twenty to thirty years. Meeting these needs will require tremendous inventiveness.

2.2 Climate change and forests

Climate change adds to the great uncertainty we face in a changing world. It affects in particular what is likely to happen to forests and forested ecosystems, and the extent to which forests can help humans meet both mitigation and adaptation goals. It is

impossible in this report to cover the many different ways in which climate change will have enormous and complex impacts on forests in this report (but see discussion related to REDD+ below), a task that has been carried out ably in a number of other publications (CIFOR 2009, Robledo and Forner 2005, IUFRO 2009, Nilsson 2011). The relationship between forests and climate change in terms of the impacts of climate change on forest ecosystems, the contributions of terrestrial emissions to aggregate greenhouse gas emissions, the key role forests play in absorbing emissions from other anthropogenic sources, and the potential of wood to serve as a renewable energy source are all well recognized. But it is also worth mentioning that the impacts of climate change on forests are already being felt, both in the shape of forest outcomes, but also in terms of how forest producers are making decisions.

Pulp and paper companies, historically dominated by North American and Scandinavian capital, are becoming energy producers and opting for higher levels of diversification to spread their risks. Pulp and paper remain important in their portfolios, but producing a larger range of wood-based products, some of which are more profitable than the traditional focus on pulp and paper, is now a well-established trend (Nilsson 2011). Climate change is directing attention to renewable forms of energy, including that from wood.

Climate change intersects with science and technological changes to spur a restructuring of forest industries. These industries are moving into what is termed "bio-refining"—the production of energy, plastics, textiles, food additives, and so forth. Globally such new forms of vertical integration for wood-based products are projected to lead to additional industrial output worth more than 200 billion USD by 2015 (Nilsson 2011). DSM, the world's largest vitamin maker plans to supply yeast and enzymes to help produce ethanol on a large scale, including from forest products and second generation biofuels. Estimates are that this activity alone will be worth $3-5 billion a year by 2022 (Gray-Block, 2011). These changes relate to climate change as a driver, but also to globalization, changes in technology, and corporate restructuring.

2.3 Globalization and economic trends

It may be hard to remember if one lives in the Northern world, but the global economy is in the middle of a major structural change, driven largely by countries in Asia. We are in a period of economic growth with trend rates of a kind that have barely been witnessed in the past. Some projections suggest a rise in real global GDP from $62 trillion today to $130 trillion or more by 2030 (Lyons et al. 2011). The economic slowdown in industrialized countries that began in 2008 is still worrisome for many countries and it will undoubtedly change the speed and magnitude of some of the future economic projections. But at the same time, other regions of the world, including Africa, are beginning to grow at a pace that could not have been anticipated even five years ago.

2.3.1 Changing economic prospects

The dominant global economic trend is a shift in economic power away from the US, Europe, and Japan and toward China and India and other emerging economies of Asia and even perhaps Africa. Over the last 5 years, cumulative GDP growth in US, Japan, and Europe has stagnated between 2-5% whereas in Brazil, India, and China it has been between 25 and 69% (Nilsson 2011). Advanced countries had 63% of global GDP in 2000, but by the end of 2013 those countries are projected to account for less than half of the global GDP (Lyons et al. 2011; Bain & Co. 2011). This does not mean that the US, Europe, and Japan are countries in absolute decline. They will still be very important in 30 years: the Chinese economy may soon overtake that of US, but the average Chinese person is still 5-10 times poorer than an American. But it does mean that emerging economies will begin to have an economic clout that will be more proportional to their share of the global population.

This economic growth, together with rising per capita income and a global population of 9 billion by 2050 has profound implications for the pressure on resources, including forests.

South-South trade will continue to grow and quickly (Lee et al 2012, Chatham House, 2012). This will have substantial implications for the market share of companies that today practice corporate social responsibility (CSR) as also for the influence of the consumers and their tastes that provoke CSR. Unless consumers in China and India come to develop similar tastes and concern for the environment and are willing to shift their purchasing power to reflect this concern, it may become increasingly more difficult to influence global companies, including those in Europe and North America.

Regulations and governance arrangements linked with FLEGT, the Lacey Act and the like may then come to have lesser power. Similarly, ongoing efforts to increase the sustainability of agricultural commodities such palm oil, soy and beef will also come to be under threat. As trading patterns change and companies domiciled elsewhere come to the fore, efforts to influence corporate behavior for social and environmental ends will need to be rethought. A key ingredient of such rethinking would need to be multi-country coordination for legislation and policies that favor sustainably produced commodities, media campaigns that do not stop at a national border, and peer-to-peer digital social media efforts that span social and political boundaries.

2.3.2 Increasing scarcity and competition of natural resources

The idea of resource scarcity, once voiced only by activists or marginalized academics, has now become mainstream as evidenced by reports from McKenzie & Company and others (McKinsey Global Institute 2011, Global Footprints Network 2010, Grantham 2011). Other similar analyses focus on food as a resource and make similar arguments about the challenges of addressing food security (Evans 2011). The McKenzie Global Institute report in particular highlights the rise in prices of commodities (by more than 50% since the beginning of the century despite a recession); the extraordinarily high levels of resource subsidies that governments provide (worth more than a trillion dollars annually); and the urgent need for higher investments in resource systems to ensure that future demand can be met (more than a trillion dollars annually).

Although prices of commodities fell for much of the 20th century, the first decade of this century has wiped out the price declines of the previous century (Figure 6). The creation of 3 billion more middle class consumers in the next two decades means that this change in the relative prices of resources is no flash in the pan but likely to endure. Further, demand for resources and raw materials is increasing at precisely a time when new supply sources are unclear and costs of extraction for many resources are rising.

Figure 6: Changes in commodity prices (1900-2010)

Source: MGI 2011: 5

If we look at this issue through the lens of forests, the major implications for forests and the people who depend on them relate to this competition for land to produce food and fuel and fiber. One set of concerns relates to limits on land and the extent to which increases in food production might be possible without deforestation. A number of researchers have highlighted possible scarcities of land as a result of increasing demands (Lambin and Meyfroidt 2011).

We can also expect that this will lead to more conflicts over land as the large literature on land grabs already makes very clear (Cotula et al. 2009, Von Braun and Meinzen-Dick 2011, World Bank 2010). With reports of changing control over land from countries such as Papua New Guinea, Russia, Colombia, and a range of other countries

in sub-Saharan Africa, Southeast Asia, and Latin America, it is evident that the phenomenon is global, and that the term "global land grab" is at least descriptively accurate even if normatively contestable. The effects of change in land ownership and control on such a massive scale will be felt for decades and will inevitably mean a tremendous change in land cover on the areas in question.

2.3.3 Changing consumption and production patterns

Although the discussion above has focused mainly on the consumption effects of demographic trends in the next twenty to forty years, production patterns are also going to register major shifts over this time period. These shifts will occur along spatial and social axes, but also have important qualitative and quantitative dimensions that are important to appreciate.

The last 15-20 years have seen huge changes in wood processing capacity with growth, being particularly rapid in China, Brazil, Vietnam, and Russia (see table 2 below). China and Vietnam have relied on imports of forest products from all over the world whereas Russia and Brazil have relied more on domestic timber sources. There has also been a major investment in forest resources in China itself.

Regionally, exports of forest products such as timber and pulp and paper grew far faster between 1990 and 2005 in Eastern Europe and developing Asia-Pacific countries at the expense of North America (although the growth occurred from a lower base). Similarly, value added in forest products also grew much faster in the developing countries of the Asia-Pacific than it did in North America or Western European countries (FAO 2010). In the next twenty to twenty five years, the production of wood, fiber, and food from forests is also likely to register major shifts, with some speculation that some of this expansion may occur in Southern and Central African countries, particularly if the governance and political problems in these countries can be addressed (McKenzie 2006, Persson 2006). Indeed, a number of research studies have made the same argument about the continued shift of the paper, processed wood, and timber sector to the Global South in the next twenty to thirty years (FAO 2007, STCP 2007).

Table 2: Changing share of selected countries in exports and international trade of wood products (from Nilsson 2007).

Country	Exports (USD million)		Trade (%)	
	1990	2005	1990	2005
Emerging Players				
Brazil	1,604	8,151	1.3	3.2
Chile	1,010	3,528	0.8	1.4
China	1,848	18,455	1.5	7.2
India	72	688	0.1	0.3
Indonesia	3,530	8,174	2.9	3.2
Malaysia	3,386	6,097	2.8	2.4
Russia	1,715	7,633	1.3	3.0
Vietnam	144	1,612	0.1	0.6
Traditional Players				
Canada	18,375	35,408	15.2	13.8
Finland	9,724	12,912	8.1	5.0

Source: STCP (2007).

Another possibility, presented by Sten Nilsson (2007) is that competition for land in Southern countries will intensify and it is doubtful that the forest sector in the South will remain competitive with food and energy Forest industry will then shift back to Northern countries. This conclusion, however, depends on whether a changing climate will permit expansion of cropland in the developing world. Indeed, the combination of a number of factors make it more likely that it will be crop production rather than tree production that will increase in temperate climates. In general, agricultural productivity in terms of output per unit area in most developing countries (with the clear exception of China) is much lower than in temperate countries (Agrawal Forthcoming). We also know that the adverse effects of climate change will be greater in the tropical than in the temperate world, particularly in the next two to three decades and even in the longer run (IPCC 2007). Finally, crop production is more profitable than forestry implying that temperate countries that have a land frontier (e.g. Canada and Russia) with surplus land that becomes suitable for agriculture with climate change will likely emphasize crops over forests if they have a choice. These considerations suggest that in fact the conventional wisdom about shift of timber production towards emerging economies

might be right, *pace* Nilsson.

2.3.4 Infrastructure development

One of the most consequential areas of change for forests is the scale at which new investment is likely to take place in infrastructure development in what is today viewed as the global South, particularly the contiguous tropical forest countries of the Amazon and the Congo Basins and in Southeast Asia. The numbers associated with investments over the next two to three decades – in the many trillions of dollars - are staggering.

For example, needed and planned infrastructure investments in Asia alone are expected to be upwards of 10 trillion dollars over the next decade (Standard and Chartered 2010: 10). Although these investments will occur in both the South and the North, the levels of investment in the South are more significant. Such developments, particularly in combination with large scale changes in land ownership, can have positive or negative consequences on local economies and jobs depending on how they are managed, the safeguards in place, and the willingness of nation states to put the interests of their poorer citizens in the forefront. But infrastructure development, especially mining and oil and gas extraction, often occurs against the wishes of those who claim the land where the resources are found. There have been many examples of violent conflicts relating to this issue (Bannon and Collier 2003, Carstens and Hilson 2009, Tull 2006).

Infrastructure investors and infrastructures are vulnerable to action by those on whose land they are situated and given the high costs of infrastructure such as pipelines, roads, and other structures, there are high incentives for the protection of infrastructure investments. In the past, investors/private actors have dealt with resistance by coercion and by having powerful friends in government. But as people become more aware of their rights and willing to mobilize to protect them, new forms of negotiations will be necessary. But the level of investments is going to be such that new institutional arrangements will be necessary to manage the changes in incentives, particularly for resources that cannot be protected easily such as forests and oil

pipelines. As competition for land and resources intensifies, those involved in infrastructure development and extractive industry will therefore need to be willing to make adequate concessions to local land and right holders to protect their investments.

3. MAJOR CHALLENGES AND OPPORTUNITIES FOR FORESTS AND FOREST STAKEHOLDERS

The trends identified in the previous section around demographic changes, shifts in global economic balances, increasing scarcity of resources, higher demands from an enlarged middle class, climate change, and infrastructure development have momentous implications for forests. Whether the goal is greater sustainability of forest resources, continued high levels of forest product extraction and harvests, production of sufficient food for a richer, larger population, conservation of biodiversity, or sustenance of forest-based livelihoods, these trends pose obvious challenges to current business-as-usual approaches to exploiting forests but also stand for potential opportunities.

Some of the most important of these lie in the way decisions are made about forests and how forests are governed, ensuring stronger and more effective involvement of private sector actors and decision makers in supporting forest sector goals, developing a cross-sectoral approach to management of forests and ensuring that landscape level planning is integrated into the decision calculus of forest sector actors, and taking advantage of scientific and technological advances related to the management and production of forest sector goods and services.

3.1 Governance

The importance of forest governance, from the international to the local level, cannot be overstated. And there are major challenges and opportunities associated with governance at each of these levels, as also with how different actors are involved in governance.

In many ways, the global governance system for economic and environmental outcomes is already changing and shifting from its “traditional” sources of power in

Europe and North America. Even if these sources of power continue to be very important, efforts by the BRICs (Brazil, Russia, India, and China) to have more of a say in how the IMF and the World Bank make decisions, and how the UN system is run are likely to chip away at the dominance of the United States and Europe – although at a slower pace than the economic changes are occurring (Economist 2010). That the BRICs have committed new funds to the IMF reserves recently demonstrates their interest in how international institutions are run. The tradition of the IMF and the World Bank always being led by a European or a US citizen will likely come to an end in the next two decades as ongoing economic trends continue to place more power in the hands of emerging economies.

The implications of the negotiations and discussions at Rio+20 for global governance remain unclear. The communiqué issued at the end of the meeting suggests that some UN institutions such as the UNEP and perhaps the UNDP will gain strength. Substantial sums of money were also pledged for green economies and protection of oceans. Clauses 192-196 of the Rio+20 communique recognized the social, economic, and environmental contributions of forests to people, called for the urgent implementation of the Non-legally Binding Instrument (NLBI) on all Types of Forests, and called on the Collaborative Partnership on Forests to continue its support to the UNFF. But the vast majority of the actual pledges and commitments for greater sustainability were in areas of energy and infrastructure, reaffirming the need for forests to be considered in an integrated and holistic manner with substantial emphasis on how they are connected to the larger set of economic and environmental issues.

In this sense, there are evident parallels between the governance of forests and the wider issues of global environmental governance (Rayner et al. 2010). International forest governance is highly fragmented and enormously complex. In and of itself, this is not necessarily bad and relates to the arguments made by Ostrom (2012) prior to Rio+20: “Inaction in Rio would be disastrous, but a single international agreement would be a grave mistake. We cannot rely on singular global policies to solve the problem of managing our common resources: the oceans, atmosphere, forests, waterways, and rich

diversity of life that combine to create the right conditions for life… No one knows for sure what will work, so it is important to build a system that can evolve and adapt rapidly… Such an evolutionary approach to policy provides essential safety nets should one or more policies fail. The good news is that evolutionary policymaking is already happening organically…"

Some of the key challenges and opportunities related to forest governance were summarized by Rayner et al. (2010). They correctly emphasized that many forest problems of overriding importance (e.g. deforestation and forest degradation) are cross-sectoral and have their sources in pressures outside the forest sector – this means that the critical governance challenge for forests is to move from a focus on forests to a concept of forests+ which embraces and works with the inter-institutional complexity inherent in managing and governing forests (Chomitz 2007, Landers et al. 2010, Preston 2010, PRP 2010). The key features of a forests+ approach to governance are recognition of the need for synergistic approaches involving a wide range of policy instruments, the inclusion of multiple actors' interests, ideas and incentives in the design and implementation of these instruments, the willingness to adapt and develop new institutional arrangements depending on country and local capacities; and an emphasis on learning and the creation of appropriate platforms and processes to facilitate learning related to forest governance (Rayner et al. 2010).

3.2 The role of the private sector and market actors

The private sector, even if in a manner very different from its role in the early stages of colonial and capitalist forest use and exploitation, is now the primary agent of change across most forest landscapes. The assertion of control over forests that governments made over forests even a generation ago is no longer the main driver of change in forests. Given that central governments continue to control more than 80% of the global forest estate (Agrawal 2007), and have formal rights over an even larger proportion of forests including in the developing world, they are by association involved in ongoing changes: their involvement includes the granting of public lands and forests

as concessions, setting the terms on which concessions are managed, and configuring the larger policy and institutional environment within which forest governance is one piece. But change is being driven by markets and competition among private sector actors. And their goal is to seek the most favorable opportunities to generate forest products demanded in the market, and to put land on which forests are located to its most profitable uses to meet the exploding demand for commodities (Chomitz 2007, see also above).

In this context, it is important to note that a small number of agricultural commodities—soy, palm oil, cattle and cocoa—account for a large percentage of deforestation in tropical regions that have high deforestation. Rapid expansion in output has been driven by private investment, with both large companies and small farmers involved in these industries (often through a combination of out-grower, cooperative, concession and supplier arrangements). Further growth in output is forecast. For example, the area under oil palm is expected to increase from 12m hectares currently to 18m ha by 2020 and 24m ha by 2050 (ProForest 2011). Mining and infrastructure also have a considerable impact on deforestation.

The importance of the private sector in the expansion of commodity production is evident. The experience of oil palm in Indonesia and Malaysia is a good example. Rapid expansion in the area under cultivation is taking place in both countries to meet population growth, changing dietary preferences, and demand for biofuels. The two countries dominate production with nearly 8 million ha of land under oil palm between them producing just about 40 million tons (Thailand, the next largest producer accounts for only 1.3 million tons in comparison) (FAOStat 2012, accessed November 2012). Much of the growth in the area under oil palm (five million hectares in the last two decades) has come from deforestation (Newton et al. 2013). But shortage of suitable new land in Malaysia and the moratorium on forest clearance in Indonesia, plus rising costs in both countries is forcing investors to seek new lands for commodity agriculture. Africa is the next frontier. Recent concession agreements include such companies as Sime Darby (Liberia 220,000 ha; Cameroon, 300,000 ha), Olam (Gabon, 300,000 ha); Equatorial Palm

Oil (Liberia, 169,000 ha) and Wilmar (Ghana, more than 100,000 ha) (ProForest 2011).

The power of the market and consumer preferences has been used in the forest sector for the last 20 years through non-state regulation in the form of certification – and more recently in the form of legality verification through FLEGT, the Lacey Act, and other measures to promote better environmental and social outcomes. Certification does not involve governments as much as legality verification does (see Background Paper 1). The same market power is now being applied to the production and trade of some agricultural commodities, including oil palm, soy, and to a lesser extent meat and leather. The forest industry and the agricultural commodity industries are certainly very different, however, and it remains to be seen how effectively a combination of demand and supply side measures can influence agricultural commodities and their impacts on forests. The Forest Footprint Disclosure Project, modeled along the lines of the Carbon Disclosure Project (CDP) and recently joining the CDP, attempts to provide investors with information on whether companies may be sourcing products from high deforestation areas. Such voluntary information provision to investors by companies is another example of efforts to use the power of markets and consumer choice to move towards sustainability and sustainable supply chains.

3.2.1 The increasing importance of market signals

Over the past ten years many countries have moved away from rules-based systems for determining patterns of land use management to a market-based approach, where private investment increasingly determines landscape patterns and processes. Central governments continue to play an important regulatory function, but have a lesser role in land allocation, rural credit provision, technology extension, and food production than in the latter part of the 20th century. If these trends towards market-based signals for determining land use changes continue over the next two decades as they have developed in the last, market-based sustainability instruments are likely to grow in importance together with the need to identify the most effective means to use them to prompt sustainable production practices.

Markets are also driving change in production and processing standards in the direction of consumer preferences. Some of the biggest consumer goods companies are voluntarily adopting mandatory requirements for sustainable production and responsible sourcing in a range of forest-risk commodities, such as palm oil, soya, beef and cocoa. Unilever, the world's largest buyer of palm oil, has committed to the sustainable sourcing of half of its raw materials by 2015 and 100% by 2020" (Unilever, 2013). Nestle has committed to ensuring that all its raw materials sourced in forest areas have not led to deforestation (Nestle 2011). Grupo Andre Maggi has committed to the sustainable production principles embodied in the Roundtable on Responsible Soya (RTRS) (Mongabay 2011). The Consumer Goods Forum, which represents companies with annual revenues worth US$3 trillion, has pledged to help achieve zero net deforestation by 2020 (Consumer Goods Forum 2010).

But these commitments will require companies to adopt some of the practices and mechanisms that have been used in certification of timber (Lawson 2010), particularly in ensuring that the different stages of processing of a commodity are indeed sustainable. Barcoding, isotope tracking, and DNA evidence may all be used to manage sustainable supply chains. Some of these approaches have also been used in ensuring food quality and for health interventions, but that experience can as well be adapted in the context of agricultural commodities to track them back to their source and thereby to encourage more socially and environmentally acceptable practices.

3.2.2 Multiple actors and instruments

NGOs and various civil society actors have been instrumental in providing evidence of unsustainable land use and forest management practices and in helping develop new standards. Their actions have assisted on both the demand and the supply side aspects of sustainable commodity production. It is necessary to both influence and shift commodity investments leading to deforestation, and to encourage new investments in sustainable practices that at the same time enhance value created in the forest sector.

Demand-side measures include a) market incentives (public procurement

policies, private sector responsible sourcing policies, consumer awareness campaigns); b) supply chains and business-to-business links (private sector responsible sourcing policies, certification systems); and c) greater accountability and transparency (monitoring and reporting of commitments for sustainable sourcing and production, sharing of information on best practice). Such measures, particularly public procurement and corresponding private sector practices, offer an effective way to leverage sustainability practices on-the-ground. Experience with timber procurement offers important lessons. Eleven EU governments now have public procurement policies that require "legal and sustainable" timber or variants thereof (European Commission, 2012). Many private sector buyers, as discussed above, are also beginning to observe similar standards – critical for a steady transformation in the market for timber.

Ultimately, a single country by itself only has a small influence on markets for agricultural commodities. But countries acting in concert can have transformative influence. For example, the UK only consumes about 1% of palm oil traded internationally. However, EU accounts for 22%, offering much greater scope to influence production sourcing in the market. The big question here, as also discussed earlier, is whether companies and consumers in emerging markets will also have the willingness to translate their purchasing power into incentives that prompt sustainable practices for producing commodity and forest goods.

Demand side measures are, of course, inadequate on their own. A combination of demand and supply side measures is needed, including financial incentives. Some of the key supply-side measures include a) subsidies and incentives (technical assistance, grants, and capital to support sustainable investments); b) support for compliance with standards and improved practices including technical and financial assistance to meet sustainable production standards); c) coherent and clear regulation and an enabling policy environment; d) clear land tenure and rules defining land use.

A concrete example will make the above point more clear. In the Indonesian case, the key question is how to put into place policies that simultaneously recognize the economic benefits of producing palm oil for the market but encourage plantations

and production strategies that are based on degraded rather than new forest areas. For companies the incentive is to clear primary forests as they get benefits of timber sales, and the government provides a clearer tenure right than can communities. So, placing plantations on degraded or secondary forest areas will require clarification of property and tenure, strategic development and placement of road and power infrastructure in degraded land areas, research support on the practices that enhance production on degraded forest lands, and a simplified and predictable regulatory framework. These developments depend on politics, governance, and supply side interventions. But additional demand side support in terms of information to consumers and buyers about the sourcing of commodities, consumer awareness campaigns about the difference between no-deforestation and sustainably produced commodities, and public and sustainable procurement policies will serve as additional measures to encourage a shift to degraded forest land based palm oil production.

3.3 Moving beyond GDP indicators: Natural capital and sustainability practices

The Gross Domestic Product (GDP) and Per Capita Income (PCI) have long been the standard measures of progress, development, and improvement. Although disputed by some, often considered to be on the fringes of the project of economic development if not on the fringe entirely, these concepts and associated metrics have held sway for a remarkably long time, with some promising revisions through the concept of the human development index in the early 1990s.

The search for new indicators that may substitute for the GDP and PCI reflects the fact that economic growth as measured by the gross domestic product has not delivered greater well-being to truly massive numbers of people. Increases in average incomes have also not improved the stock of real, sustainable wealth for posterity, for our children and grandchildren. And growth has left nature impoverished owing to high levels of consumption and waste without necessarily increasing happiness.

This is not the place to launch or summarize a critique of GDP as a measure of development but it is still worth making a few points. Calculations of GDP do not

distinguish between different kinds of spending. If GDP alone were the measure of development, the BP oil spill in the Gulf of Mexico would be viewed as contributing to the economy "positively" because it led to expenditures on cleanup of the spill and these expenditures became a part of the GDP. Nor does GDP take into account the distribution of growth. It doesn't tell whether the aggregate levels of growth have benefitted a few or have been widely shared. It doesn't account for depletion of natural capital and ecosystem services. The harvesting of all the trees in the world's forests and the capture and sale of all the fish in the oceans will boost global GDP even if the result was the destruction of terrestrial biodiversity and fisheries subsequently. Nor does GDP reflect valuable goods and services that are not exchanged in the market but are critically important for society, such as volunteer work or parenting.

Therefore, there is growing interest among researchers, in a number of countries, at the World Bank, in many private sector organizations (e.g. Nestle), and in civil society organizations (e.g. Conservation International) in natural capital accounting. Ten African countries signed the Gaborone Declaration committing themselves to value natural capital in their pursuit of sustainable development (CI 2012). The subject was also discussed in the Rio+20 meetings, and there was a side event on natural capital accounting that several heads of state and CEOs attended. But the references to this issue in the in the draft communiqué suggest that there is no broad agreement on how to proceed: "We recognize the need for broader measures of progress to complement GDP in order to better inform policy decisions, and in this regard, we request the UN Statistical Commission in consultation with relevant UN System entities and other relevant organizations to launch a programme of work in this area building on existing initiatives." The development and widespread adoption of alternative indicators of wealth is necessary to account for environmental values more effectively. It presents an important emerging opportunity for more sustainable forest management.

3.4 Forests and livelihoods

It is difficult to summarize the implications for rural livelihoods of changes that affect

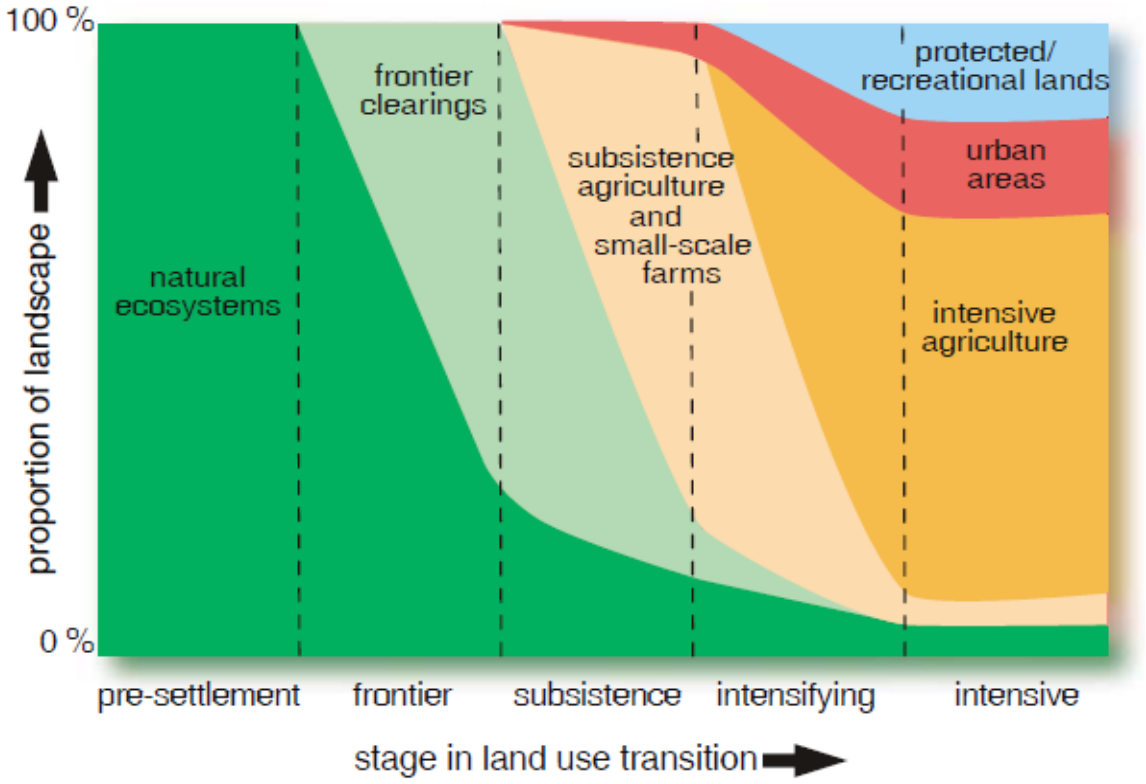
forests, in part because the impacts of forest conversion on livelihoods range from wholly positive to wholly negative depending on the circumstances of those affected and the time horizons considered. But it is evident that the current processes pose substantial risks to many forest-dependent peoples in the developing world. Examples of poor and marginal groups losing access to resources that are vitally important to their livelihoods and culture can be cited from southeast Asia (Colchester and Chao 2011), Africa (Deininger year), and even internally in China (Landesa 2012) and India (RRI 2012). Many general overviews of land grabbing and the effects of such land grabs on the poor have recently become available (RRI 2008, Hatcher 2011, Pearce 2012).

This potential for adverse impacts on livelihoods, even though the land grabs may contribute to higher levels of cash incomes and tax revenues for the nation-state, have led several groups to propose principles to guide transfers of land and property in land (FAO et al. 2010). Clearly, one of the key livelihood implications for forest dependent peoples as the transfer of land rights and control over vast new areas of land formally passes from communities and governments to domestic and international capital owners is the need to establish clear legal arrangements for such transfers, and principles for investments that will promote responsible behavior by new landowners (see next section).

3.5 A landscape approach: Land use and planning

A landscape approach to land use, change, and planning considers changes in different areas of the landscape as being connected and driven by common processes. The same basic underlying incentives to produce for the market or to maximize revenues may lead to recovery of forest cover in some areas and deforestation in others depending on the capacities of the soil and topographic features, and access to markets and finance. The basic insight of this approach at the global scale can be summarized in the land-use transition figure below (Foley et al. 2005).

Figure 7: The Global Land-Use Transition

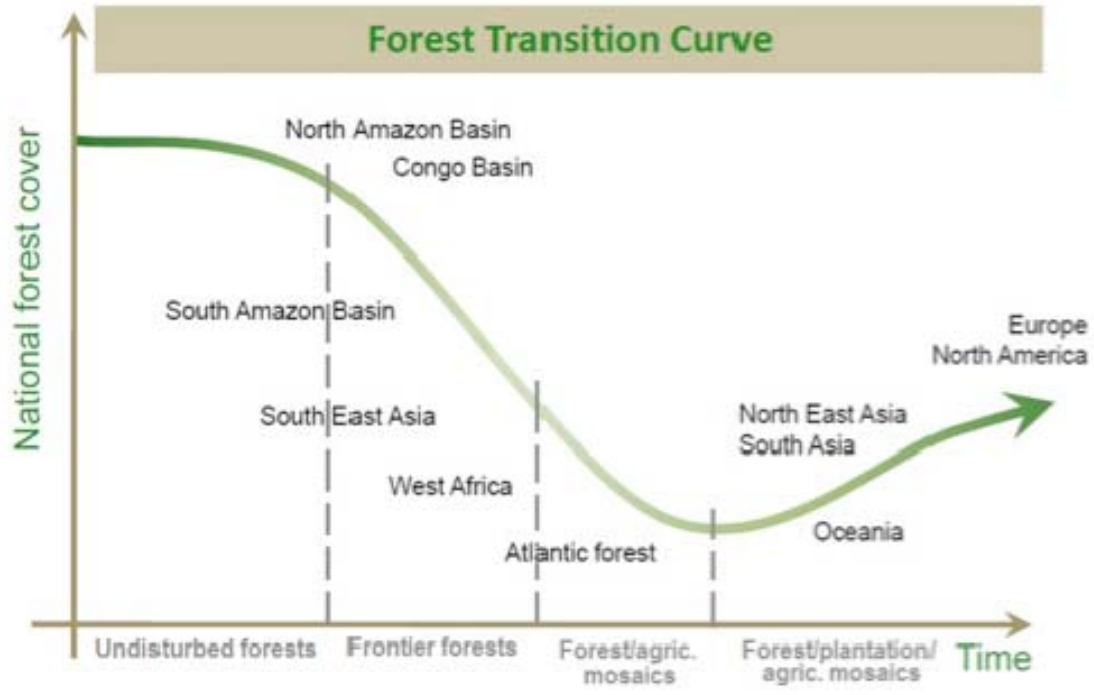


Source: Foley et al. 2005: 571

A landscape approach to understanding land transitions can help identify specific opportunities for enhancing social, economic, and environmental benefits as described in numerous case studies. For example, faced with a choice between building a new water filtration plant for drinking water and paying landowners in the Catskills to protect watersheds, the city government of New York chose the latter at a cost of approximately US$ 1 billion, saving itself US$ 6 billion that the filtration plant would have cost and annual operating costs of US$ 300 million (PCAST 1998). Coffee farms within a kilometer of forest areas benefit from wild pollinators, increasing coffee yield by 20% and reducing the incidence of misshapen beans by 27% (Ricketts et al). These case studies highlight the importance of multiple land use strategies in both managed and natural ecosystems so that ecosystem services such as pest control by natural predators, pollination by wild bees and other insects, reduced erosion with hedgerows, and filtration of runoff through buffer strips can be enhanced beyond forests.

Indeed, one of the central implications of the ways in which forest transitions are occurring across different countries is the need to manage the non-forest. Because trees are in many different parts of the landscape and not just in forests and because the extent of trees outside forests varies depending on the stage of the forest transition (see figure below), their management and use depends on the nature of ecological diversity, variations in forest dependence and uses, and goals of forest management. The *forest-transition curve,* without assuming teleological forest change, shows broadly how different world regions are moving from pristine, primary forest to agriculturally dominated land and beyond. Waxing and waning of forests reflects economic, demographic, and institutional changes.

Figure 8: Forest Transition Curve



Sources: Gregersen et al. 2011. Greener Side of REDD+; Andrasko and Bosquet 2010; Angelsen 2007

On the left of the transition curve, the relatively undisturbed natural forests in many parts of the developing world are under the control of governments. That control

may often be illusory depending on the capacity of the state and the ability and the interest in government agencies to craft effective policies and enforce the policies that exist. Further along the transition curve, under increasingly intensive agroforestry and agricultural management, farmers may have more secure rights over land, but policies affecting tree tenure, trade, credit, infrastructure and agricultural incentives define the prospects and constraints for improving resource use. These farming systems present opportunities for more intensive planting and use of tree products for food, feed and other commodities. They also provide scope for building small enterprises, backed by associated research and policy, to support improved production, management and postharvest processing and marketing—and ultimately enhance benefits for the poor and disadvantaged. In such landscapes, the conservation and maintenance of environmental services and unique biodiversity present particular challenges. Their protection requires specific policy, governance solutions and incentives. Farthest along to the right are the recovering forests in countries where forest products have become relatively valuable or where agricultural specialization is no longer profitable.

Although there are distinctive sets of issues at different points along the curve (i.e., in different landscapes), some drivers and challenges cut across all landscapes. Among these are climate change, consequences for adaptation and mitigation, and the need for better integration of development and conservation objectives in all types of landscapes where people live.

3.5.1 *Landscape approach to forest management*:

Established institutional structures for managing forests in most countries, however, militate against a more integrated approach to land-use planning and management. Decision-making around forest management must nevertheless open itself up to influences and relationships outside forests. Changing landscapes – both because of demographic, economic, land and forest transitions and also because of climate change – mean that some of the most fruitful opportunities to manage forests lie outside forests. Large areas of so-called degraded forestlands can become more productive and

deliver higher levels of goods and services than they do at present. The Global Partnership on Forest and Landscape Restoration (2012) estimates that nearly 2 billion hectares of land – half the official areas of forests worldwide – offers potential for restoration. Increasingly such areas will be where most forests and people are located, and their improved management is essential.

Land use plans can be best translated into action on the ground most easily in authoritarian systems in which governments have the power to enforce their will. Land use planning during the colonial period, in the USSR, and in the contemporary period in China typifies this. But large scale land use plans are harder to implement in pluralistic societies where decision making is often dominated by wealthy interests that can influence implementation to advance private interests at the expense of the public good or the interests of less powerful local populations.

The million hectare rice scheme in Kalimantan is a classic example. It led to large scale, publicly subsidized extraction of timber under the guise of achieving self-sufficiency in rice. Of course, there are counter examples as well. Setting aside of protected areas, extractive reserves, and indigenous reserves in the Brazilian Amazon is also land use planning at massive scale, and it has helped reduce deforestation, albeit with the help of strong enforcement and changes in commodity prices that have reduced pressures for land clearing (Nolte et al 2013).

3.6 Science and technology

Given the increasingly global use of digital and mobile technologies, some of the easiest wins for forests are in improved deployment of these technologies for monitoring forest cover and change. Remote sensing and GIS technology are critical for such monitoring. Financial support for these developments will help, but even without efforts to mobilize explicit and large-scale action to use these technologies, it is very likely that data on forest cover and change will become available at relatively fine scales (30 to 100 meters per pixel resolution) at annual or even more frequent temporal intervals and at even finer resolution for specific locations of interest. Monitoring

forests at much finer temporal intervals (4-8 weeks) but more gross spatial resolution is feasible now, and can be used to monitor outcomes on the ground in real-time (Mongabay 2012). Making this information easily and publicly available and linking it to activists networks through mobile phones and internet will help empower groups previously marginalized. The same technologies can be used to provide information about land transactions, crop, timber and NTFP prices, market supply, and sales to small holders, forest users, and producers of forest NTFPs (Scherr et al. 2004). Development of these systems, all within reach at this point, will help more of the surplus in supply chains to be moved to small producers instead of middlemen, helping make agricultural and agro-forest systems more economically efficient and equitable across the globe.

Apart from information and its better management through maturing digital innovations, the need for technological changes in the production, processing, and distribution of forest products is also of paramount importance (Nilsson 2012). Trends towards greater demand and space-limits on potential new supplies mean that higher levels of efficiency in supply chain processes together with higher productivity are necessary if redirection of forest lands towards agricultural commodity production is to be avoided (Roberts 2011a 2011b). Climate change impacts at the same time mean that the suitability of existing areas for different tree species can no longer be taken for granted. The selection of the right infrastructure in urbanizing emerging economies holds substantial dividends in the context of climate change. Similarly, the selection of the right species in efforts to restore forest areas needs to be forward looking so that planted species do not get overwhelmed by the impacts of a changing climate. Finally, given the rising costs of fuel, a focus on small enterprises in the course of forest transitions is also likely to generate double wins through higher employment but also by making it economical to locate forest industries near planted areas (Bull 2012).

4. WHAT CAN STAKEHOLDERS DO?

Governance can be viewed both as an arena of major concern for forests and its reforms as an indispensable domain of action by decision makers to improve forest outcomes.

Further, action in relation to governance is critical from the international to the national to the subnational and community level. One indicator of the importance of governance comes from a review of the experiences of the 78 countries that have increased their forest cover between 1990 and 2010 (Gregersen et al. 2011). Improvements in governance preceded improvements in forest cover in the vast majority of these countries. They were accompanied by changes in forest tenure and efforts to secure the rights of forest dwellers; these changes were accomplished only with the support of government officials at high levels.

4.1 Decision-making and Governance

We have already summarized a few principles to consider in thinking about governance solutions to forest management problems and to avoid undesirable outcomes. These may seem basic, but are worth reiterating: a) Single, simple policy solutions are unlikely to work; b) Forest problems often emerge outside forests – solutions therefore must include stakeholders outside forests; c) Variations across contexts, countries, and capacities mean that similar problems in different countries will require different solutions; and d) The complexity of problems being faced requires solutions that secure cooperation from multiple actors in public, private, and civil society arenas.

At the same time as these principles are a reflection of fundamental, ongoing shifts in the forest sector, they point towards how collaboration across sectors and decision-making levels is necessary to provoke change. The World Bank's new environment strategy (2012-2022) also provides some useful directions for future decision making. In particular, it highlights the need to take into account natural capital and the value of ecosystem services, including for oceans and marine biodiversity, in economic decisions. To do so, it will be necessary to incorporate these values in national accounting systems. This will also be a step in the right direction to strengthen the capacity of various countries in undertaking environmental assessments and country-level environmental analyses, identifying pricing and subsidy biases and market and trade barriers to promotion of sustainable supply chains, and according appropriate

weight to the criteria of maintaining soil fertility and managing land, forests, and water sustainably. Finally, the new environment strategy also calls for an expansion of financial support to reform natural resource policies and thereby improve both natural resource management and enhance biodiversity.

Most of these guidelines and recommendations focus on price and information signals. In the Bank's strategy document, these changes will lead to "a world in which farmers receive payments for preserving sensitive ecological land and wildlife habitats. It is a world in which ministries of finance are focused on overall wealth rather than gross domestic product (GDP), while pursuing innovation, efficiency, and sustainable budgeting." Nonetheless, realizing even these recommendations will require far-reaching policy changes and mobilization of political will at a level that the forest and environment sector have not seen since the 1992 Rio meetings.

Another recent report from the UNECE and the FAO (2011) on the European forest sector underscore some of the tradeoffs that will be necessary to manage forests sustainably and for values other than market profits and economic gains. If new values of conservation and sustainability are taken seriously, it will require first of all that better science informs decision making about cross-sectoral policy making. These decisions will also bring new forms of politics into forest related decisions because actors in other sectors are likely to give greater weight to issues that are not necessarily foremost in the minds of forest stakeholders. The models needed to inform such decision making will also need to be developed anew.

Take, for example, the role of wood in meeting targets for the use of renewable energy. Even with favorable assumptions about energy efficiency and increases in the production of other forms of renewable energies, higher levels of wood supply will be necessary – perhaps by about 50% in the next two decades compared to current levels. If forest area does not expand, such an expansion is likely to be associated with meaningful financial and environmental costs, and to require institutional changes as well. The areas from which the expansion occurs could well be attractive also for biodiversity conservation, recreation and tourism, and local conservation interests. The

intensive silviculture and harvesting practices that will be needed will also require political action and policy changes to modify existing European framework conditions for wood supply. The extraction of residues and stumps is likely to negatively affect nutrient flows, soil carbon, and possibly water retention and biodiversity. These interrelated effects of a single decision to enhance the role of forests in one dimension – meet more energy needs – shows the complexity of tasks ahead (see also Slee 2009).

On the other hand, if forests were managed with a greater priority on biodiversity through setting more forests land aside, the supply of wood from European forests may decline by more than 10% compared to the Reference scenario. It would mean either that the shortfall is met through imports, by reduced consumption of products and energy, through the use of substitutes for wood products, and/or by intensified use of wood from other sources such as urban and highway trees and wood originating from conservation management. The challenges posed by climate change, energy and biodiversity issues are clearly complex and require long-term thinking in the first instance. They will ultimately need profound policy and behavioral shifts to be resolved satisfactorily.

Even in European countries, with long-established institutions and practices relating to forests, making such decisions depends on a degree of sophistication that has not been seen before. Although there is no single policy instrument for dealing with the challenges posed by climate change, there are examples of multiple actions and experiments, as for example have occurred in Brazil over the past decade or so. Appendix 1 summarizes some of the key policy approaches to dealing with trade-offs related to forests and deforestation.

The rethinking of forests and their contribution to rural development requires a vision that recognizes the full range of goods and services that forests provide, and policy instruments that take all these values into account. It requires institutions and policies that reward forest owners for the ecosystem services they provide (Slee 2009, FAO 2012, Innes 2012).

In this context, the debate over land sharing vs. land sparing is quite relevant (CIFOR, 2012). The key lessons from this discussion are that intensively managed agro-ecosystems can be combined with protected areas or low intensity managed systems at the landscape level where intensification is possible. But there are situations and places where intensification is not possible and land sharing options (e.g. shifting cultivation practices and smallholder production systems) may be more effective to produce needed food and protect environmental outcomes. Therefore, ultimately, the choice is not between land sparing or land sharing but rather on how to best apply a mix of both depending on the socio-ecological system considered and the anticipated trajectory of change.

4.2 Tenure and Rights

Globally, resources are at the center of the emerging world order with new centers of political and economic power in a way they have not been before due to pressure on land because of increased demand for commodities (RRI 2012). A large tenure implementation gap – between laws on the books and their realization on the ground – continues to make forest tenure uncertain and to affect management adversely, particularly for local level managers and users. Implementing these laws is a key site for action.

Over the past few years a number of social and environmental processes related to forests have made themselves felt strongly. The shift in global political and economic power towards emerging economies has become clear. Even the followers of conventional economic paradigms have come to recognize the increasing scarcity of natural resources. It has become clear that national and global development and security hinges on appropriate responses to people's expectations, resources, and rights – particularly through the uprisings associated with people's movements in the Middle East and North Africa, but also because of the ways in which indigenous peoples, farmers, and local populations have made their demands and needs more visible.

Where forests are concerned, a large body of recent research has made the case for the importance of local level governance for securing enhanced outcomes in multiple dimensions. For example, in a review of studies in 80 forest areas in 10 countries in South Asia, East Africa, and Latin America, Chhatre and Agrawal (2009) conclude that community-owned and managed forests delivered both superior community benefits and greater carbon storage than forests not under such local governance regimes. Studies in Tanzania, India, Nepal, Guatemala, and elsewhere have found that the conventional idea of a trade-off between community benefits and the integrity of the forest did not necessarily apply in the case of community forest management, and that higher involvement of local peoples in rule making and decision making is associated with positive outcomes (Persha etal. 2011).

In this context, establishing clear tenure and realizing tenure changes on the ground becomes very important. About 3 billion people in the developing world live without secure legal rights to their lands, forests, and pastures (Maru & White 2013). There is an intimate relationship between stewardship and ownership. Forest decision makers who seek to address poverty and enhance the economic contributions of forests towards food and climate security need to prioritize the rights of indigenous peoples and communities to forest land and resources. Issues of secure tenure and rights are underlying conditions for green growth. Therefore, it is necessary to devise and implement new models of rights-based and community-led conservation. With better information sources and monitoring, it is possible to hold the private sector more accountable compared to the past. And the responsiveness of private sector decision makers to reputation losses is often in evidence more readily than that of governments. It is therefore necessary to identify the factors that can improve monitoring and information sharing.

4.3 Markets, Industry, Investments

Rights and tenure are also critically important in relation to the expansion of commodity production and in relation to industry and investments. The previous section

identified the need for governments and corporate actors to adhere to clear principles of responsible behavior in instances of large scale land rights transfers for agricultural commodity production. A set of such principles have been adopted by the FAO together with a group of international agencies as *Principles for responsible agricultural investment*. They are:

- Existing rights to land and associated natural resources need to be recognized and respected.
- Agricultural and land investments must not jeopardize food security but strengthen it.
- Processes relating to investment in agriculture need to be transparent, monitored, and ensure accountability by all stakeholders, within a proper business, legal, and regulatory environment.
- People materially affected by agricultural and land investments should be consulted, and agreements from consultations must be recorded and enforced.
- Investors must ensure that projects respect the rule of law, reflect industry best practice, are viable economically, and result in durable shared value.
- Investments should generate desirable social and distributional impacts and not increase vulnerability
- Environmental impacts of a project need to be quantified and measures taken to encourage sustainable resource use, while minimizing the risk/magnitude of negative impacts and mitigating them.

Although these statements do not constitute a platform for Free, Prior, and Informed Consent (FPIC), they are a beginning in a sector that has thus far been guided primarily by concerns of national interest and market profits. Implementing them - and getting governments to implement them, will be a substantial achievement for forest actors and will require mobilization of farmer interest as well as advocacy by other stakeholders including commodity roundtables.

An example from Brazil shows that such principles are in fact being followed by at least some corporate actors. The mining giant Vale is planning to invest more than US$

500 million in palm oil in the Brazilian Amazon. Vale is under some pressure to reduce its emissions and wants to produce biodiesel from palm oil. But what is notable is that it will focus its investments in forestlands that are already 'degraded' and will not follow the route of palm oil developers elsewhere of targeting existing natural forests first (Pearson 2012). Brazil has a favorable policy environment for this move and Vale has a reputation it doesn't want to lose. This presents an example of forest positive development. To the extent that markets for these commodities are integrated and that the ability to monitor and learn is rapid, stories such as this may spread to have quick results in Brazil and beyond.

4.4 Managing the non-forest

When it comes to the future of forests, the need to be clear about what forests *are* assumes greater importance than it has in the past, notwithstanding the complexity and difficulty of attempting to define forests. The goal, of course, is not to reach a consensus definition but to open up the definition to include landscapes that contain trees and provide services similar to those in and from landscapes conventionally understood as forests. The reason for such a broadening of the definition is obvious – many of these landscapes contribute economically to human welfare in ways that are similar to the ways in which forests do.

Trees in semi-arid areas and drylands, by roadsides, on farms, and in urban areas provide many of the services and economic benefits that humans need from forests: firewood, fodder, timber, emissions reduction, and others. Their management, however, typically requires very different strategies than does the management of forests. But managed effectively, they will not only provide a substantial measure of what forest-dependent peoples need, but also reduce the pressure of forest product demands on forests and thereby help reduce deforestation. Relieving pressure on contiguous areas of forests can then help support other functions that such forest areas provide such as protection of biodiversity, controlling erosion, and maintaining the water cycle. Indeed, the story of forest area increase and forest transition that 78

countries around the world are already witnessing (FAO 2010, Gregerson et al. 2011) is in large measure a story of forest restoration and increase in trees outside dense forests. The mosaics of cropland, pastures, agroforests, tree plantations and remnants of natural forests are increasingly likely to play major roles in meeting human and social needs for wood and other functions forests serve – indeed, they have been doing so in densely populated, human-dominated landscapes for centuries. As the demand for tree and wood products rises over the next two to three decades, potentially doubling from its current levels, managing the non-forest is not only going to be very important, it will be crucial for protecting existing forests and meeting human needs at the same time (CIFOR, ICRAF, Biodiversity and CIAT 2011, FAO 2002, WRI 2011).

That such farmer managed and assisted regeneration is already occurring is supported by evidence from many countries (Agroforestry World 2012). The reason for such tree recovery by individual actions of land owners and farmers is evident: planting and assisted regeneration of trees is in their interests in conditions where there is a scarcity of the products and benefits that forests and trees provide!

4.5 Information and data management

The tremendous advances in digital and information technologies, including with respect to forests, create massive opportunities for better knowledge to improve decision making related to forests. Particularly impressive in this regard are remote sensed data and land cover and cover change products based on such data that are fast becoming available for many countries and will soon be available for the entire tropical biome and indeed for the whole planet at relatively low cost. Such datasets create new possibilities for managing forests to greater effect because it is possible now to understand and assess how exactly forest cover is changing in specific locations of interest (Hansen et al. 2003, Hansen et al. 2010).

4.5.1 Datasets and information technologies

More effective use and decision-making based on forests-related data, however,

depends on the capacity to connect biophysical data with social, institutional, and policy data. Such data, despite some recent improvements, mostly continues to be unavailable at the necessary temporal and spatial resolution. Census data, which can often be connected with remote sensed data on forest cover is only available publicly for a relatively small number of countries, typically at little better than decadal intervals, and at spatially gross resolution as well compared to forest cover data. There are few or no long-term datasets that combine data on social, institutional, ecological, and forest characteristics of given locations, making it particularly difficult to answer questions into which policy actors and decision makers would like greater insight. A number of recent studies have lamented the absence of rigorous work on synergies and tradeoffs between different forest outcomes, and the lack of the kind of datasets that can support such rigorous analyses (Angelsen 2010, Ferraro et al. 2011). Where such work is being carried out, it is hugely valuable and much more of this kind of data and analysis is needed.

In particular, some of the more recent work combining social and biophysical data to look at different outcomes of forests under varying property rights regimes has attended to the nature of tradeoffs involved (Hirsch et al. 2010, Sunderland et al. 2008). It has shown that for forests managed by communities, higher levels of carbon storage and livelihoods can be achieved by allocating larger parcels of forest lands to local level decision makers and that greater autonomy in decision making can also help achieve both these objectives (Chhatre and Agrawal 2009). Other research suggests that participation in making rules at the local level is associated with greater levels of livelihood benefits and biodiversity in forests managed by communities (Persha et al. 2011).

For forests managed through different forms of protected area arrangements, analysis of changes in forest cover has also shown the ability of most forms of protection to improve carbon sequestration (Nelson and Chomitz, 2011, Nepstad et al. 2006, Scharlemann et al. 2010, Soares-Filho et al. 2010). A spate of recent studies has used remote sensed data and information about protected area boundaries to assess

the effectiveness of protected areas in general (Andam et al. 2008, Gaveau et al. 2009). Using sophisticated matching techniques to mimic random assignment of treatment in experimental designs, these studies have also examined how variations in location of protected areas and differences in types of protection influence the effectiveness of protection (Joppa and Pfaff 2009, 2011, Nolte and Agrawal 2012).

These studies show what is possible even with limited social and comparable biophysical data availability. Far more work of this kind is needed for more informed decision-making. Greater and longer term support that helps identify effectiveness of different kinds of property regimes and tenure arrangements, of different forms of external interventions and local and national mobilization of resources and of different policies and institutions will be necessary to understand how to use the most cost effective interventions to secure better forest outcomes. Equally important are efforts to create greater public access to such systematically collected data.

But in addition to research on the role of governance in future forest outcomes, there is also an urgent need for more scientific and technical studies. The CGIAR's research program on "Forests, Trees and Agroforestry: Livelihoods, Landscapes and Governance" provides a global framework (CGIAR, 2011) for discussing such needs. The aforementioned European outlook study (UNECE &FAO 2011) identifies research priorities for addressing knowledge gaps specific to that region:

> *Soil carbon*: Investigate carbon flows in forest soil and the consequences of disturbance because of afforestation, harvesting or stump extraction;
> *Strategies for adaptation to climate change*: Assess which species and forest structures are more resilient under different biophysical conditions and whether and what times such species can be used to replace those that exist; Examine whether changes be proactive or reactive;
> *Ecological / physiological range of forest trees*: Improve the understanding of tolerance of extreme events and physiological limits of specific species.

Sustainability of wood supply: Measure in better detail the relations between net and gross annual increment, fellings and removals, including consideration of natural and harvesting losses, and assess wood supply from outside the forest, to provide an accurate basis for calculating sustainable levels of wood supply.

Drivers of wood supply: Assess the roles of price elasticity of supply, cost structures of forest management practices (silviculture, harvesting, transport), management priorities and behavior of forest owners, and non-forest related sources of income for land owners;

Short rotation coppice and rural land use: Determine how much land is realistically available for short rotation coppice and where possible take account of competing land uses and policy priorities.

Non-forest wood supply: examine the potential and constraints for supply of wood from outside the forest, notably landscape care wood and post-consumer wood.

Wood for energy: Develop scenarios for demand and supply of wood energy, demand drivers including sensitivity to price and policy changes, and supply constraints, taking account of gross differences in national and local circumstances.

4.5.2 Best practice examples

In addition to deploying more systematic knowledge management systems that incorporate and take advantage of new digital and spatial data technologies, it is also necessary to ensure that sufficient learning on the basis of such new information in fact occurs. Establishing a comprehensive clearing-house mechanism is largely a technical challenge that requires the imaginative use of appropriate information and communication technologies. But many organizations have found that improved knowledge management does not necessarily lead to learning. To ensure learning, it is also necessary to identify policy and decision relevant knowledge and knowledge gaps,

communicate the knowledge, and translate it so that it is relevant and suitable for different contexts (Rayner et al 2010).

The core ideas of support for and bridging between knowledge generation and knowledge use lead to the concept of a learning platform – defined as an integrated set of services that provide information, tools and resources to support policy learning. Learning platforms need both bottom-up tools of inter-organizational network management and the top-down impetus provided by access to key decision-making and coordinating bodies.

These learning platforms, particularly for forests and forest related activities cannot and should not be independent of existing networks of communication and information in the forest sector as also in domains outside the forest sector. The importance of problem-driven learning cannot be overemphasized in this context. Knowledge and learning activities that are built around addressing specific problems have a greater likelihood of being taken up and of continuing to be relevant until the problem is addressed.

Both bottom up and top down actions are necessary for such platforms. Indeed, two-way communication and trust between members are essential requirements for participatory or shared network effectiveness (Gokhale 1995). Given the history of conflict on forest issues and the parallel development of non-governmental and state-led forest networks, the level of trust among networks will initially be low. Creating the circumstances in which these disparate networks will willingly share knowledge, and trust the knowledge obtained from external sources, will take time. At the outset, leading organizations or specialized network administration organizations will be required (Rayner et al 2010).

The policy learning literature emphasizes the critical role of policy entrepreneurs in promoting innovation (Berkes 2009), individuals who work from outside the formal governmental system to introduce, translate and help implement innovative ideas. Entrepreneurship in this context means not only being alive to the possibilities of new ideas in local contexts, but also identifying opportunities to build trust in the learning

platforms and their ability to deliver successful outcomes. Finally, if information is to serve a coordination function, such as the organization of monitoring, evaluation and peer review as mutual learning processes, there is a need for overall direction. Even if this direction is in the form of flexible guidelines with ample scope for national and local interpretation, general goals will need to be negotiated and agreed.

5. Conclusions and Recommendations

One way to think about potential recommendations flowing from the discussion in this paper on future trends and their implications for forests is to consider them in the light of what kinds of outcomes are likely to coincide with a sustainable, prosperous future and the steps that will take decision makers, stakeholders, and different forest constituencies closer to those outcomes.

As noted earlier, the greatest drivers of deforestation today and in the near-term future are the expansion of agricultural commodity production and the occurrence of this expansion in forested areas. This expansion simultaneously threatens forests and the poor that depend on forests. But it also fuels increased output of saleable commodities, higher revenues for both the private sector and for governments through taxes, and potential employment opportunities in the agricultural as well as processing sectors. The major concern for decision makers is how to manage the tradeoffs between provisioning and other ecosystem services that this expansion represents.

Although substantial new research is outlining and highlighting the risks of agricultural commodity expansion on forests, it is also critically important to address these risks. The rapid expansion of agribusiness and the continuing criticality of forest livelihoods in the lives of hundreds of millions of poor, local and indigenous peoples are often at odds, and technological, policy, and governance interventions that can reduce the impacts of agribusiness expansion merit far more attention than has been the case until now. Although current research has begun to map spatially the distribution of new areas under soy, beef, cocoa, and oil palm, it is also equally necessary to map the different information, incentives, and institutions-based interventions that have already

occurred, assess their effectiveness in different policy environments, and examine how they can be deployed proactively in the future. Undertaking such a mapping of commodity agriculture expansion and effective interventions to improve the sustainability of such expansion will enable development of transformed commodity production systems that can be implemented at scale by both large- and small-scale producers.

Additional measures that will help secure the sustainability of supply chains include independent, transparent, robust and widely used evidence on supply chains and large-scale forest and agricultural investments; no-deforestation commitments and partnerships in both developed world and emerging economies; better regulated global trade and investment flows to promote sustainable forest management; and steps to create a more informed global consumer class that can influence forest use through purchasing decisions and who have access to forest and tree products through improved value chains.

Also necessary are governance and market reforms that reduce the illegal use of forest resources and benefit poor people. We already know a fair amount about what should be the content of such reforms – collective ownership of larger areas of forests, rights to make decisions about managing and using forests, and autonomy in operations all within a policy framework that discourages illegal felling and rewards whistle blowers. But in addition to these, the commercial rights and enterprise capacity of poor, forest-dependent peoples must also be recognized and enhanced through greater clarification of rights to forests; enhancement of multi-stakeholder processes; and more transparent benefit sharing arrangements.

Because forests do not occur in standardized patches with uniform characteristics, a large part of effective forest governance in the future will have to rely on innovative landscape management approaches at scale that take into account the diversity of forests and their stakeholders. Landscape approaches to forest management are critical as well to effective and efficient climate change mitigation and adaptation.

A substantial body of research has also highlighted the importance of effective enforcement for improved forest outcomes. Lack of effective enforcement is a major gap in the way forests are managed in a very large number of tropical countries, with substantial areas of forest and large forest revenues lost to nations because of illegal forest harvests and forest product extraction. It is critically necessary to identify public policies and private business standards that can address trade in illegal timber and other commodities from illegal forest practices.

These recommendations related to sustainable supply chains, governance and market reforms, and learning platforms translate into five no-regrets actions for governments and other decision makers. Advancing on these fronts is part of a forward looking strategy to secure the economic gains forests provide, the distribute them equitably and through participatory channels, and to take advantage of new opportunities afforded by changes in the global distribution of population, consumption even in a context characterized by climate change impacts. These actions include

1. Investments to identify and develop more sustainable agricultural commodity supply chains and the mix of information, incentive, and institutional arrangements that will be conducive to their sustainability. The global expansion of agricultural commodity production is a force of larger than titanic proportions and ensuring that it occurs sustainably is one of the greatest prerequisites for enhanced economic gains in countries that can balance such commodity production with maintenance of forest cover.
2. Crafting of media strategies that recognize the increasingly sophisticated nature of consumption and the greater environmental awareness of a richer class of consumers to take advantage of peer-to-peer social media relationships. As the global consuming class expands with the increase in the size of the middle class, buys more consumer durable goods, particularly devices that connect them to the world of digitally distributed information, they will become part of a social medial landscape in which standard instruments of information access and

apprehension are quickly becoming outdated. More sophisticated strategies that engage these social actors will substantially enhance the sustainability and economic contributions of forests into the future.

3. Changes in property and rights regimes that constrain rapid shift in land ownership and encourage broader public comment and involvement in large scale land transfers, infrastructure development, and extractive activities. With the rising demand for agricultural goods, nearly a hundred million hectares of land have changed hands in the last decade, with attendant implications for poor and marginal groups whose interests will need to be safeguarded in the face of large scale extractive and agricultural development activities.
4. Scaling up of support for research on the production and distribution of forest products, creation of employment intensive processing methods, and development of climate-resilient tree species and forest restoration. The level of investments in enhancing the productivity of the forest estate is woefully inadequate and higher levels of investments will be necessary to identify and enhance productive opportunities in the future.
5. Deployment of hybrid governance approaches for forests from patch- to-landscape scale, and attention to attitudinal, behavioral, and institutional dimensions of forest management. As an increasing number of decision makers comes to play a role in shaping resource use and management strategies, the role of multi-party governance arrangements in shaping the future of forests is also becoming clearer. The expansion of stakeholders and their interests demands a greater attention to the need for governing the complex social landscape in which forest and management are situated.

The above recommendations are no more than just a part of the sustainable, livable future for which societies and political decision makers may wish. But despite their incompleteness, they are a way of spelling out and specifying the tradeoffs between the goals of higher forest cover and greater prosperity. Indeed, they are a recognition that

beginning to tackle these tradeoffs does not necessarily lead to platitudes about synergies and happy people.

In the long run, the goals of environmental sustainability and development with poverty reduction are not and cannot be opposed to each other. The absence of one ultimately presage doom for the other. Thus a balance between the two is the natural goal to seek. But in the short run, they do not necessarily imply the same action steps and therein lies the problem. The differences in action steps mean that assessment of decisions against specific principles is critically important. Without assessing outcomes against principles important in more than a single dimension, it is often the case that a given choice will improve matters in a given domain or dimension, but also that its effects on other dimensions will not even be appreciated by decision makers.

In 1990s, there was great concern about the inefficiency of multiple institutions related to forest governance. The pendulum has shifted since then. A variety of approaches and institutions is far more likely to move governance in the right direction, with appropriate room for experimentation and adaptation. The Collaborative Partnership on Forests is a fine example of the way polycentric institutions can work and form functional solutions to complex problems of forest governance. This insight is resonant with the work of Elinor Ostrom on polycentrism and the skepticism about silver bullets and panaceas.

References

Agroforestry World. 2012. The baffling simplicity of farmer managed natural regeneration. April 17, 2012 Blog by Christopher Mesiku, April 17, 2012. http://blog.worldagroforestry.org/index.php/2012/04/17/the-baffling-simplicity-of-fmnr/

Andreoni, J., Levinson, A., 2001. The simple analytics of the Environmental Kuznets Curve. *Journal of Public Economics* 80(2): 269– 286.

Andam KS, Ferraro PJ, Pfaff A, Sanchez-Azofeifa GA, Robalino JA. 2008. Measuring the effectiveness of protected area networks in reducing deforestation. *Proceedings of the National Academy of Sciences* 105:16089–94.

Andrasko, Ken and Benoît Bosquet. 2010. Introduction and Early Lessons: Briefing Guyana Civil Society. Forest Carbon Partnership Facility presentation on April 21, 2010.

Angelsen, Arild. 2007. *Forest Cover Change in Space and Time: Combining the von Thünen and Forest Transition Theories*. Policy Research Working Paper 4117. Washington D.C.: World Bank.

Angelsen A. 2010. Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences* 107:19639–44.

Assunção, Juliano, et al. 2012. Deforestation Slowdown in the Legal Amazon: Prices or Policies? Climate Policy Initiative Working Paper. http://climatepolicyinitiative.org/wp-content/uploads/2012/03/Deforestation-Prices-or-Policies-Working-Paper.pdf

Assunção, Juliano et al. 2013. Does Credit Affect Deforestation? Evidence from a Rural Credit Policy in the Brazilian Amazon. Climate Policy Initiative Working Paper. http://climatepolicyinitiative.org/wp-content/uploads/2013/01/Does-Credit-Affect-Deforestation-Evidence-from-a-Rural-Credit-Policy-in-the-Brazilian-Amazon-Technical-Paper-English.pdf

Bain and Company. 2011. The Great Eight: Trillion-Dollar Growth Trends to 2020. http://www.bain.com/Images/BAIN_BRIEF_8MacroTrends.pdf

Bannon, I. & P. Collier, eds. 2003. *Natural Resources and Violent Conflict: Options and actions*. Washington, DC: The World Bank.

Berkes, F. 2009. Evolution of comanagement: Role of knowledge generation, bridging organizations, and social learning. *Journal of Environmental Management* 90(5): 1692-1702.

Bull, Gary. 2012. Role of Smaller Forest Enterprises in Transition. Global Issues in Governing Natural Resources: Next Generation Leadership of Public Forest Agencies. RRI, Canadian Forest Service, UBC, Megaflorestais. June 4-8, 2012, Whistler, Canada. http://www.rightsandresources.org/documents/files/doc_5138.pdf

Cameron, L.D., Brown, P.M., Chapman, J.G., 1998. Social values and decisions to take proenvironmental action. *Journal of Applied Social Psychology* 28: 675–697.

Carstens, J., Hilson, G., 2009. Mining and grievance in rural Tanzania. *International Development Planning Review*, 31(3): 301–326.

CGIAR . 2011. Forests, Trees and Agroforestry: Livelihoods, Landscapes and Governance http://www.cifor.org/fileadmin/fileupload/crp6/CRP6_7feb_lowres.pdf

Chao, Sophie. 2012, Forest peoples: numbers across the world. Forest Peoples Programme http://www.forestpeoples.org/sites/fpp/files/publication/2012/05/forest-peoples-numbers-across-world-final_0.pdf

Chhatre, A. and A. Agrawal. 2009.

Chomitz, K.M. 2007. At loggerheads? Agricultural expansion, poverty reduction and environment in the tropical forests. The World Bank: Washington DC.

CIFOR, World Agroforestry Centre and USAID 2009 Forest and climate change toolbox [PowerPoint presentation]. Available from http://www.cifor.cgiar.org/fctoolbox/.

CIFOR, ICRAF, Biodiversity and CIAT. 2011. Forests, Trees and Agroforestry. Consortium research Program 6 proposal to the CGIAR. http://www.cifor.org/fileadmin/fileupload/crp6/CRP6_7feb_lowres.pdf

CIFOR. 2012. The "land sharing or land sparing" conundrum. A CIFOR learning event at Agriculture and Rural Development Day. http://www.cifor.org/events/rio20/ardd.html

Colchester, M. and Chao, S. (eds). 2011. Oil Palm Expansion in South East Asia: Trends and implications for local communities and indigenous peoples. Forest Peoples Programme, UK. http://www.forestpeoples.org/sites/fpp/files/publication/2011/11/oil-palm-expansion-south-east-asia-final.pdf

Consumer Goods Forum. 2012. Resolution on deforestation. http://www.theconsumergoodsforum.com/sustainability.aspx

Conservation International (CI). 2012. Gabarone Declaration pioneers commitment to value natural capital on new path to sustainable development. http://www.conservation.org/newsroom/pressreleases/Pages/Gaborone-Declaration-Pioneers-Commitment-to-Value-Natural-Capital-.aspx

Consumer Goods Forum. 2010. Resolution on deforestation. http://www.theconsumergoodsforum.com/sustainability.aspx

Cotula, L., S. Vermeulen, R. Leonard, and J. Keeley 2009. Land grab or development opportunity?: Agricultural investments and international land deals in Africa. London: IIED.

Deininger, K. 2011. Challenges posed by the new wave of farmland investment. *J of Peasant Studies* 38(2): 217-247 http://www.tandfonline.com/doi/pdf/10.1080/03066150.2011.559007
Dietz Thomas, Eugene Rosa, and Richard York. 2007. Driving the Human Ecological Footprint. *Frontiers in Ecology and The Environment* 5:13–18.

Dinda, S., 2004. Environmental Kuznets curve hypothesis: a survey. Ecological Economics 49: 431–455.

Economist. 2010. East or famine: Asia's economic weight in the world has risen, but by less than commonly assumed. http://www.economist.com/node/15579727

European Commission. 2012. Combating illegal logging: Lessons from the EU FLEGT Action Plan. Luxembourg: Publications Office of the European Union

Evans, Alex. 2011 Food Security: Are We Nearly There Yet? Presentation at RRI / Oxfam conference, The Hague, 7 September 2011. http://www.rightsandresources.org/documents/files/doc_2659.pdf. Accessed on Dec. 29, 2012

Fabig, Heike and Boele, Richard, 1999. The Changing Nature of NGO Activity in a Globalizing World?Pushing the Corporate Responsibility Agenda', IDS Bulletin Institute of Development Studies, 30(3): 58-67.

FAO. 2007. Global Wood and Wood Products Flow; Trends and Perspectives. Advisory Committee on Paper and Wood Products, Shanghai, China, 6 June, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO, 2010. *Global Forest Resource Assessment* 2010. Rome, FAO.

FAO. 2012. Forests at the heart of a sustainable future. FAO, Rome. http://foris.fao.org/static/sofo/SOFO2012_executiveSummary.pdf

FAO, IFAD, UNCTAD and World Bank Group. 2010. Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources. A discussion note prepared by FAO, IFAD, the UNCTAD Secretariat and the World Bank Group to contribute to an ongoing global dialogue. http://www.fao.org/fileadmin/templates/est/INTERNATIONAL-TRADE/FDIs/RAI_Principles_Synoptic.pdf

Ferraro PJ, Lawlor K, Mullan KL, Pattanayak SK. 2011. Forest Figures: Ecosystem Services Valuation and Policy Evaluation in Developing Countries. *Review of Environmental Economics and Policy* 6:20–44.

Foley, J. et al. 2005. Global consequences of land use. *Science* 309: 570-574. DOI: 10.1126/science.1111772

Gaveau DL et al. 2009. Evaluating whether protected areas reduce tropical deforestation in Sumatra. *Journal of Biogeography* 36:2165–2175

Gilg, A., Barr, S., Ford, N., 2005. Green consumption or sustainable lifestyles? Identifying the sustainable consumer. Futures 37: 481–504.

Global Footprint Network. 2010. Annual Report. http://www.footprintnetwork.org/images/uploads/2010_Annual_Report_spread.pdf. Accessed on January 1, 2013.

The Global partnership for Forest and Landscape Restoration www.ideastransformlandscapes.org.

Gokhale. A. 1995. Collaborative learning enhances critical thinking. *Journal of Technology Education* 7(1). http://scholar.lib.vt.edu/ejournals/JTE/v7n1/gokhale.jte-v7n1.html?ref=Sawos.Org. Accessed in Nov. 2012.

Grantham, J. 2011. Time to Wake Up: Days of Abundant Resources and Falling Prices Are Over Forever. The Oil Drum. http://www.energybulletin.net/stories/2011-04-29/time-wake-days-abundant-resources-and-falling-prices-are-over-forever. Accessed on December 28. 2012.

Gray-Block, Aaron . 2011. Second generation biofuel on cusp of breakthough: DSM. http://www.reuters.com/article/2011/10/19/us-interview-second-generation-biofuel-o-idUSTRE79I48X20111019. Accessed November 5, 2013.

Gregersen, H., H. El-Lakany, L. Bailey & A. White. 2011. *The greener side of REDD+: Lessons for REDD+ from countries where forest area is increasing.* Washington DC: Rights and Resources Initiative.

Gueterbock, R. 2004. Greenpeace campaign case study-Stop Esso. *Journal of Consumer Behaviour* 3(3): 265-71.

Hall, Anthony (2008) *Better RED than dead: paying the people for environmental services in Amazonia.* Philosophical transactions of the Royal Society b: biological sciences, 363 (1498). pp. 1925-1932. ISSN 0962-8436
http://eprints.lse.ac.uk/21241/

Hansen MC et al. 2003. Global Percent Tree Cover at a Spatial Resolution of 500 Meters: First Results of the Modis Vegetation Continuous Fields Algorithm. *Earth Interactions* 7:1–15.

Hansen MC, Stehman S V., Potapov P V. 2010. Quantification of global gross forest cover loss. *Proceedings of the National Academy of Sciences* 107: 8650–8655.

Hatcher, Jeffrey. 2011. Status of Governance, Livelihoods and Rights in Rural Areas. RRI-Oxfam Dialogue on Forests, Governance and Climate Change. 7-8 September 2011 | The Hague http://www.rightsandresources.org/documents/files/doc_2660.pdf

Hirsch PD et al. 2010. Acknowledging Conservation Trade-Offs and Embracing Complexity. *Conservation Biology* 25:1–6

Hobson, K., 2002. Competing discourses of sustainable consumption: does the 'rationalisation of lifestyles' make sense? *Environmental Politics* 11: 95–120.

Innes, John. 2012. Resources for the Future: What we expect from our forest? Global Issues in Governing Natural Resources: Next Generation Leadership of Public Forest Agencies. RRI, Canadian Forest Service, UBC, Megaflorestais. June 4-8, 2012, Whistler, Canada. http://www.rightsandresources.org/documents/files/doc_5139.pdf

IUFRO. 2009. Making forests fit for climate change. www.iufro.org/download/file/4486/.../Policy_Brief_ENG_final.pdf/. Accessed on December 22, 2012.

Joppa LN, Pfaff A. 2009. High and far: biases in the location of protected areas. *PloS one* 4:e8273.

Joppa LN, Pfaff A. 2011. Global protected area impacts. *Proceedings of the Royal Society B* 278:1633–8.

Lambin, E. F. and P. Meyfroidt. 2011. Global land use change, economic globalization, and the looming land scarcity. *Proceedings of the National Acadamy of Science, USA* 108(9):3465-3472.

Landers, J. E. Krebsky and G. Martha Jr. 2010. Opportunities for increasing agricultural production without deforestation through the intensification of animal production in grazing systems and PPA Recovery.

Landesa. 2012. *Insecure Land Rights: The Single Greatest Challenge Facing China's Sustainable Development and Continued Stability,* Landesa; http://www.landesa.org/wp-content/uploads/Landesa-Press-Release-6th-17-province-China-survey.pdf

Lawson, S. 2010. Illegal Logging and Related Trade: Indicators of the Global Response. Chatham House Briefing Paper. http://www.illegal-logging.info/uploads/0904CHAillegalloggingbriefingpaper09.0731.pdf

Bernice Lee et al. 2012. Resources Futures. A Chatham House Report. http://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/1212r_resourcesfutures.pdf

Lerda, Daniela and Steve Zwick. 2009. A Brief Tour of Brazilian Payments for Ecosystem Service. Beyond Carbon: Biodiversity and Water Markets. Katoomba Group's Ecosystem Marketplace
http://www.forest-trends.org/documents/files/doc_2371.pdf

Mauru, Vivek and Andy White. 2013. Next Billion.
http://www.nextbillion.net/acp/blogpost-edit.aspx?BlogID=2838

May, P.H. *et al* 2011. The context of REDD+ in Brazil: Drivers, Agents and Institutions. CIFOR Occasional Paper 55.

McKinsey. 2006. The Impact of Global Development on Swedish Forest Policies from an Industrial Perspective. Appendix 4 of Forest Commission 2004, SOU 2006. McKinsey, Stockholm, Sweden.

McKinsey Global Institute (MGI). 2011. Resource revolution: Meeting the world's energy, materials, food and water needs.
http://www.mckinsey.com/insights/mgi/research/natural_resources/resource_revolution. Accessed on December 31, 2012.

Mainieri, T., Barnett, E.G., Valdero, T.R., Unipan, J.B., Oskamp, S., 1997. Green buying: the inXuence of environmental concern on consumer behaviour. The Journal of Social Psychology 137: 189–204.

Mongabay. 2011. Dutch buy first responsible soy sourced from the Amazon. Mongabay.com, June 8, 2011, http://news.mongabay.com/2011/0608-soy_rtrs.html. Accessed on March 14, 2013.

Mongabay. 2012. Near-real time Amazon deforestation alert system added to Google Earth Engine. June 20, 2012. http://news.mongabay.com/2012/0619-google-earth-engine-imazon.html.

Nelson A, Chomitz KM. 2011. Effectiveness of Strict vs. Multiple Use Protected Areas in Reducing Tropical Forest Fires: A Global Analysis Using Matching Methods. *PLoS ONE* 6:e22722.

Nepstad D et al. 2006. Inhibition of Amazon Deforestation and Fire by Parks and Indigenous Lands. *Conservation Biology* 20:65–73

Nestle, 2011. Commitment on deforestation and forest stewardship. http://www.nestle.com/asset-library/Documents/Media/Statements/2012-October/2011-Nestle_Commitments_on_Deforestation_Forest_Stewardship.pdf. Accessed on March 14, 2013.

Nilsson, Sten. 2007. The Boomerang—When Will the Global Forest Sector Reallocate from the South to the North? IIASA, Vienna. http://rightsandresources.org/documents/files/doc_107.pdf

Nilsson, S. 2011. Resource trends and climate change to 2030. RRI Resources, Rights & Development in a Changing World Meeting, London.

Nilsson, S. 2011. The megatrends and the forest sector. The Secretariat for International Forestry Issues, Sweden.

Nilsson, Sten. 2012. What to expect. Seminar on the Transformation of the Canadian Forest Sector and Swedish Experiences. KSLA, Stockholm, 28 May 2012. http://www.sifi.se/wp-content/uploads/2012/06/Sten-Nilsson.pdf

Nolte C, Agrawal A. 2012. Linking Management Effectiveness Indicators to Observed Effects of Protected Areas on Fire Occurrence in the Amazon Rainforest. *Conservation Biology*:1–11.

Nolte, C., A. Agrawal, B. Soares-Filho, K. Silvius. 2013. Governance regime and location influence avoided deforestation success of protected areas in the Brazilian Amazon. *PNAS* doi/10.1073/pnas.1214786110

Ostrom, E. 2012. “Green from the Grassroots.” http://www.project-syndicate.org/commentary/green-from-the-grassroots.

Pearce, Fred. 2012. The land grabbers. Transworld Digital.

Pearson, Samantha. 2012. Vale’s palm oil strategy under scrutiny. *Financial Times* June 25, 2012, http://www.ft.com/cms/s/0/46b0d5c6-b9fc-11e1-aa8d-00144feabdc0.html#axzz2NlRVlNPp. Accessedon March 11, 2013.

Persha, L. P., A. Agrawal, and A. Chhatre. 2011.

Persson (2006). Increased Forest Production in the South—Threat or Opportunity. The Swedish FAO Committee Report No. 3, Stockholm, Sweden.

Porter-Bolland L et al. 2011. Community managed forests and forest protected areas: An assessment of their conservation effectiveness across the tropics. *Forest Ecology and Management*.

President’s Committee of Advisors on Science and Technology. 1998. Panel on Biodiversity and Ecosystems Washington DC: Office of Science and Technology Policy.

Preston, S. 2010. Consumer Goods Forum plans to tackle deforestation and other key drivers of climate change. The Guardian, 1 December 2010. http://www.guardian.co.uk/sustainable-business/consumer-goods-forum-deforestation-climate

Prince’s Rainforests Project (PRP). 2010. REDD+ and Agriculture Proposed Solutions from the Private Sector. http://www.rainforestsos.org/wp-content/uploads/pdfs/REDD-and-Agriculture-Proposed-Solutions-from-Private-Sector.pdf

The Prince’s Rainforests Project (PRP). Opportunities to increase agricultural production without further deforestation. http://www.rainforestsos.org/wp-content/uploads/pdfs/Opportunities-to-increase-agricultural-production-without-further-deforestation.pdf

ProForest 2011. Commodities reports. Oxford: ProForest.

Rayner, J., A. Buck and P. Katila (eds). 2010. *Embracing complexity: Meeting the challenges of international forest governance, A Global Assessment Report*. Prepared by the Global Forest Expert Panel on the International Forest Regime.

Ricketts, T. H., G. C. Daily, P. R. Ehrlich, C. Michener, PNAS.

Rights and Resources Initiative (RRI). 2008. Seeing People Through The Trees: Scaling Up Efforts to Advance Rights and Address Poverty, Conflict and Climate Change. Washington DC: Rights and Resources Initiative. http://www.rightsandresources.org/documents/files/doc_737.pdf. Accessed on December 19, 2012.

Rights and Resources Initiative (RRI) India. 2012. *New Findings Predict Rising Trend in India's Violent Land Conflicts: Map Shows Massive Resource Takeover Spurring Conflict in 130 Districts.* Washington DC: RRI. http://www.rightsandresources.org/documents/files/doc_5644.pdf. Accessed on December 23, 2012.

Roberts, Don. 2011a. The Forest Sector in Transition: An Economic Perspective: Global Issues in Governance of Natural Resources - New Leadership for New Challenges. Grey Towers, Pennsylvania. September 12-16, 2011. http://www.rightsandresources.org/documents/files/doc_2672.pdf

Roberts, Don. 2011b. Global Trends for Investments in Forestry & Bio-Energy. Megaflorestais Meeting, Oaxaca, Mexico. http://www.rightsandresources.org/documents/files/doc_2713.pdf

Robledo, C., and C. Forner. 2005. Adaptation of forest ecosystems and the forest sector to climate change. Forests and Climate Change Working Paper 2, Rome: Food and Agriculture Organization.

Scharlemann JPW et al. 2010. Securing tropical forest carbon: the contribution of protected areas to REDD. *Oryx* 44:352–357

Scher, S. White, A, and Kaimowitz, D. 2004. *Making markets work for low-income producers.* Washington DC: Forest Trends http://www.rightsandresources.org/documents/files/doc_761.pdf. Accessed on December 18, 2012.

Slee, Bill. 2009. Re-imagining forests as multifunctional and sustainable resources for a low carbon rural economy: the potential for forest-based rural development**.** Developing rural policies to meet the needs of a changing world OECD Conference Quebec October 13-15th 2009. http://www.oecd.org/dataoecd/41/23/44272665.pdf

Soares-Filho B et al. 2010. Role of Brazilian Amazon protected areas in climate change mitigation. *Proceedings of the National Academy of Sciences* 107:10821–10826

Sonnenfeld, D. A. 2002. Social movements and ecological modernization: The transformation of pulp and paper manufacturing. *Development and Change* 33(1): 1-27.

STCP 2007. Presentation by Ivan Tomaselli at Global Wood and Wood Products Flow; Trends and Perspectives. Advisory Committee on Paper and Wood Products, Shanghai, China, 6 June, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Standard and Chartered Research. 2010. The Supercycle Report. https://research.standardchartered.com. Accessed on March 12, 2013.

Stern, D.I., 2004. The rise and fall of the environmental Kuznets curve. World Development 32, 1419–1439.

Sunderland TCH, Ehringhaus C, Campbell BM. 2008. Conservation and development in tropical forest landscapes: a time to face the trade-offs? *Environmental Conservation* 34:276–279

Tull, D. M. 2006. China's Engagement in Africa: Scope, Significance and Consequences. *The Journal of Modern African Studies* 44(3): 459-479

UNECE and FAO. 2011. *European Forest Sector Outlook Study II 2010-2030*. http://www.unece.org/efsos2.html

Von Braun, J. and R. Meinzen-Dick. 2009. 'Land Grabbing' by foreign investors in developing countries: risks and opportunities. IFPRI Policy Brief 13. Washington, DC: IFPRI.

World Bank. 2010. Rising global interest in farmland: can it yield sustainable and equitable benefits? Washington, DC: World Bank.

World Bank. 2012. Toward a Green, Clean, and Resilient World for All. A World Bank Group Environment Strategy 2012 – 2022. web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTENVSTRATEGY/0,,contentMDK:22544401~pagePK:210058~piPK:210062~theSitePK:6975693,00.html

World Resources Institute (WRI). 2011. A New Approach to Feeding the World. Janet Ranganathan and Craig Hanson in WRI Insights. http://insights.wri.org/news/2011/09/new-approach-feeding-world

Appendix 1 – Policy Innovations in the Brazilian Amazon

Deforestation in the Brazilian Amazon fell from 2.7 million hectares (ha) in 2004 to 0.6 million ha in 2010. A range of policy instruments and technical interventions were responsible for this change. Falling agricultural prices played a role too but research suggests that half the deforestation that was avoided from 2005 to 2009 can be attributed to the policies introduced in the second half of the 2000s (Assunção et al 2012). Maintaining this level of progress in reducing deforestation in the face of growing demand for agricultural commodities and Brazil's Growth Acceleration Program will be difficult. As the room for maneuver diminishes and tradeoffs become harder to negotiate, Brazilian stakeholders and institutions will have to build on the sophistication in policy and decision making that they have demonstrated in recent years.

This appendix summarizes the policy innovations introduced by Brazil as a way of illustrating how a mix of approaches will inevitably be necessary to respect the multifunctional nature of forests. Among the factors which explain the positive outcomes in the Brazilian Amazon are:

- High quality and transparent monitoring by the National Institute for Space Research(INPE) that commands political and public attention;
- Deforestation reduction targets and supporting legislation in some Amazonian states;
- Political commitment to emissions reduction at the federal government level as exemplified by adoption of the National Climate Change Policy in 2009, incorporating an 80% reduction in Amazon deforestation and 40% in the Cerrado. Establishment of the Amazon Fund encouraged adoption of these targets;
- A deforestation control program (PPCDAm) focused on critical municipalities (though effective coordination with support for agribusiness, mining and infrastructure development is lacking);
- A major investment in law enforcement by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) supported by the police and army. Uncertainty regarding access rights and ownership of land constrains effectiveness. Confiscation of assets and denial of access to credit are better deterrents than imposition of fines, most of which are simply not paid (May et al, 2011);.
- Placing conditions on farmers seeking credit. Reduction in credit of US$1.4 billion from 2008 to 2011 is estimated to have prevented over 2,700 km^2 of forest area from being cleared (Assunção et al 2013);

- Tenure reforms, including expansion of protected areas, removal of the motive to clear forest for speculation by reservation of previously 'undesignated' public land, and voluntary registration of properties whose owners are dedicated to good land stewardship;
- A commitment by Brazilian traders to boycott soya grown in recently deforested areas;
- A similar commitment by the beef industry (though at an earlier stage of implementation, with evidence of widespread breeches – farms are geo-referenced but the cattle within them are not);
- A vigorous and professional civil society, former members of which now hold positions of influence in government.
- A national REDD+ policy and a program for the payment of environmental services are under development. A national cap and trade system involving government and carbon emitting industries is under discussion and some large Brazilian industries have already committed to substantial emissions reductions which could lead to a demand for REDD credits.

Over the years Brazil has developed and introduced a range of imaginative schemes for payments for ecosystem services (see Lerda 2009; the following summary relies on this source).

- *The Ecological Sales Tax* (ICMS Ecológico): A tax on all goods and services provides funds for municipalities related to the protected areas they maintain.

- *Environmental Compensation* (Compensação Ambiental): Payments from the licensing of new developments are directed to protected areas (IUCN Categories one and two).

- *Payment for Watershed Services*: Water payments that relate to the use of resources from a particular watershed are collected by the local water management agency which charges a usage fee and redistributes a portion of the payment to local watershed management committees.

- *Gas and Oil Royalty Payments*: Oil and gas companies pay royalties to the federal or local government, depending on the jurisdiction. The recently introduced Climate Change Fund is funded from this source.

- *Private Nature Reserves*: Brazil offers private land-owners the opportunity to avoid paying property taxes by turning their land into a private nature reserve.

- *Mitigation Banking*: The Forest Code requires anyone owning rural land to set aside some of it in a Legal Reserve. Landowners can reach their quota by setting aside their own land or by purchasing tradable certificates from other landowners within the same micro-region or watershed.

- *Voluntary Carbon Market*: According to the State of the Voluntary Carbon Markets 2011, transactions in Brazil more than doubled in 2010; they harnessed emissions reductions from a variety of project types including REDD and biomass; the world's first sub-national carbon registry was established in the State of Amapá; and a new standard for payment for environmental services, Brasil Mata Viva, was launched.

- *Amazon Protected Areas Program:* ARPA is a federal program designed to protect 37.5 million ha of protected areas and consolidate another 12.5 m ha. Funding comes mainly from KfW, GEF and WWF. FUNBIO, the Brazilian Biodiversity Fund, administers the program. The aim is to establish an endowment fund of $240 million to meet recurrent costs. $22 million has been raised so far.

- *Forest Concessions*: Concessionaires are required to pay a tax and re-plant.

- *Green Tax Deduction*: Individuals and companies get income tax relief for charitable donations, but only for those related to culture, education and athletics. A new bill, *Imposto de Renda Ecológico*, aims to extend this status to donations in support of environmental projects.

- *Proambiente Program*: The Ministry of the Environment has piloted provision of technical assistance and payments to small farmers in several regions. One assessment suggests that performance has been undermined by the lack of a national legal framework, limited funding, implementation capacity constraints, poor cross-sector collaboration and incompatibility with existing regional development policies. IPAM, the Environmental Research Institute of Amazonia, is now administering a pilot financed by the Amazon Fund.