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Background Paper 1

ECONOMIC CONTRIBUTIONS OF FORESTS

Arun Agrawal
Ben Cashore
Rebecca Hardin
Gill Shepherd
Catherine Benson
Daniel Miller

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Executive Summary:
Economic Contributions of Forests

For millennia before the industrial revolution, forests, woodlands, and trees were the source of land for settlement and cultivation, products and materials for construction, woody biomass for fuel and energy, and indeed, directly for food and nutrition as well. The spread of agricultural revolution depended on the conversion of forests into cultivable land. The continuing contributions of forests to global biodiversity, to the fertility of agricultural lands, and to the welfare of those who depend on them mean that forests are immensely valuable for sustainability. The massive *economic* contributions forests continue to make to human livelihoods, economic development, and national incomes are the main focus of our report.

Changes in forest cover and the economic contributions of forests to development have created many different patterns across the globe. But the basic pattern of deforestation accompanying the initial period of economic growth, followed by a phase during which forest area and cover stabilize and then slowly begin to recover seems to be remarkably consistent - with obvious differences in timing. The specific reasons for this pattern differ – in some cases these reasons are primarily owed to changes in the distribution of economic activities from agriculture to industry to service sectors, in other cases to active government policies aiming to improve forest cover or penalize illegal extraction, and in yet other cases as a result to the role of international capital and trade. But under all these patterns of loss, stabilization, and recovery, the constant is the contributions forests make to international trade, national economies, employment, and household incomes.

Even if only the formally recognized, officially reported monetary contributions of forests to the economies of the developing world are taken into account, they exceed US$ 250B – easily more than double the flow of total development assistance and more than the annual global output of gold and silver combined. These direct, cash exchange-based contributions of forests represent approximately 1% of the global output.

Data gaps and absence of reliable information are major problem in estimating the economic contributions of forests beyond what is available in official reports. Country- and region-specific efforts indicate that where such data are reliably available, the non-cash economic contributions of forests to household and national economies range between 3 and 5 times the formally recognized, cash contributions.

In addition to their direct, cash and non-cash economic contributions, forests also provide substantial levels of employment. More than 13 million people are employed in forest sector activities in the formal sector. In the informal sector of small and medium forest enterprises, another 40-60 million people may be employed. Once again, however, the lack of systematic data makes it near impossible to estimate closely how many people are employed in the forest sector. Estimates of the number of people deriving direct and indirect benefits from forests – in the form of employment, forest products, and direct or indirect contributions to livelihoods and incomes – range between 1 billion - 1.5 billion.

And unlike most other sectors, forests also contribute massively to the ecosystems services that humans value, even if these are not traded or even if it is difficult to put an economic figure on that value. Different economic valuation strategies peg the economic value of ecosystem services from forests in the neighborhood of additional hundreds of billions of dollars.

The absence of aggregated data on the economic contributions related to non-timber forest products (NTFPs) and their value, and the lack of information systems that can incorporate such data systematically are major bottlenecks in a better understanding of forest sector contributions. They also represent a deficiency when it comes to improved management so as to enhance the total economic contributions of forests. Indeed, the effective absence of information on the value of such benefits from forests has meant an overemphasis in forest governance systems on managing forests for products that are highly visible, formally recognized, and with cash market value. This imbalance means that official management systems are ill-equipped to improve the larger economic benefits forests provide through non-cash valued products and services. Consequently, investments in the forest sector remain in imbalance, and aimed mainly at capturing benefits that are visible and based on monetary exchanges.

It is necessary to recognize and appropriately value the outstanding economic contributions of forests to human welfare and development. But the pattern of change in such contributions should be a major cause of concern to forest professionals and others interested in forests – whether that interest is related to ecological sustainability, ecosystem services, or economic benefits.

In the decades since the 1980s, officially measured contributions from forests as a proportion of overall economic activity have registered a steady downward trend. Their contributions have fallen by more than 50% on a number of key economic dimensions since the 1980s: from more than 1.6% to less than 1% of the formal global GDP; from 0.7% to a little less than 0.4% of the formally employed labor force; and from

more than 3.5% to less than 2.4% of total merchandise exports. Even the recent prominence of forests owing to their potential to reduce total greenhouse gas emissions will be lost as emissions from other sectors of the economy rapidly outstrip those from forests because of reduced rates of deforestation. The decline in the prominence of forests is mainly the result of the rapid growth of the global economy and the faster growth of other sectors. Thus total value added in the forest sector has increased in the same period but at a slower pace than that of the global economy.

A substantial reason forests have become less prominent economically is the relatively isolated nature of forestry agencies and services, including the limited exchanges between professionals in the forest and other sectors. Forest sector activities in most countries are separated between private, public, and civil society sectors based on the nature of forest tenure. Efforts to improve interactions and exchanges across the tenure divide, as also across economic sector-based divisions are recent and at best incipient. Greater integration between the forest and other sectors are a precondition to enhance the recognition of the economic contributions of forests. Such integration will require major changes in policies and institutional arrangements. For these arrangements to work successfully, forest professionals will also need to be far more open to improved connections with those outside the forest sector.

The efficiency of operations in the forest sector has improved in the past decades in the developed world. But few major technological changes have influenced levels of value addition in the forest sector in the developing world. Illegal and unsustainable harvesting in many countries, at times accompanied by political violence and social unrest, make problems related to forest economic contributions a matter of national concern and competition.

Enhanced economic contributions from the forest sector in the future will depend on the extent to which decision makers are able effectively to make progress to address four key issues:

The first of these concerns efforts to better understand and capture forest benefits that are currently neither recognized nor, consequently, being captured. The deployment of new technologies in the forest sector for improved value added in processing, manufacturing, and exchange are key intervention areas. Equally important is the need to understand the contributions of forests to other sectors, in particular tourism, industry, health, water, and agriculture. Finally, efforts to address the legality of harvesting of forest products are likely to improve substantially the extent to which governments and citizens are able to benefit from forests. Catalytic donor funding should aim to improve fundamentally the existing data systems and data related to

forests, forest benefits, and forest tenure and governance – all areas in which even basic information needed for improved decision making is missing.

A critical constraint on improved understanding and management are data and information gaps. Current forest-related data collection is deficient in its representation of activities and benefits from forests that are not exchanged for cash, that are in the informal sector, and that are not recognized by forest authorities. Gathering such data systematically is necessary if the bulk of the economic contributions from forests are to be recognized and if action to improve the generation and capture of such benefits is to be possible. Better information on the contributions of forests in the form of NTFPs is possible as a large number of research studies have demonstrated, but more methodological research is needed on simple and inexpensive techniques for doing so which will appeal to governments and multilateral organizations. Systematic data on these products, on different forms of tenure, and on how these benefits contribute to poverty reduction are activities that will help decision makers recognize better the key economic contributions of forests.

Improved economic contributions from the forest sector in the future are likely to hinge on improved governance. Improved governance has two facets – changes that directly address gaps in efficient economic utilization of forest values, and changes that aim at the long-term sustainability of both economic and other values from forests. These include ecosystem, cultural, and spiritual values in addition to the cash and non-cash economic contributions. The first set of changes can be accomplished through top-down decisions based on better information and evidence. But for the second set of improvements, greater participation of constituents, likely to be affected by policy decisions, is critically important as well.

A key part of the improved governance of forests is a more integrated approach to forest management – such integration must be concerned with greater cross-sectoral synergies, stronger interactions and connections across levels of forest governance, and improved engagement between the public, private, and civil society actors. New approaches such as landscape approaches may be helpful in this. Higher levels of value addition, employment, and trade benefits through the forest sector will hinge on the achievement of such coordination.

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ECONOMIC CONTRIBUTIONS OF FORESTS

1. INTRODUCTION

The dominant economic theme in human-forest relationships over the past two millennia, but especially during the last two centuries, has been one of value abstraction and increasingly intensive management. Humans have depended on forests for a remarkable variety of products, services, and benefits. With rapid economic growth and technological changes, they have refined and added to the values forests make available. Even as deforestation has accompanied early stages of economic growth (Richards and Tucker 1988, Tucker and Richards 1983), advanced levels of economic development are associated with forest transitions and increased forest cover (Grainger 1995). The following review of economic contributions from forests surveys the state of the literature on how forests contribute to human well-being through the many different goods and services they provide, the ways in which they are managed and governed, and some directions for more effective protection of the heritage they constitute and enhancing of the benefits they provide.

Historically, forests have played a major role to influence patterns of economic development, supporting livelihoods, helping structure economic change, and promoting sustainable growth. For millennia before the industrial revolution, forests, woodland, and trees were the source of land for cultivation and settlement, of construction materials, of fuel and energy, and indeed of food and nutrition as well (Williams 2002). The extended use and exploitation of forest resources even before the industrial revolution had led to efforts to conserve forested areas and plant new trees in specific regions of the world. In Europe, France and Germany were leaders in developing policies in the 17th and 18th centuries to regulate the use of and to protect forests. The emergence of forestry as a science with its focus on sustainable timber production was also a hallmark of colonial forest departments founded all over the developing world by European colonizers (Barton 2001, Peluso and Vandergeest 2001, Troup 1940). The foundational justification for many forestry departments all over the world was to

improve management and enhance the public benefits of forests in terms of soil conservation, watershed protection and flood control. But most forestry departments were also under substantial pressure to generate revenues and often sought to protect forests for commercial exploitation. The consequence was tensions between government forest agencies and the poor populations that depended on forests for their livelihoods (Guha 2000).

Forests continue today to provide the high levels of commercial benefits to households, companies, and governments that formed the initial impetus for protective statutes and policies. The FAO estimates that forest industries contribute more than US$ 450 billion to national incomes, contributing nearly 1 percent of the global GDP in 2008 and providing formal employment to 0.4% of the global labor force (FAO 2012). Forests also provide other sources of incomes and subsistence benefits, generate informal work opportunities, and constitute reservoirs of economic values that help ameliorate shocks to household incomes – particularly in rural areas in poor countries (Chomitz and Kumari 1998). But systematically collected data to permit aggregate estimates of non-industrial economic contributions of forests are simply not available - either at the global or at the national level. The individual country level estimates that are available demonstrate that such benefits are substantial, in many cases 3-10 times higher than those for which systematic national and global data are collected (see discussion below).

In the last fifty years, changing views about the importance of forests and their relationship to humans have been associated with corresponding changes in emphases in how forests are managed. Earlier efforts to manage forests for sustained yields of commercial timber were in many countries replaced in the 1970s and 1980s by the watchwords of sustainable forest management and ecosystem management as the multi-functional nature of forests and woodlands became obvious. Increasing levels of deforestation despite efforts to reduce and reverse loss forests led many governments and international agencies to attempt policy experiments that would have a positive influence on net deforestation. The growing recognition of the importance of biodiversity and of forests as the reservoirs of terrestrial biodiversity led to a rapid and

unprecedented expansion of protected areas such that they now cover more than 10% of the global land surface.

At the same time, the integral connection between forests and the livelihoods of poor, marginal, and indigenous groups found greater emphasis all through the 1970s and beyond. As a result, substantial policy efforts have attempted to recognize and create a role for these groups in the management of forests and the distribution of benefits from forests. Terms such as social forestry, community forestry, and participatory forestry have tried to capture some of the ways people have been involved in forest use and governance to make them more equitable and effective. In many developing countries, policies to decentralize forest management, often the result of increasing fiscal strains upon governments, have also gone hand in hand with efforts to include people in at least some aspects of forest management.

More recent shifts in thinking about forests and the benefits they provide have used the lens of ecosystem services. Many researchers and decision makers recognize the important role of economic incentives from local to national levels in reducing deforestation. They argue for the need to compensate producers of forest ecosystem services. The possibility of mitigating climate change through terrestrial carbon sequestration in forest areas has thus led to the development of new regulatory and economic strategies to protect and improve forest cover through payments for ecosystem services in programs such as REDD+.

Sustainability of forests, their biodiversity, and their flows of goods and services will require innovative emphases on areas of value added that create alliances beyond forests, cross-sector and multi-scale governance strategies, effective financing that counts the contributions of a range of stakeholders, and greater emphasis on coordination and communication among stakeholders than has been the case till now.

2. REGIONAL PATTERNS OF FOREST CHANGE AND ECONOMIC DEVELOPMENT

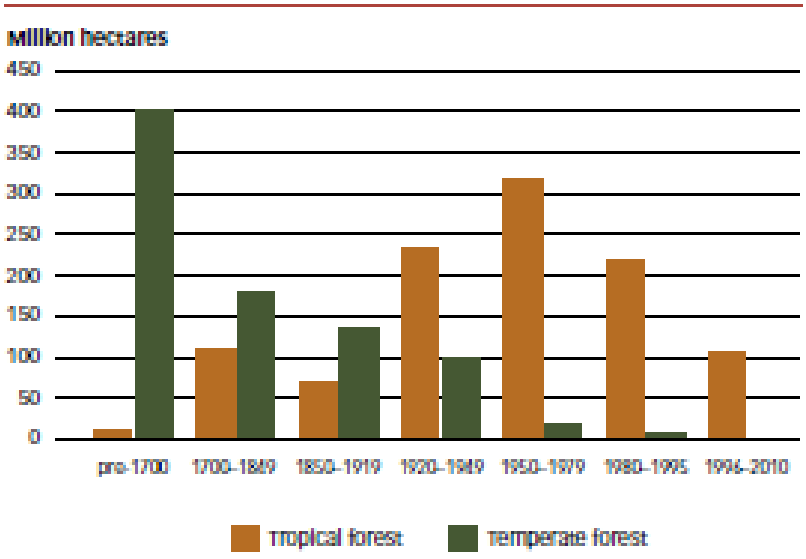
Rapid economic development since the 1850s has followed different trajectories in different parts of the world. Accordingly, the role of forests has also varied within the

general statement that early economic growth is coupled with deforestation. Early societies comprising mostly hunting-gathering households depended on forests for nearly all of their livelihood needs. The agricultural transition translated into deforestation for cultivable land at a scale that was limited only by available technologies, by the labor available to cultivate land and grow crops and by the presence or absence of markets. Forest provided fodder, firewood, and subsistence timber – goods for which they are still the major source for most poor households in the developing world.

2.1 Patterns of forest change

Industrial development resulted however in a shift in types of forest products demanded as also in the scale of the demand. Forests became the source land for industrial and commodity crops, and of raw materials for construction, furniture, and paper and pulp. The massive and global scale of the demand for these commodities has led to remarkably high rates of deforestation, particularly in the tropical world in the 20th century. Some areas of the world – particularly South and East Asia and Europe underwent unprecedented deforestation early in their history. This early deforestation was mainly on land suited to agriculture.

Figure 1: Estimates of deforestation by type of forests and time period
(Source: FAO 2012: 9)



Both China and India experienced deforestation early in their histories. With an increasing population, China reached a historically low point in its forest cover in the mid-twentieth century so that just about 10% of the country was covered with forests in 1950. But forest cover has increased slowly if steadily over the past two decades with 80 million hectares of planted forests being added to the overall forest area. In much of South Asia, forests had been cleared during the pre-colonial period to provide for an expanding agricultural frontier. Ironically, one of the most intense periods of deforestation in south Asia occurred after the creation of the Imperial Forest Department whose stated aim included the improvement of ecosystem services such as soil conservation and flood control through scientific forest management. The region, particularly India, has witnessed a slow growth in forest cover in the last two decades, again because of plantation and conservation actions. Southeast Asia, in contrast both to China and India, continues to lose forest cover. The global demand for timber coupled with the expansion of commodity agriculture accounts for much of the deforestation in this region. Widespread problems of governance and low-grade conflict certainly further exacerbate the problem.

European settlement in Latin America reduced the native population disastrously, with some estimates suggesting population declines by 90 to 95 percent between initial contact and 1700. The 18th and 19th centuries saw relatively small amounts of deforestation in the region, but the pace has been rapid and has continued into the 21st century – mainly as a result of colonization along the extensive frontier and conversation of forests to commodity agriculture such as cattle and soybean. A decline in rates of deforestation is now visible. Dry and savannah forests in Africa have been cleared mainly for agricultural expansion. The extensive forests of the Congo Basin have mainly been intact until recently, but there are now increasing deforestation pressures as a result of demand for tropical hardwoods. Elsewhere in the continent, deforestation occurs because of the expansion of cash crops, and large-scale land transfers to support industrial needs globally.

In much of Europe, rapid deforestation between the 17th and 19th centuries fueled both agricultural expansion and industrial development. As coal and other fossil fuels replaced wood for energy needs, deforestation rates began to decline in the twentieth century and today forests are stable or increasing in most European countries. Similarly in North America, rapid rates of deforestation in the 19th century had begun to stabilize by the beginning of the twentieth century and there has been a return of forests in both Canada and the United States.

2.2. Forest Transition Theories

Analyses of forest recovery in a number of European countries was noted by Mather and others in the 1990s (Mather 1992, Drake 1993, Mather et al 1998) and at its simplest references the point at which a country, as it becomes economically more prosperous, begins to gain forest area rather than losing it. Economic growth is associated with rising value of agricultural land and deforestation as users bring more land under the plough. But with continuing growth and deforestation, either returns to agricultural land decline or those to forest land increase, or both, leading to a recovery in forest cover. Studies of documented forest transitions (Foster 1992, Rudel 2001, Andre 1998, Staaland et al. 1998, Walker 1993) have led both to more careful theorizing and a more general set of explanations of why forest transitions may occur (Angelsen 2007, Rudel et al. 2005).

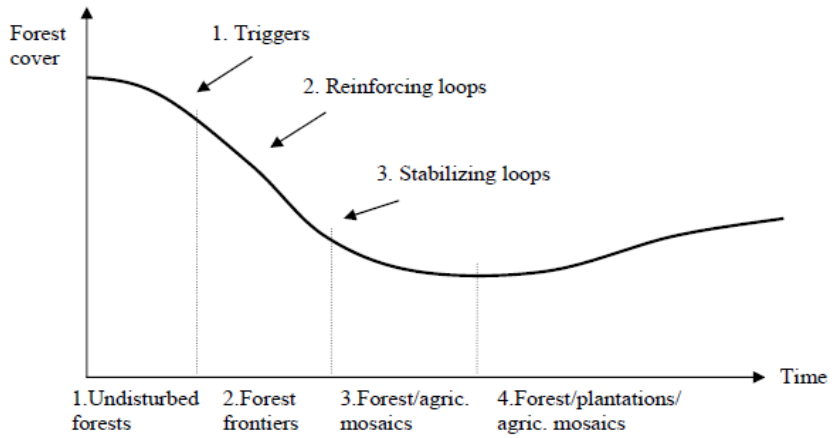
This section discusses several different typologies of forest cover change, from Mather's traditional concept of "forest transition" to Rudel's characterization among forest cover change and regeneration pathways. This section then highlights some challenges with overarching theories on forest trajectories and presents individual cases from the Brazilian and Peruvian Amazon, China, South Asia and the US on forest cover and forest regeneration over time.

Mather proposed the concept of "forest transition" to describe how forest cover changes in predictable ways in response to economic development, industrialization and urbanization trends over time (Mather 1990 in Rudel 2005). Forest transition theory

predicts that forest cover will exhibit a U-shaped curve, showing an initial decline in forest cover that is later reduced and then outweighed by forest expansion and recovery (Perez and Skole 2003).

The figure below presents an abstract representation of forest transition theory according to which forest cover declines in the early stages of development as users and managers convert forests into agricultural land and use timber and other forest products for a primary commodity based developmental path.

Figure 2: Representing forest transition theory
(Source: Angelsen 2007)

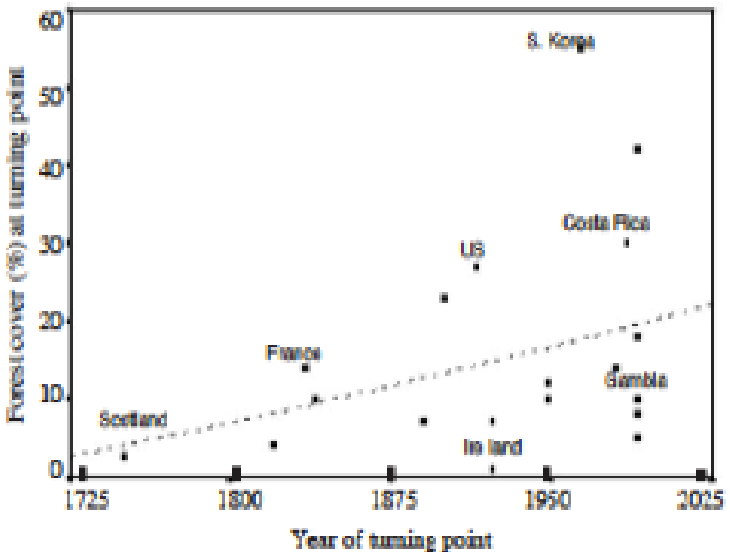


According to the figure, undisturbed forests prior to agricultural or industrial revolution are protected passively because there is little demand for either the land on which they stand or because extracting products is economically unviable. But a number of factors – road construction, technological changes, new market opportunities, agricultural development, population growth, immigration – can trigger declines in forest cover. The effects of these triggers are likely to be reinforced by rise in prices of agricultural products, improvement in processing facilities, or improved access to forested areas. Existing customary tenure arrangements are often inadequate bulwarks against demand pressures, leading to high rates of deforestation in frontier areas. The effects of these reinforcing factors can be modified over time, either as a result of movement of labor from agriculture to industry or because of increasing scarcity of forest products. Changes in policies that raise the costs of extracting forest products can

also counter the effects of different forms of demand for forest products. As these factors unfold, forest transition theory posits an increase in forest cover over time.

Forest transition theory shares assumptions about transitions in economic activities, environmental impacts and resource use with the environmental Kuznets curve (Perez and Skole 2003). Northern Europe, between 1850 and 1980, for instance, illustrates this type of transition (Rudel 2005). Figure 3 below shows how 20 countries have undergone forest transition over the past 200 years (Rudel 2005: 26).

Figure 3: Forest Cover at the Turning point
(Source: Rudel 2005: 26)



2.3 Trajectories of forest cover change

Rudel (2005: 27) characterizes five types of forest cover change, using FAO forest data from 1990 to 2000. The first of these concerns afforestation resulting from labor scarcities, for example in Greece, Ireland, and Portugal. In these countries, economic development and urbanization has meant that farm labor and other rural labor has moved to cities and less land is used for farming. Owing to comparative advantages that agricultural activities enjoy in other parts of Europe, the economic advantages of land holding consolidation in these countries are insufficient to overcome the institutional constraints favoring continued small landholdings and ownership. Following the rural to

urban shift in labor, afforestation has occurred through spontaneous changes such as old-field succession. Government policies can promote this transition through purchase of fallow or neglected farmland for forest reserves or protection of new reserves.

A second example of forest recovery is afforestation resulting from scarcity of forest products as has occurred for example in some high population density countries such as Bangladesh, China, and India. In this "forest scarcity" example, countries with large populations but little available forest may experience increased prices for forest products to such an extent that individuals and households start planting trees rather than using land only for farming or for pasture. Government policies can support this transition by creating programs to reforest marginal lands and that has certainly also happened in China and India.

A third pattern of forest cover change is decline in forests through deforestation associated with poverty. Some example of this pattern, according to Rudel, can be found in loss of forest cover in Ethiopia, Haiti, and Togo. Indeed, a substantial body of research attributes loss of forests and forest cover to the subsistence activities of the poor (Geist and Lambin 2002).

Deforestation can also occur under conditions of violence and war as for example in Burundi, El Salvador, Rwanda, and Sierra Leone). Civil war or other forms of unrest are associated with deforestation, either by rebel groups who utilize forest revenue to finance their operations or because of a lack of civil authority to govern and protect forests. In other cases, warring groups within a country may cut down forests to reduce cover and increase visibility of enemy forces.

Finally, deforestation can result from forest market demand as is the case for Brazil, Cameroon, and Indonesia. In these countries, forests have been used as a source of wealth, resulting in large-scale deforestation to generate revenue. This logic of deforestation is also historically the one associated with initial declines in forest cover as happened in Canada, United States, or much of Europe as discussed earlier in this section.

2.4 Drivers of deforestation

There are two distinct literatures on drivers of deforestation and explanations of forest outcomes. They can be distinguished by their theoretical and methodological emphases, and by the level of analysis: a focus on macro-level drivers of deforestation (DoD) versus micro-level institutional accounts of forest governance (IFG). To a substantial extent, these two literatures are not in much dialog, nor is there much interaction between micro *vs.* macro accounts of forest outcomes. This divide diminishes the understanding of the causal processes and the causal pathways linking specific interventions to forest outcomes. It also raises the threat that policy initiatives emerging from these two bodies of writings are unconnected and that they will fail to be based on relevant explanatory factors.

The methodological approaches of DoD and IFG writings differ in three fundamental ways. First, the main objective of DoD is the estimation of causal effects for biophysical and socio-economic variables leading to deforestation. In comparison, IFG researchers seek to generate insights into the causal mechanisms linking social and institutional factors to forest outcomes. Second – and related to the first difference - DoD writings focus on determining the effects of individual variables whereas a primary IFG goal is to develop common theoretical frameworks to guide comparative research on collective action for sustainable natural resource management. These discrepancies are due, in part, to the different disciplinary backgrounds that define the core group of scholars in each of these two fields. Economists exert the largest influence in the DoD literature, whereas political scientists, anthropologists, and rural sociologists have developed much of the IFG literature. Third, the unit of analysis tends to be different between these two bodies. While empirical work by IFG scholars examines data at the forest patch level, DoD work generally uses pixels, plot level data, and country level observations to explain outcomes at the national or international level outcomes.

The key methodological approach used in the DoD literature tends to be large N-statistical and econometric. Because the central goal of DoD researchers is to establish causal effects of variables on the likelihood of deforestation, their analyses rely on

econometric techniques and large data sets on biophysical, demographic and economic drivers of deforestation. In contrast, IFG researchers often focus on small scale case studies of specific forest locations, and at times may undertake statistical analysis of the patterns of outcomes in these small scale forest patches.

Over the past two decades, the empirical literature in DoD has witnessed an evolution in the methodological approach and unit of analysis under investigation. Previous work represented cross-national analyses that correlated factors of interest at the national level with national measures of deforestation (Allen and Barnes 1985; Rudel 1989, Cropper et al. 2001). The use of national data shifted to the use of district and county level data on forest outcomes, and now, to the analysis of disaggregated spatial data (Andam et. al. 2008; Robalino and Pfaff 2011). Moreover, the examination of broader national measures of deforestation has been replaced with the investigation of a more specific question about the effectiveness of forest protected areas and contagion effects.

This distinct shift between the early and later literature has been driven by technological advances that have made available higher quality, spatially explicit, social and economic data. This data has allowed researchers to utilize a refined set of econometric tools to more precisely estimate the effect of individual variables on deforestation rates. Currently, approaches that combine digital maps with socio-economic variables and apply various quasi-experimental matching techniques and instrumental variables estimators are dominant. In particular, matching and instrumental variables techniques are seen as a means to achieve the fundamental goal of estimating causal effects because they more closely mimic experimental conditions. In particular, studies have used IV methods to control for location bias in road placement (Chomitz and Gray 1996), and have sought to control for endogeneity of protected area placement through matching methods (Andam et. al 2008; Pfaff et. al 2009; Joppa and Pfaff 2009).

In addition to quantitative analysis, several important studies have sought to glean an understanding of the primary drivers of deforestation through comprehensive

literature reviews and synthesis of the economic models used to determine rates of deforestation (Angelsen and Kaimowitz 1999, Geist and Lambin 2001, Grainger 1993, Rudel 2005). For example, Thomas Rudel's (2005) work on forest cover change analyzes hundreds of DoD studies through a comparative historical meta-analysis. His study investigates the regional variation in deforestation trends, and although economic opportunities afforded by globalization ultimately drive deforestation, he finds important variation in the historical market trends leading to deforestation among countries. In particular, logging in South East Asia, cattle ranching in Latin America and smaller land holders in Africa - can be attributed to differences in natural resource endowments in conjunction with deviations in development efforts.

In comparison to the DoD literature, the forest governance field differs substantially in its orientation to global and cross country data-sets based on local-level institutional arrangements, particulars of institutional regimes, socio-economic conditions, as well as micro-level data on users and user groups. This divergence is driven by the IFG objective of understanding the mechanisms that link these factors to forest outcomes at a much smaller scale than that explored in the DoD literature. Moreover, in contrast to DoD reliance on pre-existing quantitative data sets, IFG scholars often collect original data required for their analysis from deliberate, in-depth field work at local village and community scales.

IFG writings often focus on causal mechanisms as well. In conjunction with disciplinary affiliations, this focus leads to methodological approaches do not typically rely on sophisticated econometric techniques that are present in DoD analyses. In particular, although recent work has begun to use quantitative data and analytical tools such as regression techniques and game-theoretic modeling the forest governance literature is generally defined by case studies, comparative approaches and ethnographic descriptions of an immense number of communities or other units of analysis.

Chhatre and Agrawal's (2009) study of the tradeoffs and synergies between carbon storage and livelihood benefits from forest commons, and the Persha et al

(2011) study of livelihoods and diversity outcomes are examples of recent IFG research that applies quantitative methods. These studies use regression analyses to investigate outcomes in tropical forest commons in Asia, Africa and Latin America. A limited set of independent variables were included in the statistical models used in these studies, including forest size, ownership, autonomy, distance of users to forest and the distance of forest to the administrative center.

The empirical findings suggest that larger forest patches at the local level help enhance biodiversity, livelihoods, and forest condition related outcomes. Secure tenure rights, coupled with payments for carbon storage in relatively large forests, are likely to promote biomass conservation. Although ownership provides local communities with the incentive to defer present livelihood benefits, community autonomy in resource management results in conservation measures that are appropriate to local demands and system capacity. Local users perceive insecurity in their rights when the central government owns the land; this prompts them to extract high levels of livelihood benefits from forests. In contrast, when their tenure rights are safe, they conserve the biomass.

These results speak directly to international climate change mitigation initiatives such as REDD+ and efforts to advance biodiversity and livelihoods goals. The essential policy implications of these studies are that stronger participation in local forest governance, larger forest patches under the control of local communities, and secure ownership rights can reduce deforestation pressures without negatively affecting local livelihoods. Furthermore, these studies also provide evidence to support the assumption that greater autonomy in managing local resource institutions will result in conservation measures appropriate to local demands and system capacity because this mechanism ensures more efficient translation of local knowledge into sustainable resource management.

Apart from insights into causal mechanisms, IFG scholars seek also to develop common theoretical frameworks for identifying and classifying subsystem variables that affect the likelihood of self-organization in efforts to achieve a sustainable social-

ecological system. The goal here is to develop organizational frameworks for findings across the FG field in order to better manage, direct and encourage the accumulating body of knowledge.

The theoretical framework underlying the "drivers of deforestation" work emphasizes the importance of economic drivers and changes in relative for natural resources such as forest products *vs*. agricultural outputs. The factors expected to directly affect price expectations include market demand for products and macro-economic policies, such as economic liberalization and credit subsidies. However, given concerns with data availability and quality, scholars have found it highly difficult to effectively test the impact of these direct/primary variables. Instead, the empirical work is focused on an investigation of the secondary factors that influence the value of forest products and land. The variables prevalent in empirical analyses include biophysical features, transportation costs, technology, and population pressures (Angelsen and Kaimowitz 1999; Geist and Lambin 2001).

To begin, DoD studies emphasize the critical role played by biophysical or pre-disposing environmental factors in determining the economic value of preserving or removing a forest. Forests not suitable for conversion to agriculture or cattle ranching may be passively protected because deforestation is less profitable. In contrast, forests with low relief, flat topography, good soil and high water availability will often face a higher threat of land clearing for crop expansion (Andam et. al 2008, Cropper et. al 2001, Deninger and Minten 2002, Pfaff and Joppa 2009). Meanwhile, areas with a significant amount of rainfall – beyond a level suitable for many crops – may be ideal for conversion to pasture for cattle ranching (Margulis 2004). Finally, easily accessible areas may also stimulate logging due to low extraction and transportation costs. Accordingly, climate, size, elevation, slope and soil quality represent key physio-geographic factors investigated in statistical models.

With the exception of biophysical features, road construction is cited as having an important influence on incentives to log territories or convert them to agricultural uses (Chomitz and Gray 1996). Roads facilitate market access while reducing the costs

of migration, land access and land clearing. Next, demographic explanations view population density and population growth through migration as factors that may market pressures. Rapidly increasing or dense populations translate into an increased demand for food and wood (Allen and Barnes 1985, Cropper et. al 2001). Finally, isolated studies investigate wage rates to determine whether higher labor costs reduce deforestation by making it less profitable. Higher payments for the labor necessary for clearing land raise the cost of deforestation, while higher agricultural wages may make it less beneficial for poor people to engage in activities that promote deforestation (Deninger and Minten 2002).

In contrast to the drivers of deforestation literature, studies of forest governance are concerned with institutional explanations and user-group characteristics. Although forest governance scholars also address biophysical, market and population factors, their research concentrates on whether and how institutional arrangements and capacity mediate these pressures. In particular, the primary institutional capacity variables of interest include monitoring, enforcement, and sanctioning. Scholars in this field are especially interested in the effects of formal institutional arrangements that devolve ownership and autonomy to local community groups. Community management is expected to incentivize user groups to engage in sustainable forest management through the mechanisms of enhanced knowledge, stronger accountability and perceived legitimacy of forest rules.

In addition, the socio-cultural factors of interest can include, for example, such features as historical experience with resource management, group size, social capital, user group heterogeneity and leadership. Heterogeneity can be further broken down into wealth, gender, ethnic and religious differences. The above discussion of drivers of deforestation is summarized in table 1 below through five distinct sets of driving causes of deforestation and forest outcomes according to the two bodies of reviewed writings.

The table shows how the two different literatures have viewed factors affecting forest cover and deforestation. A blank cell signifies limited to no attention having been devoted to a particular factor in the given set of writings. Negative vs. positive indicate

the direction of influence the factor is supposed to exert on forest outcomes. It is evident that there are specific sets of variables that tend to be under-represented in the analyses offered by these two literatures. Thus, user group and institutional arrangement related variables receive limited attention in the drivers of deforestation writings. On the other hand, scholars focusing on institutions and forest governance tend to under-emphasize the role of physical and biological factors in explaining forest outcomes and deforestation.

Table 1: Causal variables and effects on forests in writings on deforestation
(Source: Mcgee LaRue and Agrawal 2012)

User group variables	**Effects on forests in writings on**		**Biophysical variables**	**Effects on forests in writings on**	
	Drivers of deforestation	**Institutions/ Governance**		**Drivers of deforestation**	**Institutions/ Governance**
Heterogeneity		Negative	Soil fertility	Negative	
Social capital		Positive	Elevation	Positive	Positive
History/ Experience		Positive	Slope	Positive	Positive
Leadership		Positive	Vegetation density	Negative	
Education	Positive	Positive	Fragmentation	Negative	
Forest Dependence		Positive	Rainfall	Mixed	
Remoteness	Positive	Positive	Fire	Negative	
Public attitudes	Positive	Positive	Forest size	positive	Mixed
Poverty	Negative	Mixed			
Market Variables	**Effects on forests in writings on**		**Institutional Variables**	**Effects on forests in writings on**	
	Drivers of deforestation	**Institutions/ Governance**		**Drivers of deforestation**	**Institutions/ Governance**
Liberalization	Mixed	Mixed	Weak state	Negative	Negative
Roads	Negative	Positive	Property rights	Positive	Positive
Distance to administrative center	Negative	Negative	Tenure security	Mixed	Positive
New technology	Negative	Mixed	Local autonomy		Positive
Market demand	Negative	Negative	Monitoring		Positive
Input prices	Negative		Enforcement	Positive	Positive
Product prices	Negative	Negative	Accountability		Positive
Per Capita Income	Negative	Mixed	Formal authority		Positive
Wage levels	Positive		Well defined		Positive

			rules		
Effects of Demographic Variables on forests in writings on					
	Drivers of deforestation	**Institutions/ Governance**		**Drivers of deforestation**	**Institutions/ Governance**
Population levels	Negative	Mixed	Population change	Negative	Negative
Population density	Negative	Mixed	Migration	Positive	Mixed

Despite this difference in the explanatory variables of focus, the hypothesized relationships between causal variables and forest outcomes tend to be remarkably consistent across the two literatures: even though methods, data, and underlying explanatory theories and frameworks vary. Where there are differences between these two bodies of writings, they are often because the causal variables in question are complex and multi-dimensional. For example, tenure security can be interpreted as security of tenure over forest products, forests, or land. If decision agents gain secure tenure over land only when used for agricultural purposes, tenure security can drive deforestation for agricultural purposes. If forested lands can be held under secure tenure rights it may inhibit forest clearing.

The difference between these writings often comes down to the way the variable is specified or operationalized in these writings or as a result of how a given factor may produce different effects depending on the contextual conditions. Consider again the example of tenure security. Scholars of drivers of deforestation mostly see the effects of tenure security as being positive on forest outcomes, but the issue is also about freedom of action an actor has to take advantage of secure tenure and the relative prices of agricultural vs forest products. If agricultural output is valued more highly and the landowner has secure tenure over forests, the reasonable choice may be to harvest forest trees and plant them with agricultural crops. Secure tenure would then lead to deforestation. On the other hand, if tenure is secure but limited – macro-level forest policy effectively restricts the ability to clear cut a forest – then secure tenure even to collective actors such as communities would help reduce deforestation.

2.5 Regeneration pathways

Rudel (2010) outlines three pathways that promote reforestation under different social scenarios: spontaneous regeneration; forest plantations; and agro-forestry (See Table 2). Some forest regeneration may represent mixed cases, such as when unplanted species may spontaneously regenerate in a forest plantation under the understory. Rudel also notes that these pathways may result in indirect effects that further influence forestry cover. For instance, tree harvesting in natural forests may decrease following an increase in tree plantations. In other cases, residents evicted from the site of the plantation may then deforest a nearby forest area to plant farm crops.

Table 2: Three Regeneration Pathways
(Source: Rudel 2010)

	Spontaneous Regeneration	Forest Plantations	Agroforestry
Type of pathway	--"Old-field succession:" occurs when residents abandon an area of land, leaving it to regenerate --Illustrates second stage of environmental Kuznets curve: forests increase when populations move to urban areas following economic growth	--Deliberate planting of trees, often as part of forest plantations	--Deliberate planting of trees as part of an agro-ecosystem
Drivers	--Alternative economic opportunities that result in farmers leaving their land (farming areas in the Philippines and Puerto Rico in the 1990s) --Technological advances that focus agricultural efforts on high-yield areas and result in abandonment of low productivity areas (American South between 1935 and 1975)	--Demand for forest products in deforested countries or regions --Clean Development Mechanism (CDM) provides incentives for planting forests	--Generally small-scale efforts by farmers or households --Environmental movements such as the Greenbelt Movement may promote "tree fences" as part of agro-forestry approach
Other examples	--Europe is a typical example. --Pattern is observed in areas with shifting cultivation or other areas where land has been abandoned	--All regions show an increase between 1990 and 2005 --Particularly prevalent in East and South Asia --Less common in Africa	--Not included in FAO national data. --Occurs in peri-urban settings in developing world --Examples include green belts around African cities such as Nairobi

Several scholars caution, however, that characterizations of large-scale reforestation or deforestation may oversimplify forest dynamics, miss sub-national trends, and mask local complexities (Perez and Skole 2003; Evans et al 2010). Perez and Skole (2003) caution this theory focuses on overall forest cover, which means that the

theory does not account for ecological and economic differences between primary and secondary forests. Studies illustrate that countries with increased forest cover may still have regions or sub-regions that are experiencing high deforestation (Rudel 2005; Grainger 1993). Evans et al (2010) caution that a 20% forest cover for a pre-settlement, mature forest is not the same as a similar forest cover for a post-settlement secondary forest. They elaborate these differences in their case study in south-central Indiana, in the US, where forest regrowth in formerly agricultural areas had different canopy cover, forest density and species composition than the pre-settlement forests. Similarly, Eriksson et al (2010) demonstrate the long-term effects of historical use patterns on forest type and biodiversity in their examination of the use patterns that influenced distribution of coniferous, deciduous, and mixed forests in Sweden between 1725 and 2007.

Further, countries that experience afforestation may use different means and policies to achieve such reforestation. Although Rudel (2005) identifies China and India as countries that have experienced afforestation, in part due to scarcity of forest products, he and others note that these two countries have followed different afforestation paths, with central government policy playing a key role in China while decentralized village efforts contributed to afforestation in India.

2.6 Regional patterns of forest transitions

2.6.1 Forest transition in the Brazilian Amazon

Perez and Skole (2003) examine forest transition theory in emerging secondary forests in the Brazilian Amazon. They use a remote subregion, a frontier sub-region, and a settled sub-region as proxies for points along the forest transition curve. They find that the Amazon region experienced rapid secondary forest expansion without forest depletion. Perez and Skole (2003) explain that the Amazon experienced an income decline that likely hindered agricultural capitalization and shifted land use from crops to pasture and overall resulted in primary forest cover throughout each type of sub-region. They conclude that the Amazon does not exhibit “one long-run forest transition that

involves extensive forest depletion before recovery" but rather experiences short, periodic transition cycles, similar to the economic boom-bust cycle of Amazonian development.

Perez and Skole (2003) stress that their findings underscore the importance factors and dynamics that are not well represented in forest transition theory. They propose that forest transition theory can be refined to account for different forest types, recognize different temporal dynamics and focus on local and regional specific biophysical conditions and social drivers as well as external factors that may influence the forest sector.

2.6.2 Multiple trajectories of agriculture and deforestation in the Peruvian Amazon

Arce-Nazario (2007) illustrates land use change and forest transitions in the Peruvian Amazon as a result of changes in economy, local markets, policy and river dynamics. In 1948, upland agriculture and farm areas expanded into primary forest. As a result of agricultural credit programs that promoted farm crops, farmers left upland farm areas. Consequently, by 1965 49% of this upland farm area became secondary forestry. Between 1965 and 1977, the number of agricultural loans increased nine-fold and river migration and extreme flooding occurred throughout the area, resulting in many farmers moving to the city. At this time, the economy was also experiencing an oil boom, which may have resulted in reduced land dependency. After the collapse of the oil boom, farmers again received agricultural support in the 1980s. By 1993, farm density was at its highest level and farmers also deforested swamp areas for charcoal. When the agricultural credits were discontinued, farming activity reduced. In 2005, the area covered by farms was 10% less than in 1993.

Arce-Nazario (2007) concludes that these findings illustrate the multiple, non-linear trajectories between agriculture and deforestation, stressing that deforestation trends do not follow a simple or predictable pathway. Arce-Nazario (2007) also notes that afforestation in response to demographic and economic changes is a common pattern in Ecuador, El Salvador and Puerto Rico.

2.6.3 Reforestation in China through government policy

Song and Zhang (2010) illustrate how forest cover in China increased from 8.6% in 1949 to 18.2% in 2003 as a result of central government policies and efforts. They characterize China's forest transition in three stages: 1) unsustainable from 1949 to 1981; 2) recovery from 1982 to 1993; and 3) expansion from 1994 to the present.

Between 1949 and 1981, the central government's forest management goals focused on timber extraction to fuel economic reconstruction after WWII. At this time, the government owned 42% of the total forest area and also set the price for timber. Song and Zhang (2010) characterize this forest resource use as unsustainable because timber volume growth was lower than timber volume harvested.

Between 1982 and 1993 the Chinese government continued to focus on timber production but began to harvest timber primarily from plantation areas to allow natural forest areas to recover. Forest plantations contributed to 80% of the forest cover increase from 1962-2003. The Chinese government also began several environmental programs focused on protection, such as high afforestation standards, resulting in increases in forest area and timber volume by the end of this stage.

Beginning in 1994, the government no longer focused primarily on forest management and Chinese forest cover expanded. In 1998, the Chinese government adopted a forest policy that prioritized sustainable forest use and environmental protection over timber production. China's economic growth also enabled the government to make forest investments.

In contrast to common assumptions that forest cover may increase following economic development, Song and Zhang (2010) stress, that these forest cover increases are the result of government policy. They note the potential for reforestation gains to be reversed if government policy shifts away from sustainable forest management.

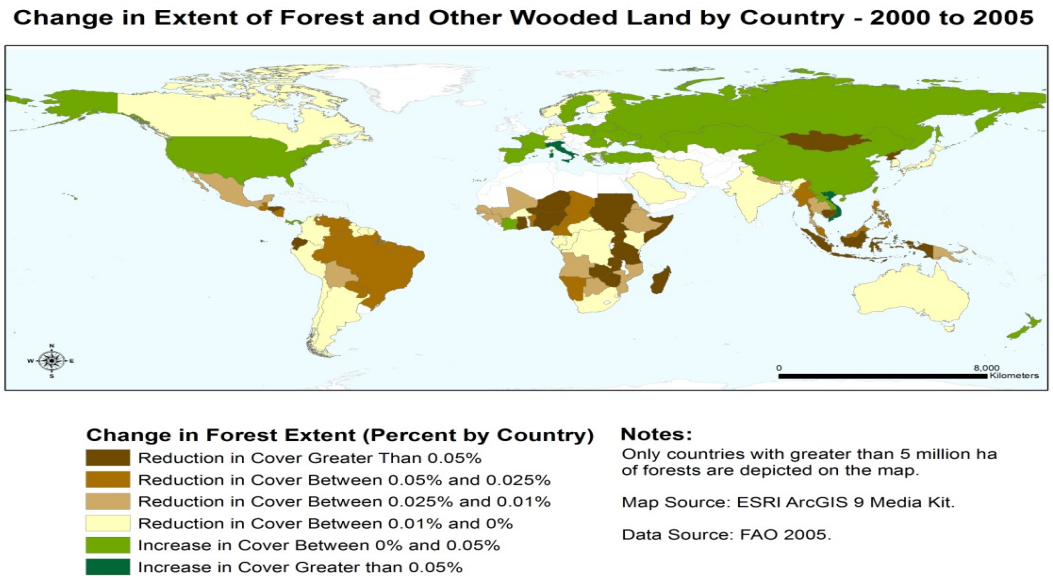
2.6.4 Reforestation in South Asia

Nagendra (2010) conducted a meta-analysis of papers from South Asia to examine whether current drivers of reforestation explained forest change pathways (2 in Bangladesh, 6 in India, 14 in Nepal, 1 in Pakistan, 1 in Sri Lanka). She concludes planting and protection primarily drive reforestation and regrowth, often as a result of

forest product scarcity, strong conservation ethics and decentralization reforms. While noting that some proponents of the environmental Kuznets curve suggest wealthier countries are more likely to reforest areas as a result of conservation awareness, Nagendra highlights evidence that poor communities also care strongly enough to protect their forests, even when it means they temporarily experience reduced access to forest products.

Figure 4 below summarizes much of the above empirical discussion above by presenting information on forest cover change visually for the different countries in the world in the last five years.

Figure 4: Global forest cover change at the national level (Source: FAO 2006 2011)



2.7. Summary of Forest Change Patterns

The ongoing recovery of forest cover in countries in both the developing and the developed world, under conditions of high and low population density, with rapid and slow growth, and under situations of secure and insecure tenure demonstrates that there is no obvious or necessary relationship between population growth, economic development, and deforestation. This observation is also strengthened by cross-national and temporal variations within countries in the relationship between population, agricultural growth, and deforestation. Indeed, once we begin to look into the specific

explanations underpinning the general argument of forest transitions and the drivers of forest loss vs. gain, it becomes clearer that the observed relationships are contingent: Deforestation and afforestation in specific locations have occurred together with a rising global population, demand for forest products, and agricultural output, and are clearly shaped by economic development pathways, levels of technological innovation, and institutional configurations than being the outcome of a trans-historical, immutable association.

3. FOREST ECONOMY AND ITS CHALLENGES

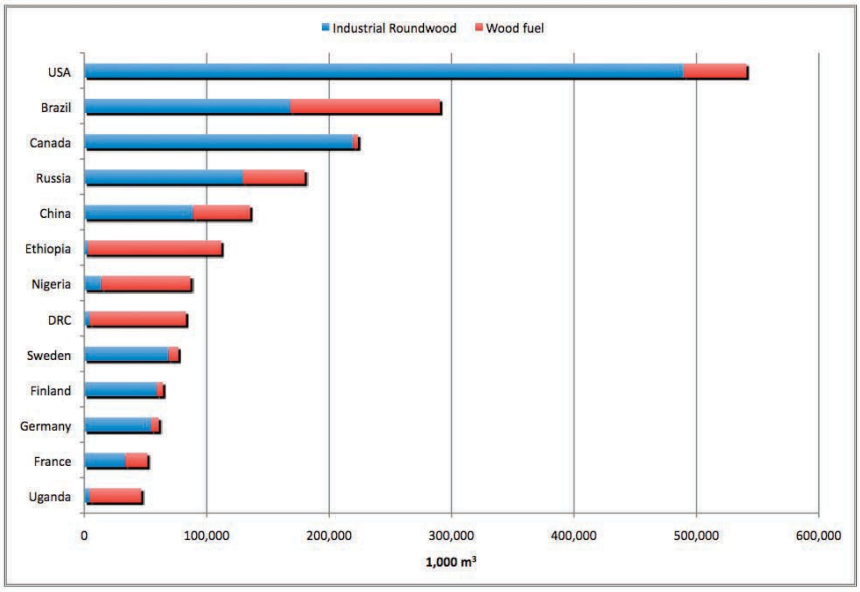
Although many studies on the subject describe the range of benefits forest provide, reliable quantitative data are simply not available for global estimates. Thus, for example, estimates of the numbers of people that rely on forests for some part of their livelihood and income vary between 1 billion and 1.6 billion. But the basis for these estimates is unclear at best. Take another example: many country and subnational studies provide some estimates of benefits from forests to household incomes. A review of 51 studies from 19 countries suggests forest may contribute as much as 22% of household incomes in these countries (Vedeld 2007). But we do not know if these figures can be extrapolated to other countries. Other analyses have also highlighted the paucity of reliable estimates of the value of forest ecosystem services including their contributions to direct household incomes (Ferraro et al. 2012).

Two distinct, related challenges confront efforts to identify and assess the role and impacts of the economic contribution of forests. First, how we conceive of forests themselves, from "natural" to "forest plantation" to "agricultural crops" that grow trees for non-timber purposes, such as palm oil plantations, will affect and shape the data that is produced. And even once we have decided on an appropriate definition of what constitutes forests, we need to decide what types of incomes, economic uses, employment, and other contributions to include: from logging in the forest, to manufacturing of some type, to transportation along supply chains, to retail jobs created by selling timber to final consumers to domestic economic use. And even more complicated are the "indirect" or "multiplier" effects that the forest sector has on

employment in other sectors owing to the economic development and growth that result from forest employment and returns on investment. That is, employees and business spend money that creates growth in a range of sectors from consumer goods such as automobiles and computers, to demands on real estate, which themselves provide complex feedback loops. Likewise growth in forest sector employment and business revenue leads to higher tax revenue, which then can permit governments at local, regional and national scales to invest in education, health care, and other social services.

Second, identifying the direct and indirect causal impacts of the forest sector on economic life would require some significant expenditure of resources and analytical effort. There are certainly data challenges as also challenges with identifying contributions to the informal sector. However, these challenges have been addressed by many country level researchers and a systematic effort promises to yield important dividends. As figure 5 shows, many countries use wood for fuel, and much of this fuel use is currently neither tracked nor entered as part of the formal economy.

Figure 5: Highest wood fuel and industrial roundwood producing countries
(Source of data: FAO 2006a)



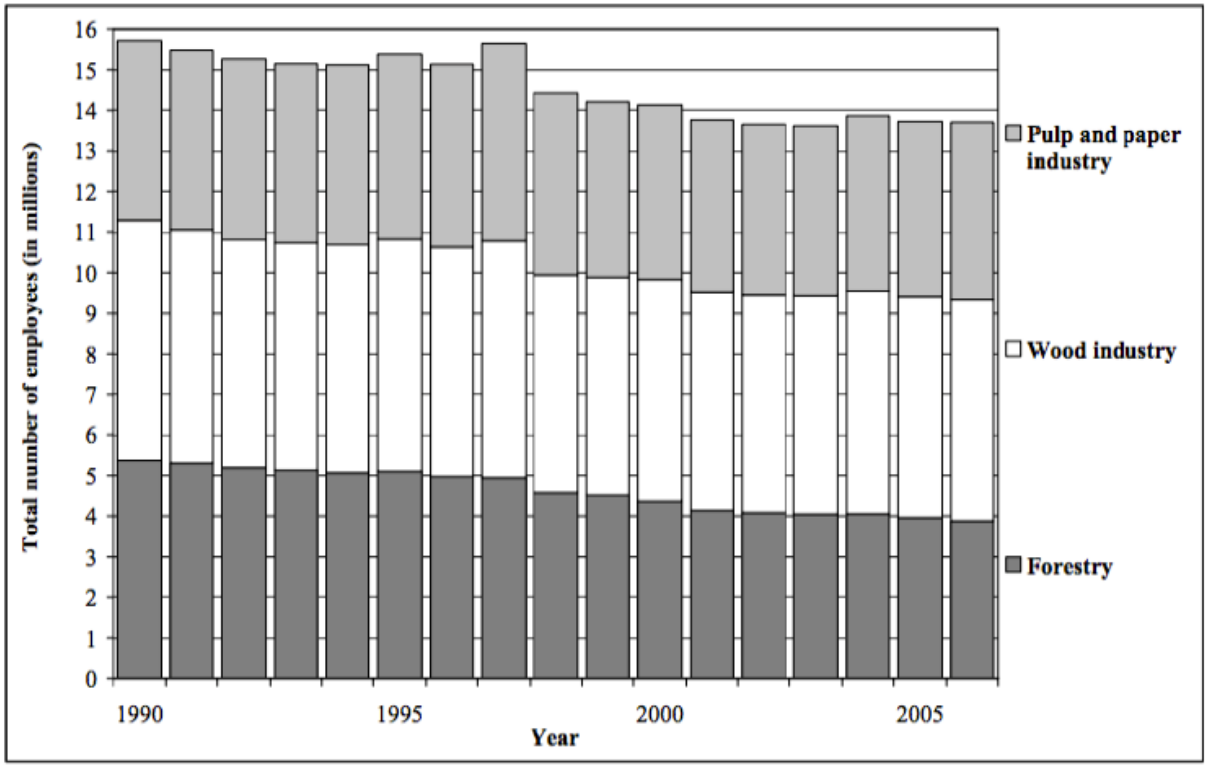
As the next section notes, many important economic contributions of forests are inadequately measured. Subsistence use of forests and informal trading of forest

products are very likely to go unrecorded: partly because customary owners have no wish to be noticed by government bodies or to have their use rights contested and partly - as a result - because these uses are not consequently quantified as part of regulation or taxation.

3.1 Monetized and cash value contributions from forests

Given the above challenges, what can we say about the contribution of forests at the global and regional scales in shaping and impacting economic life? Research by Lebedys (2008), which reviews and summarized data provided by countries themselves, provides important answers. First, figure 6 below indicates that taken together, 13 million people are reported as of 2006 to be employed in the "formal" sector either through forest management or value added manufacturing within wood processing or pulp and paper production.

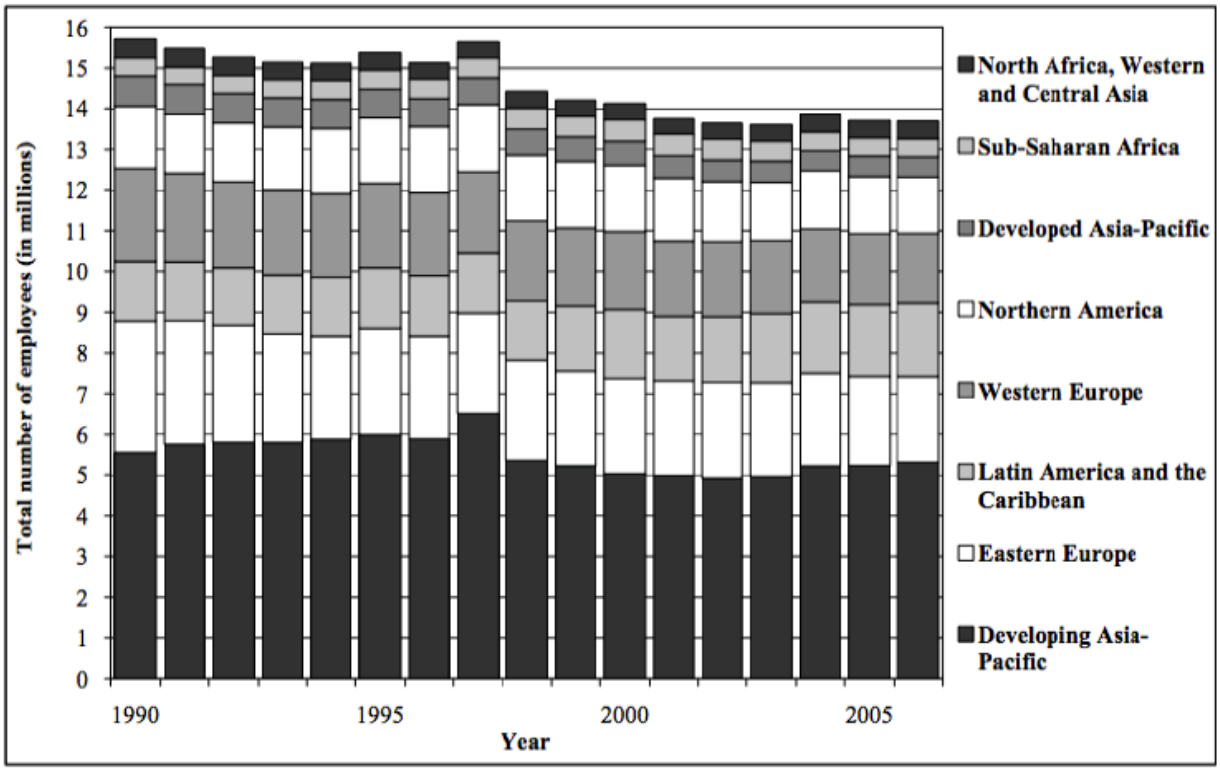
Figure 6: Forest sector formal employment by industry type
(Source: FAO 2011)



We also know that these aggregate figures reveal a decline from 15.75 million employed in 1999, and they mask the fact that this is almost exclusively owing to declines in forestry employment itself, with pulp and paper and wood industry remaining fairly constant. What explains these declines? One answer may be owing to increased efficiencies in mechanization. The other may be owing to the increase in employment in other agricultural crops, notably palm oil, which has been replacing both pulp and paper plantations as well as contributing to conversion of natural forests. Hence, there is no doubt that if we included palm oil production in these trends we would see a significant increase in employment. To be sure, the role of palm oil in encouraging land use conversion, shaping land tenure and community participation, and, in contributing to climate emissions, all render decisions about whether to measure palm oil plantations and their different effects highly contentious. The point is simply to note these dynamics and that they affect and shape whether when and how employment of people in resource extraction occurs and is counted.

Second, we know that the relative importance of forest sector employment, value added, and exports vary significantly across regions. For instance, in the Asia – Pacific Developing Region 5.3 million people are formally employed in forestry or 39 percent of the world's total forest sector work force (see figure 7). This is important, since it is clear that forests play a greater role in developing countries than it does in developed ones, with profound policy implications for the development of forest management choices which help contribute to poverty alleviation. At the same time formal employment in Sub-Saharan Africa is only 500,000 or 3 percent of the world's total, while employment in North America, Western Europe, and Eastern Europe is 1.4, 1.7 and 2.1 percent respectively.

Figure 7: Forest sector formal employment by region
(Source: FAO 2011)



Third, the relatively high degree of formal employment in developing Asia-Pacific Rim countries does not translate into higher forest exports, which stand at 14 % of global totals, in contrasts to Western and Eastern Europe's combined total of 56%. Likewise while Asia-Pacific Rim developing countries account for 17% ($78 billion) of the world's value added, North America, which a fraction of the formally employed work force, contributes 30% (140 billion) of the value added.

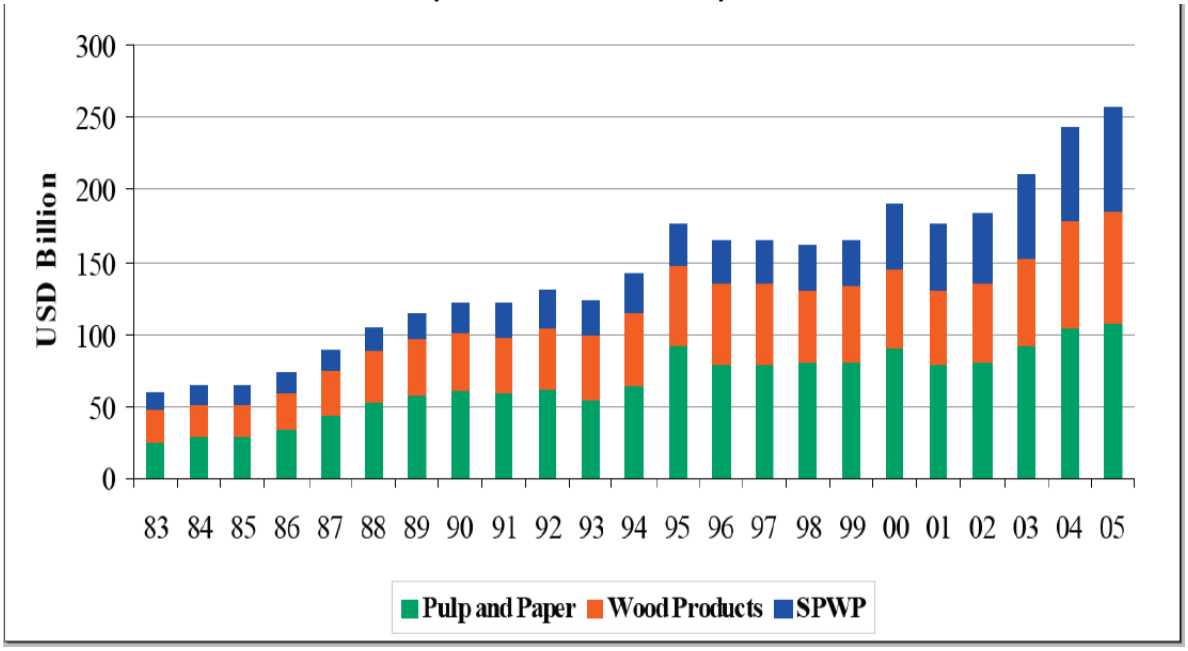
Important trends also emerge when comparing forest sector employment and value added to other sectors. In these cases, developing Asia-Pacific Rim countries, owing to high population levels, sees its share of labor force relatively low at 0.6 percent, which, owing to increasing population growth and declines in forest management employment, has shrunk from 1 % in 1990 and .6 in 2006. Reflecting low employment numbers and the importance of the informal economy, both the Sub-Saharan Africa region and the North Africa, and Western and Central Asia regions only

contribute 0.1 and 0.2 percent respectively to overall employment levels. Meanwhile as a share of labor force, North America claims 0.8 percent, Eastern Europe 1.2 percent and Western Europe about 0.9 percent of overall employment (FAO 2011).

These trends are also reflected in overall contribution to GDP with forestry generally declining compared to other sectors from 1990 to 2006, in part a reflection of government and international efforts to initiate policies aimed at fostering growth and development as a way to alleviate poverty and diversify economic activity. Still, even these direct and formal figures show that forestry remains important to GDP accounting for 0.7% in 2006 in developing Asia-Pacific Rim countries, 1.3 in developed Asia-Pacific, 1 percent in North America, 0.9 in Western Europe and 1.2 in Eastern Europe. What is interesting is that despite the low share of the labor force, the highest contribution in any region to share of GDP is found in sub-Saharan Africa, which accounts for 1.8 % (FAO 2011).

It is also important to note that although employment has been declining, both value added contributions and exports increased in most regions. For instance, in developing Asia-Pacific Countries value added contributions increased from 6.2% from 2000 to 2006 while exports increased by 6.2 %. Likewise in North Africa, Western and Central Asia exports increased 7.4 % and value added 1.6%.

Figure 8: Formal exports forest products
(Source: ACPWP 2007)



Overall, as the figure above from McDermott et al., with data from the FAO Advisory Committee on Paper and Wood Products (ACPWP 2007) reviews, exports in pulp and paper products, wood products, and "secondary processed wood products (SPWP), which are products produced from sawnwood (i.e. furniture, cabinets, doors) have been on an upswing since 1990.

What these single snap-shot figures arguably underestimate is the role of the forest sector in terms of its contributions to economic development. Development economists have long asserted that as countries transition, they pass through different stages that are generally characterized by an emphasis on resource extraction which, following capital investment, mechanization and training of the labor force, gives way to broader diversification and development. We have traced some of these trajectories in the previous section. But the impact of these stages on ecosystem preservation has been hotly disputed, from those asserting that countries eventually come to give increasing value to the environment following the stages implied by the Kuznets' curve, to those that assert that the new "legible" and divided landscape is a far cry from, and can never return to, the pristine state that existed originally. Nonetheless, that these stages do exist, and that forestry plays a key role in them, means that data showing

declines in forest sector contributions underestimate the role it played, and arguably continues to play, in fostering increased diversification. In other words, the increased diversification through which forestry plays a key role results in statistics on employment and value added that underestimate its influence.

Finally, we note that forests plays a greater role when we consider their contributions as a percentage of exports than in direct formal employment and GDP, though, this share has also been declining (FAO 2011). In North America forestry exports accounts for 7.1 in 1990 and 3.8 in 2006. The percent of exports was 3.4 % in 1990 in developing Asia-Pacific, which decline in 2006 to 1.4% while in Sub-Saharan Africa this figure declined from 3.6 to 1.9%. Regions that saw increases from 1990 to 2006 include North Africa, Western and Central Asia (0.2 to 0.4) , and Eastern Europe (3.6 to 3.9), although 2000 in Eastern Europe was actually the highest with 5%. Interestingly, exports account for 1.7 of GDP among all tropical countries and 1.1 for temperate ones.

Overall, the data reveal clear trends. The forest sector globally and within many regions has been, and continues to be, an important contributor to formal and direct employment. At the same time, these impacts have declined as a share since 1990 as economic diversification continues to take place amidst increasing economic liberalization. The role of forest products and trade has also been increasing. These changing dynamics underscore the importance of maintaining and developing "real time" data sets with which to map these changes, and the numerous ways in which the forest sector contributes historically to economic life, and the expanding and changing ways in which it continues to play a key role within the global political economic and economic development.

3.2 Forest economy at the household and community levels

Cash and non-cash uses are often so intertwined at the household and community levels that their contributions cannot be easily separated. The cash value of non-timber forest products is highly variable - varying by the tradable value and rarity of the product, by its location as regards markets and by whether local circumstances make value-adding

by processing worthwhile. For many years, while people suspected that NTFPs[1] were more valuable than appeared from national level forestry department records, firm evidence was difficult to come by. As Arnold points out in the introduction to the major CIFOR study conducted from 2003-2005, though it was known that NTFPs were very important for huge numbers of households, 'they attracted only limited attention and even less in the way of measurement and research' (Arnold 2004).

Three major studies by CIFOR (Belcher and Kusters, 2004, Sunderland, Harrison and Ndoye, 2004, and Alexiades and Shanley, 2005) collated a series of case studies for Asia, Africa, and Latin-America respectively, and investigated the cash value of a range of products in each. These studies contributed to debates about how far NTFPs support household incomes. Evidence gathered showed just how diverse different products were in their potential, and how their production varied according to whether they were truly wild resources, were resources from forests under some sort of management such as community forests or forest fallows, or were much more fully domesticated.

Externalities play a large part in the profitability of NTFPs. Those NTFPs which can be traded beyond the immediate area (known as 'tradables': Haggblade et al 2002) are very vulnerable to changes in accessibility and transportation; technological innovation which may create competitor products, or fashion which may make products more popular (because they are 'wild' or 'natural'). It was also found that processing did not always add value, and that the costs of doing so might outweigh benefits for local people.

Locally traded products ('non-tradables') are more immune to these forces but may be overtaken by new foods, and new domestic items (such as plastic mats or brooms) which become available in rural markets and substitute for what was once drawn from forest products (Belcher and Kusters, 2004). Not all writers sort NTFPs so

[1] The term NTFPS, non-*timber* forest products, is the most commonly-used term for everything (including fuelwood and light poles used in house construction as well as foods and fibre) drawn from the forest for home use or sale. NWFPs (non-*wood* forest products) is the term that FAO prefers, so that all wood products, from timber to fuelwood can be grouped together. Most writers prefer the former term because it divides forest products by two very distinct groupings of forest user: loggers and local people.

clearly into categories, and indeed households also likely see a continuum between the two categories rather than a clear break. For instance Shackleton et al (2011) identify four reasons why households trade NTFPs: as a response to an emergency or misfortune, where NTFPs serve as a natural insurance to bridge income gaps, manage specific income needs or deal with shocks; trading NTFPs for livelihood diversification and risk reduction, such as a complement to agriculture, or income smoothing; NTFP trade as a primary or regular source of income that may act as a stepping stone out of poverty; trading NTFPs because of a lack of alternatives, an approach which may turn into a long-term livelihood source.

Sunderland et al (2004) noted that the global case comparison undertaken as part of the CIFOR study found clear differences in reliance on NTFPs among African, Asian, and Latin American forest products. 14 out of the 17 products studied in Africa contribute less than 50% of household income and 9 of the 17 contribute less than 25%. Only three of the NTFPs contributed more than 70% of household income, from craft markets such as woodcarvings and rattan baskets and furniture as well as chew sticks, which have a large, organized market. Still, they state that these products are an exception to the rule and classify most African household income from NTFP as a "coping strategy", noting that even small NTFP contributions are important in time of household needs or emergencies. In Latin America and Asia, the production of NTFPs from managed forests or farms was more common and incomes from these sometimes much higher as a result. The CIFOR studies did not look at all at non-cash value, and their unit of analysis was the product, not the household.

A relatively larger number of other NTFP studies also consider the household as the unit of analysis as presented below. Some of these make it explicit when both cash and non-cash values are being referred to when talking of 'household income' but many unfortunately do not do so.

3.2.1 Africa

Shackleton et al (2007) suggest that household income from NTFPs in South Africa tends to be modest but that there is substantial variation (from a minimum in annual USD of $79 among marula beer sellers to $7,508 for woodworkers, with means of $189 for mat producers, $423 for broom producers, $336 for broom traders, $106 for marula beer sellers). They note that in some cases income is higher than the minimum wage, and in others the income can be substantial enough to raise standards of living among households or pull them up into a higher income category. Income in Central and West Africa was more significant, sometimes more than that of teachers or double the minimum wage, with NTFP traders earning net incomes between USD 16 and 160 per week and producers earning about 50-75% while charcoal and palm wine traders in the DRC earned USD 216 and USD 166 per month, respectively. Cameroon revenue from 9 NTFPs in 28 markets was USD 1.94 million in 1995, amounts similar to revenue from cocoa and coffee. In Belem, Brazil, three popular fruit species generated over USD 4 million in 1994.

Ingram et al (2005) suggest average annual household income from NTFP trade in Central Africa ranges between 25 and 40% and goes up to 80%. For under-story lianas sold for food, women harvesters can earn $98-110 per month while wholesalers can make $429 in Brazzaville and retailers in Central African Republic make $132 on average per month.

3.2.2 Central America

Godoy et al (2000) measure the value of food, construction, craft, and medicinal resources used and sold by 32 Indian (Tawahka) households in two villages (Krausirpe and Yapuwás) in a tropical moist forest in eastern Honduras. Their analysis included firewood, timber, crops grown in second-growth forest, wild plants, fish, and game. Krausirpe households extracted 69% more goods than Yapuwás households, which meant that Godoy et al (2000) valued the forest lower in Yapuwás because of the lower rate of extraction. They note that, for 42 days in 1996, Krausirpe villagers brought 1551

goods from the forests which they valued at US$22,246 9consumption value). Over 11 months in 1996, Krausirpe villagers sold US$91,041 of forest goods. The "combined value of consumption and sale ranged from $US 17.79 to US$23.72 per hectare per year." They conclude that the forest has a low economic value to people, which might mean that they will be open to logging or other economic alternatives in the future.

Marshall and Newton (2003) examine the importance of NTFPs to rural income among El Terrero, a highland community in the Sierra de Manantlán Biosphere Reserve, Jalisco-Colima, western Mexico. The communities identified 9 plants used as NTFPs, ranging from fruits that are eaten, used for local alcohol, and medicinal purposes to leaves and foliage used for construction, firewood, fence posts, medicinal purposes, and utensils. Some NTFPs are both consumed and sold, with women noting the importance of NTFPs to both household nutrition and income. For instance, blackberry and tila fruits are locally consumed but are also the main traded species. Similarly, the Gordolobo plant, which is collected for medicinal purposes, has national market value for treating colds. Women were the main collectors and sellers of NTFPs though they were frequently helped/accompanied by their children (and 2 women were accompanied by husbands). 28 out of 35 respondents (80%) collected NTFPs to sell and 3 out of 35 respondents collected NTFPs but did not sell them. The most important NTFPs for cash income are blackberries, tila, tejocote, and capulin. 30% of women ranked NTFP sales as the most important source of cash income for their household while 50% ranked NTFP collection as the second most important source of income, after sewing. Most households have multiple sources of income, with most women also sewing and embroidering tablecloths and napkins to sell in towns and to visitors. This article demonstrates that NTFPs are important for both the informal and the formal economy, with some of the same products being used for both consumption and sale.

3.2.3 South America

Palms in Columbia, Ecuador, Peru, and Bolivia: Balslev (2011) provides an overview of the thousands of uses of palms by rural communities throughout northwestern South America. Rural communities use almost all palm species for subsistence such as food, fiber, construction and thatch material, medicinal uses, timber, and tool-making. In addition, fruits from palm trees serve as the primary food source for large-game such as deer, peccaries, and tapirs. He suggests there are thousands of different ways that palms are used, writing "palms are used everywhere and by everybody: round trunks serve as posts for houses and split trunks are used as planks for floors and walls, numerous houses are thatched with leaves; people eat fruits on a daily basis either crude or boiled, or fermented as nutritious drinks, and seeds and palm hearts are eaten; palm materials and particularly fibers serve for hammocks, bags, mats, kitchen utensils, fishing gear, etc. and some have medicinal uses" (p. 374). In addition, palms are also collected for commercial uses and palm products are sold in local, national, and international markets.

Timber Harvesting and Household Use of NTFPs in the Brazilian Amazon: Menton et al. (2009) examine the potential for timber harvesting through company-community partnerships to increase forest revenue while maintaining household use of NTFPs in the Brazilian Amazon (Moju I and Moju II settlements). Household income from timber harvests is approximately US$342 per year and income has increased every year of the project. They found that households who participated in company-community partnerships and those who did not participate did not show significant differences in NTFP harvesting, with both types of households collecting game animals and gathering forest fruit. Households had previously expressed concern that logging in the forest would negatively impact forest game and fruit availability (due to noise/disturbance and reduction of fruit trees, respectively), but there was no statistically significant difference in harvest levels among logged (42% hunting success) and non-logged forests (49% hunting success). Out of the 10 most important fruit trees for communities, only three types are logged: piquiá, jutaí, and jatobá. Other important fruit trees include ones that

are not logged (acai, bacaba, and palms) or ones that are legally protected (Brazil nut trees). Fruit collection showed high household variability and was on a small-scale in both village types and so Menton et al (2009) conclude that, if differences exist, they were hard to detect. Overall, they conclude that company-community partnerships can improve household income and do not compromise NTFP harvests.

3.2.4 East Asia

Mushroom collection in China: Huber et al. (2010) found that hill villages primarily collect mushrooms (mainly porcini and matsutake) while valley households engage in mushroom trading. They illustrate different livelihood strategies among mountain and valley households among Tibeto-Burman groups in the Shaxi Valley, Southwest China (northwest Yunnan Province). Valley households primarily keep livestock and cultivate rice and have higher incomes while mountain households grew non-rice crops and collected mushrooms and have lower incomes. All households interviewed in the hill villages (n=10) collected mushrooms as a primary or secondary income source while only 3 valley households (n=11) collected mushrooms. 9 out of 21 people interviewed said that they rely on mushroom collection for income generation and 1 relies on mushroom trade. 10% of households, including valley households, also collect medicinal plants but this number has declined and most interviewees said that they preferred to buy medicines in stores. Huber et al. (2010) found that "trading of NWFPs…significantly correlates to a higher income…while the collection of NWFPs negatively correlates to income".

NTFPs and Agro-ecosystem shifts in China: Fu et al (2009a) analyzed households in Baka and Daka villages in Xishuangbanna, southwestern China to examine the role of NTFPs during transitions from subsistence agro-ecosystems to cash-crop dominated livelihoods. The Jinuo, Ahka and Yao ethnic groups in Xishuangbanna have traditionally been forest dwellers who collected NTFPs for both subsistence and trade. For all of these groups, NTFPs were traditionally important as a source of cash income but also to diversify household income sources and mitigate risk. Over the past 40 years, however,

as rubber plantations replaced traditional agro-ecosystems, local access to forests decreased and NTFP dependence also decreased. Baka villagers collected NTFPs such as bamboo shoots and mushrooms that generate high prices in the markets and Baka males sold NTFPs in markets to earn cash income. 29 out of 30 sampled households in Baka generated some income from NTFP sales and 6 households earned more than 25% of gross income from NTFPs, with one household generating 53.8% of its income from NTFPs. In contrast, Daka males rarely sell NTFPs and instead focus on high-income activities such as rubber plantation labor. There was a significant difference in annual NTFP income by households, with Baka households receiving US$76 (12% of gross income) compared to US$17 (1.7% of gross income) in Daka households. Income from rubber also varied between the two villages with Baka households receiving US$150 annually (23.7% of gross income) compared to US$649 annually (64.9% of gross income) in Daka households. Fu et al. (2009) attribute these differences to the amount of land that households allocated to rubber plantations: those households who had not (or not been able to) allocate large areas of land to rubber had to generate more income from NTFPs and off-farm work, leading Fu et al (2009a) to suggest that land holding inequality contributed to inequality in cash income among villagers. They found that NTFPs were important both for alleviating the risks of rubber price fluctuations and in providing income for poorer households who relied more on NTFP benefits than wealthier households. Income from NTFP sales was negatively related to rubber price fluctuations; when rubber price was at a minimum in 2001, both Baka and Daka villagers increased their income from NTFPs, suggesting that households rely on NTFPs to make up shortfalls in income. They also note that land conversion to rubber plantations has contributed to deforestation and declining abundance in NTFP availability but do not cover consumption of NTFPs in any detail.

Fu et al. (2009b) examine wealth similarities and differences in the use of NTFPs between Baka and Daka communities in Xishuangbanna, southwestern China, along lines similar to the previous article (Fu et al. 2009). In addition to the findings there (e.g., that poorer households depend more on NTFPs than wealthier households and the

differences between the two villages with respect to percentage of income from NTFP vs rubber, etc.), they emphasize gender and generational involvement in NTFP sales. They found that households without a son had lower overall gross income and depended more on NTFP incomes. Baka households ranked NTFP income from funghi the highest, followed by wild vegetables and bamboo shoots. 44 NTFP were found in Daka market investigations: 30 vegetable species; 4 spices; and 3 fruits. 42 NTFPs were found in Baka market investigations. 64 NTFP species were sold during the dry season by Baka and Daka villagers, of which 23 species overlapped while 69 species were sold at the market during the rainy season, with 19 species sold by both Baka and Daka.

3.2.5 South Asia

NTFP collection in Chittagong Hill Tracts Bangladesh: Kar and Jacobson (2012) found that households in the Chittagong Hill Tracts, Bangladesh, use different types of NTFPs for subsistence and cash income, suggesting that some NTFPs are more market oriented while others are more important for subsistence. The Chittagong Hill Tracts are a heavily degraded area, with informants saying that forest resources have declined by about 50% from levels about ten years ago; however, the region still provides the largest forest-based contribution of any region to Bangladesh's economy. The majority of NTFP use is subsistence based, with about 65% of collected NTFP-related household income being used for subsistence, while approximately one-third of surveyed households also sold NTFPs for cash income. The three most important NTFPs for cash income were bamboo, wild vegetables, and broom grass followed by sungrass, bamboo shoots, medicinal plants and menda. Bamboo provides the highest income to households, nearly twice the income received from wild vegetables or sungrass which are collected primarily for subsistence rather than for sale. Game meat is also primarily collected for subsistence. Sales of menda bark require connections with middlemen or traders and so only 3% of households sell this plant. They found a large dependence on NTFP income, higher than income from firewood or timber, which they suggest may be the result of the degraded nature of the forests. Similar to many other studies, they also show that poor

households are more dependent on NTFPs for both subsistence and cash income than households that are more well off: NTFP incomes increases as household total income increases but relatively less with villagers in the lower-income groups receiving a higher proportion of their income from NTFPs than households in the higher income groups. They also found that as household wage incomes increased, so did household incomes from NTFPs, suggesting that households may collect NTFPs when they do not have secure wage labor. They further found variation among ethnic groups and NTFP income and suggest that variables such as alternative income from rubber in some locations versus more remote villages with fewer income opportunities may explain some of the differences.

Changing NTFP Utilization Patterns Near Sinharaja World Heritage site in Sri Lanka: Senaratne et al. (2003) illustrate how the relative importance of NTFPs for household subsistence and cash income has changed over time among households living adjacent to the Sinharaja World Heritage site in Sri Lanka. NTFPs are collected for a variety of household purposes including cash income, food, energy, health, construction, agricultural and livestock, and ornamental. Some purposes overlap: for instance, spices, meat, and honey are consumed by households and sold for cash. Fruits, vegetables, mushrooms, greens, and fish are collected primarily to fulfill subsistence requirements while collection of products such as kithul, cane, and resins is for cash income. Overall, 82 NTFP species help to meet household nutrition requirements, generally as side dishes or snacks rather than as a staple food (except for yams). The contribution of NTFPs to household subsistence and cash income has significantly declined compared to past levels for a number of reasons. First, forest management has restricted villagers' access and timber extraction, hunting wild animals, shifting cultivation, and gem mining are all prohibited, which means that some of the more lucrative NTFPs, such as wild game, are no longer an option for households. Second, changing socio-economic factors, such as decreased shifting cultivation and the growing importance of tea plantations for household income, have influences patterns of utilization of different groups of NTFPs. Households now have more cash income from

growing tea: 92% of households have tea plantations of varying sizes and 86% of them receive substantial cash income from tea. Consequently, households now use this income to purchase foods and medicine rather than collecting them from the forests. Senaratne et al (2003) conclude that forest foods now play a limited role in household nutrition. However, the forest remains important for fuel wood, with 75% of households reporting gathering fuel wood from the forest and 49% of total fuel wood coming from the forest. Similarly, dependence on the forest for construction materials remains high, with 90% of households extracting construction materials for poles, pillars, and other purposes. They point out that these materials are durable and do not require regular collection, which means that the utilization of these forest resources conflicts less with tea cultivation because of the relatively lower time input compared with collecting NTFPs for food or medicine that is more time intensive.

3.2.6 Southeast Asia

NTFP collection among Orang Asli households in Malaysia: More than 30% of Peninsular Malaysia's standing forests have been converted to commercial uses since 1970, which has disproportionately affected local people such as the Orang Asli ("original people") population who have traditionally used forest resources. Howell et al (2010) found that 73% of Jah Hut households who live near the Krau Forest and Wildlife reserves in Pahang, Malaysia actively collect NTFPs. 121 out of 188 collecting households reported NTFP use for subsistence purposes. The most common NTFPs collected are construction materials (44.8%), frogs and reptiles (44.4%), fruits (40.2%), herbs and resins (18.1%), and mammals (16.6%). They found that some NTFPs are collected only for subsistence while others are collected for sale, illustrating the ways in which households rely on NTFP collection for different uses. Products, such as frogs and terrapin (the most lucrative), gaharu, large rattan, and resin were sold. Forest and legumes were consumed and sold while mammals were primarily for consumption. They also found that as market access improved, NTFP collection participation and NTFP income reliance declined. (However, herbs and resins were an exception: they were positively correlated

with market access, suggesting that households near markets may specialize in this type of NTFP collection becomes of market returns.) The poorest households were most likely to regularly collect NTFPs while wealthier households collected NTFPs less frequently. Households classified as living in absolute poverty depended on NTFPs for 31% of their income compared to 14% reliance for moderately poor households and 8% reliance for the least-poor households. Their article supports the literature that suggests that households may collect NTFPs to smooth their consumption and income over time or to avoid falling deeper into poverty, noting that NTFP income provided households with both subsistence and supplemental cash income when other livelihood strategies did not meet the household needs.

Sheil et al (2006) examine local priorities and views on forest landscapes and biodiversity among seven Merap and Punan communities in Malinau District, East Kalimantan, Indonesian Borneo. Malinau District contains tropical forest areas of conservation significance, much of which has been allocated to timber concessions without consultation among the local populations. The Punan focus more on extraction of forest products in contrast to the Merap who place more importance on swidden rice. Several of the remote Punan groups depend on wild food resources such as sago and other forest resources for food while other groups said that they relied on the forest for food during crop failures, droughts, and floods. Sheil and Liswanti (2006) conducted scoring exercises where groups of people allocated whatever proportion of one hundred seeds they chose to indicate the relative importance of various forest products. The scores showed that in somewhat less remote forest areas, the ability to hunt wild species got a score of 58/100. In more remote communities, the importance of wild species was up to 81/100 in contrast to farming communities where ability to access wild species was scored at only 45/100 because farmers also had domestic animals. Forests contribute the majority of resources, such as palms and trees, and are used to make local hunting tools, including poisonous blow darts. Communities placed the most value on unlogged forests and remote mountain areas as hunting locations (though other locations such as salt springs were also mentioned), noting that wild

animals depend on the forest for food, such as fruit. They listed 518 plant species that attracted and supported wildlife. The most valued hunting source is the bearded pig. Sheil et al (2006) record the effects of logging on forest resources. For instance, they note that cutting, associated noise, and road building drives away animals but also removes foods that attract animals, therefore also causing the animals that local people depend on to move to other areas. In addition, useful species that are used for food, craft and construction materials, and medicine are cut; palms were described as abundant in non-logged forest but much more scarce in logged areas. Logging has also destroyed gravesites in the forests—and the forest associated with gravesites since one or more hectares typically surrounds each gravesite, creating a remnant forest grove that is taboo to both Merap and Punan forest collectors.

On policy, Sheil et al. (2006) suggest that the mindsets of policymakers towards recognizing the priorities of communities such as the Merap and Punan are one of the biggest obstacles. They further recommend changing attitudes to reflect larger cross-sections of society, generating new alliances in the tropics, and developing a shared understanding of priorities and needs to serve as a foundation for dialogue among broad stakeholders. They write: "Our work underlines that local communities have complex relationships with their environment that need to be respected, understood, and taken into account in all relevant decision-making and policymaking and implementation. For Indonesia, this message requires a paradigm shift for all the institutions and processes related to forest management and conservation. There are opportunities for influence as decentralization has opened many issues for more localized scrutiny than was previously possible.

Forest Extraction and Household Shocks in Vietnam: Volker and Waibel (2010) examine forest extraction as a response to adverse shocks among households in the mountainous upland areas of Dak Lak, Ha Tinh and Thua Thien Hue provinces, in the Central Highlands and North Central Coast region of Vietnam. The poverty rate in this area is more than 40% for most communes though they found heterogeneity among the three provinces in their study, with Thua Thien Hue having a higher incidence of poverty

(38.9%) compared to Ha Tinh (21.4%) and Dak Lak (14.3% poverty). The area is 80% forested with uses equally divided among a protection forest (no extraction allowed), a special use forest (limited access), and a protection forest (permanent use, some extraction rules).

Forests in the region are generally recognized as important for household livelihoods in Vietnam for both regular consumption needs and as an additional source of income in times of shock. Households typically collected forest products one time per month though they are most likely to go during the rainy season when they do not farm, suggesting that forest extraction complement income from farming activities. Households generally use forest products to meet subsistence needs and to generate income to purchase agricultural inputs and seeds. 37.4% of households collected fuel wood for cooking and heating, of which 1.5% of households also sold fuel wood. 1.1% of households collect NTFPs (honey, rattan, wild animals) and all of these households also sold NTFPs. Similarly, all 0.3% of households that extracted non-fuel wood timber also sold it, generally to traders from other provinces.

Households were most likely to extract forest products when affected by unexpected health shocks, severe weather shocks, or changes in economic activity among household members. 84% of all households surveyed reported lost income due to shocks, with natural shocks having the most severe impact on households. In their model, every severe weather shock increased the household's chance of forest product extraction by 7.4%. Volker and Waibel (2010) note that because all household types can be affected by weather events, their study provides evidence that forests are important not just for the poor. Households of any income level may be forced to depend more on forest resources in times of such shocks. Households also took time to recover from such shocks, suggesting that households might rely on the forest to meet shortfalls for significant periods of time. (They also discuss alternative forms of coping strategies, including crop substitution, different agricultural composition, using savings, selling assets, etc.)

3.2.7 Oceania

Forest Resources in PNG: Grieg-Gran et al. (2002) conducted a PRA and various participatory exercises to assess forest resources in Buingim and Mare villages in Morobe Province, PNG. Both villages have subsistence agriculture and significant forest resources, though Buingim is only accessible by boat while Mare is connected to the provincial capital by road, which means that it has a more commoditized economy. In both communities, forest resources provided significant products and services for the communities, including for food, construction, handicrafts, medicine, shelter, and traditional ceremonies. Buingim community uses forest resources for construction, fuelwood, and medicinal plants. In Buingim, 85% of animal food caught in the forest is consumed by the household while 5% is marketed and 10% is shared with family. In general, Grieg-Gran et al (2002) conclude that very small amounts of forest resources are marketed in this community. All households in Mare depend on the forest for their fuel wood and for local construction materials for their homes. In addition, hunting of wild animals, including pigs, and collection of forest materials for customary costumes is common. In Mare, forest resources are used for home consumption, barter, and sale. In contrast to Buingim, many products are marketed. They also found increasing commercialization of fuel wood; initially it was collected by women and not sold because of its abundance. However, with the introduction of chainsaws, some men have started harvesting fuel wood for commercial sale. Again, like many other studies, this report shows that many forest resources are collected both for consumption and use and for sale, though there was variation among the two villages with Buingim using the forest primarily for consumption and use while Mare marketed a greater percentage of its collected products.

3.3 Gender, forests and NTFPs

Paumgarten and Shackleton (2011) found that the gender of the household head affected both the household's susceptibility to shocks as well as the coping strategies adopted. Shackleton et al. (2011) found that women and children are the most common

consumers of wild forest foods; in one example in South Africa, 62% of children (n=850) supplemented their diets with wild food and 30% relied on wild food for over 50% of their diet. Women benefit from the use and sale of NTFPs, as do older or less educated groups.

Shackleton et al. (2011b) examine gum arabic in Burkina Faso, gum olibanum in Ethiopia and honey in Zambia in terms of the roles played by women and the benefits they receive. Each product is sold in traditional and commercial/informal and formal markets, including both domestic and export markets.

In Burkina Faso, women play a role in gathering (picking) and sorting gum but are less involved in the storage, transport, sale and marketing of gum, which is done by men. Only men deal with exporters in the capital. Additional cleaning and sorting is undertaken by the exporting companies. Women in southern Ethiopia tap and collect gum at the same time as herding livestock, while in northern and north-western Ethiopia men tap and collect from forested areas that are far from villages and over periods that extend for several weeks, prohibiting women's' participation. Among the gum cooperatives, only 13% of members are women. Processing is done by women when they collect it and by men when they collect it while gum for export that is cleaned and graded again is done in cities, mostly by women, though men do the loading and unloading. Women are involved in selling gum at rural markets and informal urban markets (often low-grade gum rejected for export). Some women buy amounts from collectors and bulk it for sale in the local market, as do men. Men dominate the selling of gum to cooperatives for export and its transportation.

In Zambia, honey production has traditionally been dominated by men, but women have begun participating, particularly in a case where an external agency promoted beehives placed on stands close to the ground to promote women's' participation but one constraint is that these beehives are more expensive. Women are responsible for processing raw honey (more than 40% of male beekeepers said they were assisted by their wives) though the introduction of presses, which require greater strength, means that men increasingly process honey. Women are primarily responsible

for processing honey into beer. Women are also involved in selling honey, including in urban informal markets but do not travel to larger areas to sell. Women also own some of the companies that bulk honey for purchase or send representatives to purchase honey in collection areas. One survey found that 60% of informal traders were women.

Shackleton et al. (2011b) find that women's roles are often not visible or acknowledged and discuss opportunities and constraints for empowerment. In Burkina Faso, women are limited by cultural and religious barriers from participating in the more lucrative aspects of the value chain. Similar barriers exist in Ethiopia, especially related to travel and family responsibility in addition to the need to have a license for transporting tradable gum volumes, which the authors suggest is difficult for women to obtain because of their poor literacy. In Zambia, women were traditionally excluded because of the hard physical labor and tree climbing associated with honey production, as well as the distance necessary to travel, especially because women do not ride bicycles. The authors identify time away from home as the main limiting factor in women's' involvement, due to the opportunity cost they face in being away from home responsibilities. In general, they state that women's role in value chains are generally poorly supported; support is generally not given to the parts of the value chain in which women are involved and local informal markets are often neglected. Shackleton et al. (2011b) also caution that promoting NTFP trade without considering gender can result in competition, citing other studies that found that women's roles decreased when products were more highly valued or processes were mechanized, etc. Still, women identified benefits from this sort of temporary or more informal employment, such as being allowed to bring children and family members to work with them.

Carr et al. (2010) state that "relatively little has been written on the impact of globalization on women who work in the informal sector" and suggest that women working from home lack the market knowledge, mobility, and competitiveness of large companies operating in a transnational world. They also state that women are under-represented in high income employment opportunities and over-represented in low income ones. They examine the role of women in the shea butter industry and found

that women generally do not have the sophisticated technology required to process shea butter and so receive a smaller percentage of the final profits. Women sell unprocessed nuts to middlemen who then export them for additional processing, which means that this value-added is not captured by the initial women collectors. The authors caution that if processing facilities are developed in the area, the women who are now engaged in the sector will be displaced as the sector becomes more profitable.

Sunderland et al (2004) found that African case studies generally illustrate the dominant role of women in marketing and final sale of NTFPs, collection and sale of firewood (where they note that women tend to collect more fallen branches while men's involvement is associated with greater ecological harm) and in fruits and nuts, with the exception of some industries that are described as male dominated (rattan furniture production, elephant hunting). They describe women's role as organized, with "market Queens" in large urban markets in Ghana.

Ireson (1991) found that women's forest activities in Laos contribute to household economies, particularly at times when households need extra food/cash. She notes that use is differentiated by type of forest area: women who access old growth and second growth forests use forest products mainly for subsistence while women who only access second growth areas are more likely to sell forest products. She suggests that women with only second growth access might have a more commercial view of the forest. Ireson (1991) also describes division of labor in paddies, cultivation, forests and says that all family members collect and use forest resources though women and children gather forest foods and other NTFPs while men gather, hunt and cut timber for construction. Women do the majority of selling of products in markets, unless amounts are large or are rice or animals.

3.4 Discussion: Cash and non-cash income from forests at the household level

These case examples show just how difficult it is to generalize about NTFP sales and consumption, how diverse the data is by site and region, and how variably 'income' and 'economy' are interpreted as concepts. Cash income from forests comes from the sale of

the wider range of NTFPs/NWFPs collected by local people for that end. Non-cash income from forests is defined as the forest products which households collect but consume/use in the home rather than selling. These may be fuelwood, timber, forest foods and medicines, fodder or fibre (for mat and basket-making and for aspects of house construction). The two together go to make up the economy of the household, along with other cash from employment, trade or forest enterprise activity, agricultural sales and agricultural consumption.

This overall package varies enormously in the way it is made up in different situations and it is ideally by understanding all the types of income coming into a household that the role of forest economic activities in the household economy is clarified. It is only within that context that the level of forest reliance can be understood, and the balance between cash and non-cash income from forests in particular cases examined.

In the case of the IUCN programme 'Livelihoods and Landscapes' which ran for the last four years (Shepherd, 2012) three patterns emerged for levels of forest reliance (i.e. an aggregate of cash and non-cash reliance): (i) Modest or special purpose forest reliance (average contribution of forest to livelihoods is around 18%. E.g. transmigrants in Sumatra, parts of China, dry areas of Tanzania); (ii) Forests form a major part of livelihoods (average contributions of forest to livelihoods is up to 35%. E.g. in Sahel, North Thailand, rural Guatemala); and (iii) Forests are as important as or more important than agriculture (average contribution of forest to livelihoods is 50% or more - e.g. Congo Basin, Indonesian Papua). In assessing these patterns, it is worth noting that IUCN, as a conservation organisation, probably has a more remote and more forested set of sites than many of the others discussed above.

Forest use is higher where there are few opportunities for off-farm employment, and where investments open to wealthier villagers, such investment in livestock or the planting of high value trees, are unavailable to poorer farmers. Similarly, forest use is higher in the absence of easily reachable markets. There is always a relationship between

agricultural production and the use of forest: higher agricultural production tends to mean somewhat lower forest use.

Four key findings emerge from the IUCN case studies of non-cash contributions of forests. Firstly, non-cash uses of forests continue even where there are no cash sales of forest products at all. Secondly, non-cash values make a larger contribution to overall household income than do cash values in almost every case. At the same time there is quite a range in the relationship between cash and non-cash contributions to household income. Where cash values for NTFPs are high (as in Papua or among the Baka - where high value NTFPs or bushmeat are being sold) the ratio may be around 1: 2. Where they are lower the ratio rises to 1:3, or 1:4, or even more. Thirdly, on average men sell about a third of what they collect, and the remaining two-thirds of their collection labor goes to the household. Women sell about 20-25% of what they collect and the remaining 75-80% is committed to household needs. Some products like fuelwood may be collected by both sexes, but much of the collection of non-timber forest products is in fact gender-specific, particularly for contexts where forests have a high level of biodiversity. Finally, the overall picture of cash and non-cash reliance can be nuanced by examining the types of forest products being extracted. Table 3 below shows patterns of product use from eight villages in Uganda, aggregated to provide a more substantial picture than is possible from a single village. Firewood, building materials and forest foods were the most important contributors to both cash and non-cash income, but in terms of relative importance to the household other items such as fiber and herbal medicine also score high. These patterns hold in a very wide range of situations.

Table 3a: Cash and non-cash incomes for 8 Uganda villages
(Source: Shepherd 2012)

Forest Products grouped by category	CASH		NON-CASH		TOTAL	The greater importance of products for direct (non-cash) use than for cash
	No.	Per cent	No.	Per cent		
Fuel	**324**	**10.1**	951	**29.5**	39.6	3 times as important
Building materials	**276**	**8.6**	526	**16.3**	24.9	Twice as important
Forest foods	**192**	**6.0**	409	**12.7**	18.7	Twice as important
Fiber (for ropes, baskets etc)	**56**	**1.7**	205	**6.4**	8.1	4 times as important
Herbal medicine	**36**	**1.1**	116	**3.6**	4.7	Over 3 times as important
Timber	**27**	**0.8**	103	**3.2**	4	4 times as important
Number of times products flagged as important in village surveys	**911**		**2310**		**3221**	
Percentage split between cash and non-cash		28.3		71.7	**100%**	

Table 3b: Percentage importance of each type of product within cash and non-cash categories (Source: Shepherd 2012)

Forest Products grouped by category	CASH		NON-CASH	
	No.	Per cent	No.	Per cent
Fuel	**324**	**36**	951	**41**
Building materials	**276**	**30**	526	**23**
Forest foods	**192**	**21**	409	**18**
Fiber (for ropes, baskets etc)	**56**	**6**	205	**9**
Herbal medicine	**36**	**4**	116	**5**
Timber	**27**	**3**	103	**4**
No.of times products flagged as important in village surveys	**911**		**2,310**	
Percentage within each category		**100**		**100**

Within the cash category, fuelwood generates 36% of forest income, house building materials and fibers 36%, and forest foods and herbal medicine together generate 25%. Timber is of negligible importance. The order of importance is the same in the non-cash category, though the income proportions vary slightly.

3.5 The morality of the non-cash economy

There is a final aspect of the non-cash economy which is often forgotten. Money does not enter into all transactions, and in many of the contexts described, non-cash exchanges are still a very important part of daily life. Indeed, in many of the societies referred to, cash transactions may make up much less than 50% of all economic activity.

Sometimes economic exchanges consist of no more than barter - one set of goods for another. But often they are invested with more meaning than cash transactions. Sons-in-law may have to give a proportion of the forest and agricultural goods they produce to their fathers-in-law. In many parts of West Africa, any approach to a chief has to begin by the offer of kola nuts. In Papua, negotiations about anything have to begin with the presentation of betel nut and lime to the elders. Economic benefits flow from these actions. Money is morality-neutral, but non-cash exchanges often carry an additional freighting of respect for local customary law, for local authority and for the recognition that human interaction and exchange is more than a money transaction. So the 'non-cash economy' should not be written off as 'merely' subsistence, due to fade away in due course. It is often a parallel economy to the cash economy and one of great complexity. And the non-cash economy in the case of forest products may endure when cash forest transactions have come to an end.

As far as the forest economy for local people is concerned, the non-cash economy, as we see in different available data including that from the IUCN, is 2-5 times more important than the cash economy. But there is so far very limited recognition of this in the NTFP literature.

3.6 Non-cash forest income at community level

There are two obvious ways in which income from forests may be organised at the community level as well as at the individual household level. Communities, if they have the right to do so, may actively manage their forests for the forest products it supplies. Communities may also manage forest in order to enhance success in the case of their own household's economic activities.

3.6.1 Communal forest management

Sometimes it is worthwhile for communities to manage their own forests if the balance between numbers of people, size of terrain and level of pressure is conducive to that (Ostrom, 1990), and neither the State nor conservation organisations stop them from doing so. They are more likely to manage this task successfully and enthusiastically if market pressures are not too heavy, and if the gap between the wealthiest and the poorest of the forest managers is not too great. However, all these arrangements are easily damaged and destroyed by the wrong kind of outside intervention.

Among the forest user groups (FUGs) of Nepal, for instance, it was noteworthy that FUGs far from roads and markets actively managed communal forest to generate benefits for most local users while roadside FUGs had usually fractured, given up on management and fallen apart (Blaikie and Springate-Baginski 2007).

Where management takes place, there are clear boundaries, excludability, maintained footpaths and bridges, protected spring sources and streamside vegetation. There are also usually closed and open seasons on game and on the picking of fruits from particular trees so that forest products are more available for a wider range of people. Arrangements for revising boundaries and examining new problems may also exist in the right circumstances, as Jerome Lewis recorded among the Mbendjele pygmies in Congo Brazzaville in the 1990s (Lewis, 2005).

The result is a patchwork of economically valuable management arrangements. And often a protective, respectful attitude to the forest, which only begins to evaporate as dependence decreases and more and more of the overall livelihood begins to come from non-forest activities.

3.6.2 The non-cash value of forests to different kinds of livelihood systems

In many systems, communally owned forest is used for support to individually farmed plots or individually owned animals. For pastoralists living in the tropical dry forests of the Sahel and cattle-keepers in East Africa, the value of browse for much of the year is the chief value of forests. It translates into high cash and store-of-wealth

values for their animals, and as a result, pastoralists have been good forest managers where they have rights to forest (Kerkhof, 2000; PROFOR, 2008). For those farming in forest fallowing systems, the regenerative power of forest brings renewed soil fertility where population density is low; for those farming in transitioning / intensifying farming systems, forest fallowing looks after remoter farmer plots while those nearer to the house begin to be farmed with manure/fertiliser (Kusters and Belcher, 2004). Farmers in many terraced farming systems in the world pasture animals in the forest, and bring them onto the terraces at night to deposit manure for soil fertility, or tether them where the manure is needed and bring cut- and-carry fodder to them (Dev and Adhikari, 2007).

For those living near tidal rivers and the sea, mangrove forest has a special value. Such forests not only protect farms inland from floods, but provide crustaceae and nurseries for young fish which grow up among the mangrove roots before they swim to the sea. Such livelihood systems always include a substantial fishing component (Shepherd et al, 2009).

3.7 Informal employment in small and medium forest enterprises

Like that for NTFPs, it is difficult to collate accurate data on SMFEs. Many enterprises have only one or two employees, and there are good reasons in many countries to stay small, and remain 'below the radar' as far as business registration is concerned. A set of laws and taxes may well come into play if registration is attempted which have been devised for much larger businesses, and which impose crippling burdens on small enterprises.

Nketiah et al (2011) and Osei-Tutu et al (2010) assert that SMFEs offer jobs to a large percentage of Ghana's population and serve as a main, additional or alternative income source for at least 3 million people in the country. Nketiah et al (2011) estimate that tens (or maybe hundreds) of thousands of people are employed in the woodfuel production and trade industry, much of this informal too. Osei-Tutu et al (2010) state that the timber and furniture industries employing 17,000 chainsaw milling crews, with

an average of 6 people in each operation; 264,000 people involved in the chainsaw-milled lumber-haulage sector; 21,000 people involved in chainsaw lumber, 1,300 chainsaw lumber brokers, each of which engage about 3 people; and 30,000 small scale carpentry firms employing about 200,000 people. NWFP estimates include 600,000 women in shea butter collection and 300,000 local bushmeat hunters.

Fredericks et al (2012) state that there were 750 formal SMEs in Guyana's wood-based sector, including forest extraction companies, sawmills, charcoal licensees, firewood producers, furniture manufacturers, timber and sawpit dealers. Ninety per cent of SMFEs are individually or family owned and most focus on the domestic market. SMFEs cover 31% of the productive forest area but employ 75% of employees in productive forest concessions and contribute 50% of revenue collected by the government.

Shackleton et al (2011) found that employees in formal and informal forest enterprises are estimated at 45 million worldwide, while farmers who grow farm trees or manage "remnant" forests for subsistence and income are 0.5-1 billion. Macqueen (2008) corroborates these figures, states that SMFEs contribute more than 50% of forest-related jobs in many developing countries, and that more than 45 million people manage or work for forest enterprises worldwide.

Kozak (2007) suggests states that SMFEs make a significant economic contribution in terms of employment and revenue in developed and developing countries. In contrast to global trends of declining employment in wood processing, SMFEs contribution to employment is steady or growing, including in the US household wood furniture sub-sector and the Swedish sawmilling sub-sector. He suggests that SMFEs employ over 20 million individuals worldwide but that this number could be as high as 140 million if the the informal sector is included. He estimates that over US $130 billion of gross value-added is contributed from SMFEs. In the US, SMFEs contribute 37.4%+ of total employment in the sold wood products processing sector and this number is identified as increasing for firms with less than 100 employees and particularly those with less than 20 employees. The EU estimates that 90% of forestry

firms employ fewer than 20 workers. He cites Macqueen and Mayers (forthcoming) on the number of SMFE employees as a total of forestry employment was: 49.5-70% in Brazil, 50% in China, 75% in Guyana, 97.1% in India, 25% in South Africa, and 60% in Uganda. The Swedish sawmilling industry has had steady employment from 1996 to 2004, in part due to expanding trade to other regions and European trade and SMFE employment is primarily in the value-added sector.

In Kozak (2007)'s view, the growth of small SMFEs is outpacing medium SMFEs; growth is higher in the value-added sector (and lower in the commodity sector due to competitiveness, economies of scale and high capital requirements). SMFE growth seems very dependent on relevant markets.

3.7.1 SMFEs and the informal economy

Tangem (2012) found that most SMFEs in Burkina Faso are in the informal sector, are poorly organized, and are disconnected and isolated from markets and policies. One reason is that governments pay little attention to this sector. Thus, Nketiah et al. (2011) note that forest policy and management in Ghana "is skewed in favor of the conventional timber industry" with little attention paid to SMFEs. They and Osei-Tutu et al (2010) draw attention to the fact that the informal sector is not included in Ghana's forest planning, management and statistics despite the significant contribution of SMFEs to livelihoods and revenue. They also point out that the state loses revenue when it neglects the SMFE sub-sector because of non-payment of fees, taxes, non-registration, etc.

In India, Saigal and Bose (2003) found that the Indian SMFE sector under-reports on employment to avoid complying with Indian labor laws. They suggest that SMFEs may remain in the informal economy for several reasons: 1) administrative burden is too high; 2) skills and technology are not sufficient to comply; or 3) they might not be able to remain competitive with larger-scale enterprises, including on social and environmental concerns. SMFEs may "cut social and environmental corners or fade into

informality to avoid administration costs" in situations where the policy environment is not supportive or where regulation and taxation favor larger-scale operations.

3.7.2 SMFEs, livelihoods and poverty

SMFEs have the potential to diversify rural livelihoods and alleviate poverty in Burkina Faso (Tangem, 2012). They require only small initial investment to set up which can make them accessible and attractive to the poor and in turn diversify their economic opportunities and improve their livelihood security. An IIED/Forest Connect Report on Nepal (2012) found that the majority of rural people in Nepal depend on NTFP collection for their livelihoods and SMFEs can help reduce poverty through employment generation.

While large-scale, commercial forestry can play a role in poverty reduction, MacQueen (2008) argues that SMFEs offer better prospects, especially in collaboration with associations, because they are less capital-intensive and address the broader dimensions of poverty: they help to secure local community resource rights; wealth is accrued locally; local entrepreneurship is empowered; social capital is created; and cultural diversity, and increased local environmental accountability are maintained.

Nketiah et al (2011) and Osei-Tutu et al (2010) found that women are frequently involved in SMFEs as proprietors (and reference their low levels of education). Osei-Tutu et al. (2010) also state that NWFPs provide women income opportunities through collection and processing. They generally engage in SMFEs during the dry season, when the farming season has ended, and they use it to supplement household food requirements. Their study found that 77% of SMFE proprietors in Northern Ghana are women.

3.7.3 Scale considerations in SMFEs

MacQueen (2008) identifies biases against small scale enterprises and notes that there are inadequate market mechanisms to support small forest producers, and a lack of institutional mechanisms connecting groups and SMFEs to markets and policy

practices that shape the business environment. He identifies connectedness, particularly to the policy environment, as a major challenge for SMFEs: they are isolated from markets because regulations and taxes may force them into the informal sector and they are often overlooked in national forest program processes. They are also isolated from buyers who may not know that particular products or services are available and from the financial sector who may not know of commercial opportunities to support SMFEs.

3.8 Valuing NTFPs/NWFPs at national level

Few studies have attempted to aggregate up to the national level the value of non-timber forest products. This may be partly because it is methodologically difficult, but it would also seem that most researchers have preferred to stay at the case study level.

Little is known about the growth and reproductive characteristics of many or most NTFPs. The investment in basic research that would indicate what sustainable exploitation of NTFPs would look like is too great to be contemplated in most contexts, and basic knowledge is often hardly known even for species which have been exploited for hundreds of years like Brazil nut (Sunderland, Harrison and Ndoye 2004).

An IIED/Forest Connect Report on Nepal (2012) found that one-third of rural people in Nepal collect and trade forest products, which generated US7.66 million in 2010 and benefitted 78,828 participants. Barik and Mishra (2008) know that forests have a high value for local people but observe that most NTFP values are not being accounted for - only bamboo, cane, broomstick and bayleaf have been included in State estimates. However, they note that about 15,000 people are employed in the forest sector each year, and that US$60 billion is generated in wages for them annually.

Babulo et al in Ethiopia (2009) note that in a sample of 360 households from 12 villages forest environmental resources contribute the second largest share of income after crops - ahead of livestock. This is also true of Uganda, as Shepherd, et al (2012)

found Babulo et al note how these resources lift some people out of poverty, but give no figures.

In South Africa, according to valuations carried out by Dlamini and Geldenhuys, (2011), the value of NTFPs is somewhere around $49.38 million. Medicinal plants are valued at $32.1 million and fuelwood at $13.5 million. Natural resource accounting suggested that NTFPs represented 439% of the contribution of forestry reported in national accounts for 2000.

As Laird, McLain and Wynburg (2010) point out, NTFPs/NWFPs are in a curious position at national level in most countries. Few countries have explicit laws which govern their harvesting, and the challenge of valuing NTFPs at national level is enormous. Inventories of all species used and sold would be impossibly costly to undertake, and they recommend only trying to inventory the half dozen most important sold in any location. The problem would be even more complex if all the NTFPs commonly collected but more rarely sold were also considered. IUCN work has shown that, depending on location, at least twice as many species are gathered for home consumption as for sale (Shepherd 2012).

Fuelwood and charcoal are of high value everywhere and enormous volumes are traded annually, especially in Africa. In West African forests (Falconer 1990) chewsticks and wrapping leaves are among the most important exports from forest. They pass through many hands and end up in their millions all over West Africa in every market. But of course, unlike timber, no hard currency is generated by them, and most governments take little interest in such products.

In forest assessments such as FAO's five-yearly FRA, it has proven impossible so far to capture the value of the main NTFP sales (apart from fuelwood), let alone the value of NTFP consumption.

An attempt was made in the Uganda study by Shepherd et al (2012) to put a national level value on forest products (see table 4). This was done by using regional per capita income figures for rural people, in a context where the percentage of income coming from a variety of sources (including NTFPs) was known in sampled villages. The

country had been zoned, using a method developed in the past for CIFOR, so that patterns of high forest/high poverty, high forest/low poverty, low forest/high poverty and low forest/low poverty had been identified and villages sampled within those areas.

Table 4: Total annual value of forest products to rural people in Uganda, in millions of dollars
(Source: Shepherd 2012)

Forest Products grouped by category	CASH		NON-CASH		VALUE OF ALL FOREST PRODUCTS	
	$ millions	%	$ millions	%	$ millions	%
Fuel	**406**	10.1	**1,186**	29.5	**1,592**	39.6
Building materials	**346**	8.6	**655**	16.3	**1,001**	24.9
Forest Foods	**241**	6.0	**510**	12.7	**752**	18.7
Fibre (for ropes, baskets, mats etc)	**68**	1.7	**257**	6.4	**326**	8.1
Herbal medicine	**44**	1.1	**145**	3.6	**189**	4.7
Timber	**32**	0.8	**129**	3.2	**161**	4
Total	**$1,137**	**28.3**	**$2,882**	**71.7**	**$4,019**	**100%**

The results are startling. Firstly, only 28% of forest products are in the cash sector, while 72% are in the non-cash sector. Secondly, timber is of very minor importance among rural households, though house-building materials (sticks, thatch and fired mud bricks) are the second product after fuelwood. Thirdly, almost a fifth - or including medicinal herbs getting on for a quarter - of the value of forests to local people is nutritional.

Finally, a still larger picture lurks in the background. The calculations made here give a figure of $4.01 Billion for the value of forest products to rural people in Uganda. But in fact there had been a 'normal' balance between rural sources of livelihood income in the two relatively settled Regions, Central and Western, and two 'abnormal' patterns in the Regions which have experienced the most disruption from civil war and conflict with the Lord's Resistance Army - Eastern and Northern. How would the total

value of forests products look if the 'normal' pattern were applied to these two regions as well?

'Normal' in the context of Uganda, was taken as a pattern where - on average for rural people:

- 59-60% of livelihood income (cash and consumption) comes from agriculture
- 13-14% comes from livestock (cash and consumption)
- 22-23% comes from forest (cash and consumption) and
- about 4-5% comes from employment and/or trade

Applying this pattern to the two 'abnormal' regions (and using the per capita income regional figures for those regions) reliance on forest drops considerably. Overall, forest income falls to around $3.1 billion when we do this. That is to say, we see $870,000,000's worth fewer products being drawn from forests in Northern and Eastern Regions. This fall has not happened yet, but we may expect that it will happen as post-conflict reconstruction gets under way. So forests help in the transition from war to peace in three vital ways.

Firstly and most obviously they are providing the wherewithal to build new homes, as families go back to their lands and villages to start their lives again. Secondly, forests are performing one of their well-known roles: bridging a gap in the flow of other resources. In this case they are helping families to get through the time-lag before employment and trading opportunities resume in ravaged areas. Thirdly, along with agriculture, they support households while they slowly rebuild their livestock assets - an essential relatively fungible store of investment wealth vital for coping with shocks and regular or occasional expenses such as school fees, marriages and funerals. When life returns to normal, forest dependence will drop to the levels seen in other parts of Uganda, but until then it is an absolutely crucial resource in the reconstruction context, contributing close on a billion dollars a year to Uganda's post-war reconstruction.

3.9 Can forest ever be fully valued? And how could the value of forests become more appealing to policy makers?

Annex 1 contains a description and critique of valuation methods for ecosystem services, with their strengths and limitations. The table shows that many valuation techniques are in their infancy, and that there are very divergent views about methodologies and goals. Disciplinary assumptions and conflicts are part of the problem and debates are largely intra-disciplinary. This then is the first problem with valuation: most of what has been produced so far is unfortunately distant from what would inspire a policy change or can be used by decision makers. Secondly assessing the precise value of water, soil, pollination or other services, even at the local level, is not easy. Local populations are of course often aware of these benefits, at least informally. Aggregating them to a national level figure for forests or at the international level is methodologically challenging and expensive. And a mere number, however, large, is insufficient as the basis for policy decisions. Thirdly, we have already seen that even an apparently straightforward task like the inventorying of key cash and consumption NTFPs is complex and has defeated (or not been tried in) most countries. What then can be done to bring the value of forests to the attention of policy-makers in a way they find compelling and interesting?

<u>Packaging national level numbers for policy-makers</u>

Using Uganda data from Shepherd et al (2012) some examples are given of ways to package the information about the way in which rural people are using forest, to show how important forests are beyond the narrow forest sector, and how forests complement the capacities of government to deliver services to rural people.

<u>Energy</u>

The Uganda Energy budget for 2011/2012 was set to rise to $514 million. Energy from the forest, used by rural people not only for cooking but often also for lighting and space-heating, is worth almost $1.6 billion - three times as much.

Housing

Ninety-seven per cent of houses in Uganda are directly constructed from forest products or are made of wood-fired bricks. (46% are made of mud and poles and 52% of wood-fired bricks). Forty two percent of all houses have thatched roofs. Only 3% are made of concrete or other 'modern' materials. (UBOS 2009-2010). Building materials from the forest currently have a value of over a $1 billion annually. In addition forest fibres (for making rope, string, pole-ties and thatch-ties during house construction, mats, baskets) help to complete the home, and also provide the household with part of its farming, foraging and hunting equipment. Their annual value stands at $325 million.

Health and food security

In 2009/2010, Uganda's Health budget was $319 million dollars. Funding, most of it from foreign donors, is largely spent on three diseases: HIV/AIDS, TB and malaria, and funding at this level notionally allocates $10.4 per Ugandan. The Chief Planner of the Ministry of Health said in 2010 that $28 per capita would be required to provide the Uganda National Minimum Health Care Package, which would also then be able to address other diseases and health care matters such as respiratory tract infections, malnutrition, and child and maternal mortality.

The Uganda report suggests that every *rural* Ugandan, at least, can collect at least $27-worth of health-giving foods from the forest annually (forest foods are of especial value for protein, vitamins and minerals lacking in the carbohydrate-rich farm diet) and another $7-worth of herbal medicine. Herbal medicine alone is worth $189 million dollars annually to rural Ugandans - nearly 60% of the national Health budget. The forest is thus vital for supplementing what government Health budgets can afford to provide, and also absolutely essential for food security. Forest food accounts for 19% of forest income and for 8% of all food consumed and sold including that from agricultural production. As noted above, forest food nutritional quality is probably more important than its quantity (Falconer, 1990; Falconer and Arnold, 1991). It is at last well

recognized in the agriculture and food policy sectors that nutrition security is not the same as food security (Heidhues et al, 2004; ODI, 2002).

The numbers presented here invite the thought that rural people would be far worse off without these forest products. The task for forest valuation is perhaps to spell out more clearly what would be lost, practically, if the forest disappeared: and the additional costs to government that would result.

4. OPPORTUNITIES: DRIVING GROWTH, CREATING WEALTH, MANAGING SUSTAINABILITY

4.1 Role of Forests in Pathways out of Poverty

The role that forests play in reducing long term poverty and in helping people to escape from poverty has proved to be a lot more complex than was at first thought. Originally it was hoped that forest products could be identified, and their production intensified in such a way that poverty would be reduced. But the reality is that with a few highly unusual exceptions, only timber sales would do that, and timber production is too capital intensive for most of the world's forest-based poor, even if governments were prepared to allow them to become loggers.

In many cases it is not the wealth that forests can provide but the welfare contributions they offer that are so important. Many of the NTFP case examples show how profoundly forests underpin local livelihoods. They are not just for hard times, but are of value daily for men as well as women; for richer people as well as poorer people. For all rural women and for most rural men apart from the very wealthiest, the livelihood needs drawn from forests are far more important than their timber values. But this is the very reason why the contribution of forests to national GDP has been so invisible.

Sunderlin's work at CIFOR (Sunderlin et al, 2005, 2007, 2008) and the work of the Chronic Poverty Research Centre in the UK have shown how those in remote areas are unlikely to get out of poverty in one bound. Rather we should seek to understand how forests (and often other forces) can help to move the chronically poor to the sometimes

poor, and the sometimes poor to the non-poor. This has not been process that happens in a single generation, as a rule.

Very often the balance between forest dependence and agriculture has to change before poverty reduction can take place. Trend data collected at many of the IUCN sites (Shepherd, 2012) show that the intensification of agriculture as new markets come on stream, and the change in forest use which results from that, may be at least a 20-year process.

In the case of Uganda, forest-based cash is raised first and foremost from the sale of fuelwood and charcoal (36% of all sales), followed by the sale of house-building materials (30%) and forest foods (21%). Money raised from the forest as well as from other sources is used to invest in livestock (a rapid multiplier of wealth if droughts and wars do not intervene) and school-fees (Shepherd et al, 2012). These investments increase shorter-term and longer-term resilience to shocks.

But a much greater proportion of forest income goes to support the household through direct consumption rather than through cash sales. Thus the forests' chief role for rural households is to provide energy security, a house and its furnishings, to contribute to food and nutritional security and to contribute to health. All of these aspects of forest income reduce the vulnerability of the household to the unforeseen.

They increase livelihood resilience, in a phrase, and help to provide a household with a secure basis from which to take some risk as it seeks income-generating opportunities through agriculture, employment, investment in livestock or tree-planting.

In their own way, households make their plans for an exit from poverty, often over more than one generation in remoter places. Women use forest NTFPs to generate cash for school fees and school uniforms for their primary school children; and fathers sell timber or cattle, to send those children on to secondary school (Shepherd, Kazoora and Müller, 2012).

The forest also has a role in helping part-families survive tough times at home while key household members build a bridgehead as labor migrants to urban

opportunity, or to more money to invest in the farm. In Burkina Faso, for instance, two thirds of young men have left as labor migrants for countries further south such as Ghana and Cote d'Ivoire (Shepherd, 2012).

In the Middle Hills of Nepal, labor migrants to the Middle East and Malaysia leave in their thousands. A recent study (Adhikari and Hobley, 2011) investigated the impact of migration on two villages where 51-71% of households had a migrant member. Remittances in the district totaled $26 million in 2010-2011. New roads are being constructed and mobile phone networks established. (Large investment decisions are taken after mobile phone consultations between husbands and wives).

Initially, the remittances are used to repay airfare loans. Subsequently, money is invested in children's education, house improvements and land purchase, and hitherto landless wage laborers are able to buy land as wealthier families exit from the villages entirely. More trees are planted on private land and lower intensity forms of agriculture are practised, with more fallowing. Livestock continue to be important, but smaller livestock are purchased. Community forestry groups are still valued if they provide useful benefits, but membership is increasingly female with men absent and young men not interested. Forest management and local income generation lie increasingly in the hands of women and their girl children.

Often, villagers find pathways out of poverty involve a dual strategy which makes the best possible use of the symbiosis between forest and agriculture. In tropical dry forests, the pathway out of poverty is often most simply achieved through cattle investment, using the forest as fodder. In tropical moist forests where forest fallows are important in the agricultural cycle, fallows are often slowly enriched and turned into high value tree crop stands over time. This has been the pattern throughout South-East Asia, as multistory forest gardens testify, and is one of the strategies now being employed in Papua.

In a finite space like the island of Anjouan in the Comoro Islands near Madagascar, it has resulted in the conversion of the lower slopes of the mountains almost entirely into agroforestry areas combining high value tree-crops like cloves and

ylangylang with domestic fruit trees such as mango and breadfruit (Shepherd, 2010). A similar process has been at work, in a different ecological context, in the hills of Doi Mae Salong, in north-west Thailand as Rattanasorn et al note (2012). Such conversion of the composition of forest tree species upsets some, but in each case, forest function is maintained, with a different mix of tree-species, and with opportunities for poverty reduction which at the same time maintain, or indeed improve, forest cover

It is very evident in the case of post-conflict reconstruction, that the forest has been able to take up the slack, temporarily, as households settle back into their old lives and begin to look for ways to invest for the future. Over and above the normal support provided by forest, households in the Northern and Eastern Regions of Uganda have each been drawing down an additional $275 a year in forest products, to see them through the early resettlement period.

In all these ways, forests help villagers to find indirect pathways out of poverty. These are very different from the direct 'income from forests' assumptions held ten to fifteen years ago.

4.2 Sustainability supply chains and forests

Tropical landscapes in which agriculture and forests meet present key conservation and development challenges. Firstly, conservation of the remaining tropical forests in these landscapes is necessary to maintain biodiversity, mitigate carbon emissions from deforestation, maintain the provision of subsistence and income-generating forest-based resources for local livelihoods, and sustain key ecosystem services. Secondly, higher food production is needed to feed a larger, richer, global population, provide subsistence and income-generating opportunities for agriculture-based local livelihoods, and support trade in agricultural commodities for higher national incomes. Finally, creation and enforcement of secure tenure rights in frontier landscapes is necessary for legal, equitable resource access and land use, especially for local groups and indigenous peoples.

Addressing these challenges requires systematic and considered governance of agricultural expansion and intensification, particularly with respect to the spatial distribution of agriculture relative to forests (Angelson and Kaimowitz 2001); improved access to and distribution of food; and reduced food waste. Intensification, achieved historically through a combination of investments in labor, technology, fertilizer, seed stock, and irrigation (Naylor 1996), is a necessary but insufficient step towards preventing further deforestation. Although intensification increases commodity supplies, increases in local yields and productivity may over time generate profits and efficiencies that stimulate further agricultural expansion and forest encroachment, especially where demand for the commodity is growing and labor is available (Angelson 2010; Rudel et al. 2009). Further, high-yield commodity agricultural expansion can decrease the total land area used (Burney et al. 2010), but this can bypass existing agricultural or degraded lands and encourage deforestation in primary forest areas. For example, high-yield palm oil development in Peru has primarily targeted primary forest sites, demonstrating the inadequacy of intensification alone as a mechanism for avoided deforestation (Gutiérrez-Vélez et al. 2011). One part of the solution is to develop regulatory or incentive mechanisms that overcome the problems of low productivity and high costs associated with agricultural expansion in degraded lands. Thus, innovations that support agricultural intensification must be complemented by institutions and incentives that prevent expansion into forested areas (Wollenberg et al. 2011).

There is already evidence that commodity agriculture production in tropical forest regions can increase independently of deforestation, through intensification (increased yields per unit area) or by spatially disaggregating agricultural expansion from forest areas. In the Brazilian state of Mato Grosso between the first and second half of the decade 2001-2010, higher productivity increased soy production by 22% with a corresponding decline in deforestation-causing soy cropland expansion (Macedo et al. 2012). Such data provide grounds for optimism in meeting the challenges of tropical-forest and agriculture landscapes, but there is a consensus that a combination of more

secure tenure rights and effective institutions are critical to implement the policies that will lead to deforestation-reducing land-use changes.

Indeed, scholars and practitioners alike have drawn attention to sustainable supply chains to promote economically, environmentally, and socially responsible production with an aim to achieving "triple bottom lines." UNEP (2008) identifies multiple challenges that impact global supply chains--mitigating and adapting to climate change, resource scarcity, development issues, demand for markets to be open and accountable—and note that companies and suppliers are increasingly trying to align with international expectations of responsible performance and good conduct in supply chain management. In a meta-analysis of the literature on sustainable supply chains, Seuring and Muller (2008) identify the following incentives and pressures for supply chains to become more sustainable: legal demands/regulation, customer demands, responsibility to stakeholders, competitive advantage, environmental and social pressure, and reputation loss.

Efforts to build farmer capacity and to share best practices on sustainable supply chain management include the Common Code for the Coffee Community, the Ethical Tea Partnership, the International Cocoa Initiative, and the Roundtables on Sustainable Palm Oil and Responsible Soy. All of these initiatives develop industry standards and guidelines. Some initiatives, including the Common Code for the Coffee Community, the Ethical Tea Partnership, and the Roundtable on Sustainable Palm Oil also engage in certification, monitoring, and verification (UNEP 2008). For instance, the Roundtable on Sustainable Palm Oil convenes actors from all parts of the palm oil commodity chain and from the consumer goods, cosmetics, energy, and food sectors who use palm oil to develop and implement global standards for sustainable palm oil. The RSPO has developed eight principles and criteria for sustainable palm oil production, one of which is environmental responsibility and conservation of natural resources and biodiversity. In 2011, 1 million hectares of palm oil were certified as sustainable palm oil, the equivalent of 5 million metric tons, and representing 10% of global palm oil production.

By 2012, 6 million metric tons of certified sustainable palm oil were produced, mostly in Indonesia and Malaysia (RSPO website).

The global coffee commodity chain is described as a relatively simple one that begins with the sale of the raw, green coffee to the first processor and ends with the sale of a cup of coffee to a consumer (Talbot 2004). Since the dismantling of the International Coffee Agreement (ICA) in 1989, the distribution of income has shifted and is concentrated at the processing stage (Talbot 1997; Talbot 2004). When the ICA was active, producers received a greater percentage share of coffee income: depending on the year, producers received approximately 20% (Gilbert 2008) to 30% (Talbot 1997; Johannessen and Wilhite 2010). Now, more than half of the total coffee income now accrues to consuming countries who add value to green coffee through roasting and retailing in what Ponte (2002) termed the "latte revolution," leading many to describe the coffee commodity chain as a "roaster" driven chain. While some scholars (e.g., Ponte 2002; Daviron and Ponte 2005; Ponte and Gibbon 2005) argue that producers' profits have been marginalized as multinational processing companies in consuming countries add increasing value and capture a larger percentage of coffee profits, Gilbert (2008) argues that it is not a zero sum game. He explains the shifting income dynamics by pointing to changes in the cost structures of processing industries, such as increased consuming country costs for processing, marketing and distribution, amidst declining producer costs (see also FAO 2006).

Gilbert (2006; 2008) describes the value shares for both Arabica and robusta coffee producers between 1980 and 2005. The average share for Brazil, Colombia, Guatemala, Kenya, and Tanzania producers as a share of the US retail price of coffee was highest between 1980-1988 at 34.3%. The lowest average share was between 1999-2003 at 18.2% which then increased to 21.7% in 2004-2005 (2006: p. 276). The average producer shares for Brazil, Cote d'Ivoire, Indonesia, Uganda, and Vietnam Robusta producers are somewhat lower. The value was again highest in 1980-1988 at 23.8% and lowest between 1999-2003 at 9.1% and again increased by 2004-2005 to 12.1% (2006: p. 277).

In their analysis of fair trade coffee cooperatives in Guatemala and Nicaragua that sell their coffee in Norway, Johannessen and Wilhite (2010) concluded that coffee producers receive a significantly smaller percentage of the profits than the consumer country. For one cup of coffee sold in a Norwegian university café, 96% of the income goes to the consumer country while the producer country receives 3.93% of the income. In the consumer country, importers and roasters captured the highest percentage of the total price, generating just over 58% while the retailer received 13.8% and the certifier received only 2.4%. The producer cooperative received 26% of the total price in comparison with 13% received by the producer, illustrating that fair trade cooperatives benefit the producer cooperatives more than the producer.

In contrast to coffee, the cocoa chain is more complex because additional inputs go into the final product. The cocoa commodity chain is described as "lead firm" driven because of the relatively small number of companies involved in processing cocoa (Fold 2002). As Gilbert (2008) explains, "while cocoa farmers see themselves as producing the raw material for chocolate, chocolate manufacturers may see cocoa as just one of a number of ingredients in their recipes." Consequently, it is more difficult to estimate the percentage share of income received by cocoa farmers from a finished chocolate product. Gilbert (2008) estimates that the cocoa producer obtains 3.5% of the final retail price. Like coffee, the average cocoa producer prices have declined, from a sharp drop after 1985 to modest declines from 1986-1995 and 1996-2005. In 1996-2005, the average producer price as a proportion of the price of UK chocolate was 9.3%, with a range from 6.4% in Ghana and 18.7% in Nigeria (2006: 281).

The cattle/livestock supply chain has been described as "market-driven" because livestock producers often live far from markets and lack information on pricing (Legese et al 2008; Rich et al 2011). Legese et al (2008) and Rich et al (2011) describe the livestock supply chain in Ethiopia, as illustrated in the figure below. The supply chain includes smallholders and pastoralists who raise livestock and then sell it to some type of middleman, which may be a small or large trader, a livestock trading cooperative, or a producer. Next, live animal exporters and meat exporters export the livestock or

processed meat to the global market. As part of a related study, Negassa and Jabbar (2008) found "very low commercial off-take rates" for cattle and shoats for Ethiopian smallholder farmers and pastoralists. In 1999-2000, the average off-take rate for cattle, sheep and goats was 8% in Amhara, 18% in Tigray, and 22% in Oromia. In 2004-2005, the average rate was 7% for cattle and sheep and 18% for goats. They note that livestock ownership and holding size is small at the household level and not sufficient for commercial off-take levels. Further, they observe that most household keep cattle for draught purposes and many households do not participate in the market, with only 23% of households selling cattle in 1999/2000 and 50% of household selling cattle in 2004-2005.

The above discussion shows the different ways in which actors involved in supply chains for agricultural commodities are making decisions with substantial impacts on whether forests will be maintained and preserved or if the commodities will lead to new areas of deforestation. The expansion of agricultural commodities has resulted in more than 40 million ha of new land being cultivated to produce just soybean and oil palm in the last two decades. These commodities and others like cattle, cocoa, sugar and coffee are likely to require additional areas for cultivation as the demand and supply for them is integrated globally and as a growing middle class expresses its effective demand for higher value agricultural commodities. The possibility of making supply chains for agricultural commodities more sustainable through demand as well as supply side interventions has tremendous potential for protecting forests and at the same time generating higher incomes from erstwhile forest lands.

4.3 Non-Cash benefits from forests

As this paper indicates, forests produce both material and non-material benefits. The material benefits of forests generally tend to be better recognized among governments and policymakers while the non-cash value of forests are often "invisible" and not considered in decisions on natural resource use, including land use. For instance, when the value of non-cash benefits of forests are not considered in land use decisions,

governments and others may chose to promote agriculture over forests without recognizing the full costs of these actions in terms of forest cover and environmental benefits provided by forests or to make other decisions that exacerbate resource degradation (FAO 1996; TEEB 2010).

This paper also highlights the fact that forests are under-valued because non-timber forest resources are generally collected or traded informally and do not register as market transactions that are valued, with the exception of some commercially valuable products such as medicinal substances and mushrooms, among others. The aggregate value of NTFPs and NWFPs is often substantial but not collected or recorded by national governments; consequently, data on non-cash contributions of forests tends to be *ad hoc* and case-study based, resulting in unreliable data at national and global scales (GFA 2010; Barik and Mishra 2008; Delang 2006; Gram et al 2002). There is an urgent need for better data on the non-cash contributions of forests to inform governments and policymakers on the true value of forest resources.

Cross-sectoral policies that encourage sustainable forest management and incorporate economic and livelihood objectives are one step towards recognizing the non-material benefits of forests. For instance, policies that recognize the role of forests in providing food and protein sources for people around the world can jointly address forest management and food security dimensions. Similarly, PES schemes and more recent forest payment mechanisms to mitigate climate change, such as REDD+ and others, represent policies that recognize the environmental protection functions of forests (See BP2 for a discussion PES and REDD+).

Although political attention has begun to focus on the role of forests in climate change mitigation, there is less awareness of the role of forests and their non-timber, non-wood values and their environmental service and recreation values. Valuation methodologies that reflect forest goods and services represent yet another avenue for recognizing the material and non-material benefits of forests. Valuation exercises have been criticized for making subjective judgments (e.g., Balmford et al 2011); therefore, valuation methodologies that clearly state assumptions and calculations are needed.

Similarly, national accounting that incorporates data on forest products related to environmental and recreation services and fodder, food, fuel and medicinal values would facilitate better documentation of the full value of forests (See Annex 1 for different valuation methods and their appropriate use).

Another option to enhance the non-cash benefits of forests is to ensure sustainable financing that promotes a broad view of sustainable forest management, including the cultural, environmental, provisioning and recreational benefits of forests. Unsustainable forest management is often more profitable than sustainable forest management (GEF n.d.) at least for timber; while funding and financial partnerships exist for initiatives such as REDD+, these initiatives do not fully address the cultural, environmental, provisioning and recreational benefits. Consequently, a dedicated financing stream that recognizes the multiple benefits of forests could address such challenges and include incentives for enhancing the non-cash benefits of forests. One option is the GEF's Sustainable Forest Management Program, which uses a Tropical Forest Account (TFA) concept to encourage nations to allocate forest financing to projects that recognize the multiple benefits of forest conservation and management (GEF n.d.).

Finally, implementation is key in enhancing the non-cash benefits from forests. At the Fourth Ministerial Conference on the Protection of Forests in Europe, held in Vienna, Austria, from 28 to 30 April 2003, for example, ministers adopted a resolution on "Preserving and Enhancing the Social and Cultural Dimensions of Sustainable Forest Management in Europe." In the Resolution, governments recognize the relationships between forests and people and cultural and social dimensions of sustainable forest management. The signatory governments commit themselves to "address the social and cultural dimensions of sustainable forest management in national forest programs and other relevant policies" and to maintain and further develop material and non-material cultural and social aspects of sustainable forest management through enhancing and preserving cultural landscapes, among other activities. This 2003 Resolution represents an example of the types of actions that can enhance cultural, environmental,

provisioning and regulating services of forests *if* governments act upon and implement agreed commitments. Examples of countries that have adopted national forest programs on sustainable forest management or are in the process of developing or revising policies to reflect sustainable forest management goals include Brazil, Cameroon, Cyprus, Finland, Ghana, Jamaica, New Zealand and the Philippines (UNFF 2011).

5. Institutional Barriers and Opportunities

At some 4 billion hectares, forests cover nearly 30 percent of the global land area according to official statistics (FAO 2005). However, the total area of forests continues to decline. According to the most recent Global Forest Resources Assessment 13 million hectares of forests are being lost annually. But the rate of decline has slowed in more recent years (FAO 2010). The only major region of the developing world with a net gain in forest area during the period 2000-10 is Asia (as a result of new areas of planted forests in many cases). Most of the world's forests are owned by governments. But private and other forms of ownership are increasing, and governments often set aside areas for use by communities, especially in Latin America.

The importance of forests in relation to two of the most important global environmental threats – climate change, and biodiversity loss – is hard to overstate. They have long been recognized as the reservoir and source of much of the species biodiversity on the planet (Wilson 1989). They also store more carbon than does the atmosphere with 283 gigatons (Gt) in biomass alone. These statistics about forests are important to convey their immense significance for the survival of humanity as a species. They also raise questions about how forests are being governed, and the areas of governance through which the management of national forest estates can be enhanced for improved economic contributions. In this context, it is worth noting that institutional solutions to competing claims are always complex because of the simultaneous importance of forests for global conservation and local livelihoods. Such solutions are also provisional and subject to ongoing revisions as a result of

demographic shifts, developmental processes, changes in landscapes, and political alliances among other variables.

5.1 Distribution of forests under different forms of governance

Table 5 lists the estimated area under major forms of tenure for the 30 countries in the developing world with the highest forest cover (Africa, Asia, and Latin America) and an additional six developed world nations with large areas under forest cover (FAO 2005, White and Martin 2002). Collectively, these countries represent more than 80 percent of officially reported forests. Because the areas listed for different countries draw from official statistics between the years 2000 and 2010, the figures in the table are at best approximations – indeed, there are no accurate numbers in existence. The table indicates that a nontrivial area of forests is either under collective management through community-level institutions, or claimed as being owned by community-level actors.

Table 5: Ownership of Forest and Other Wooded Lands (2000/2005, in millions of hectares)
(Source: Agrawal 2007)

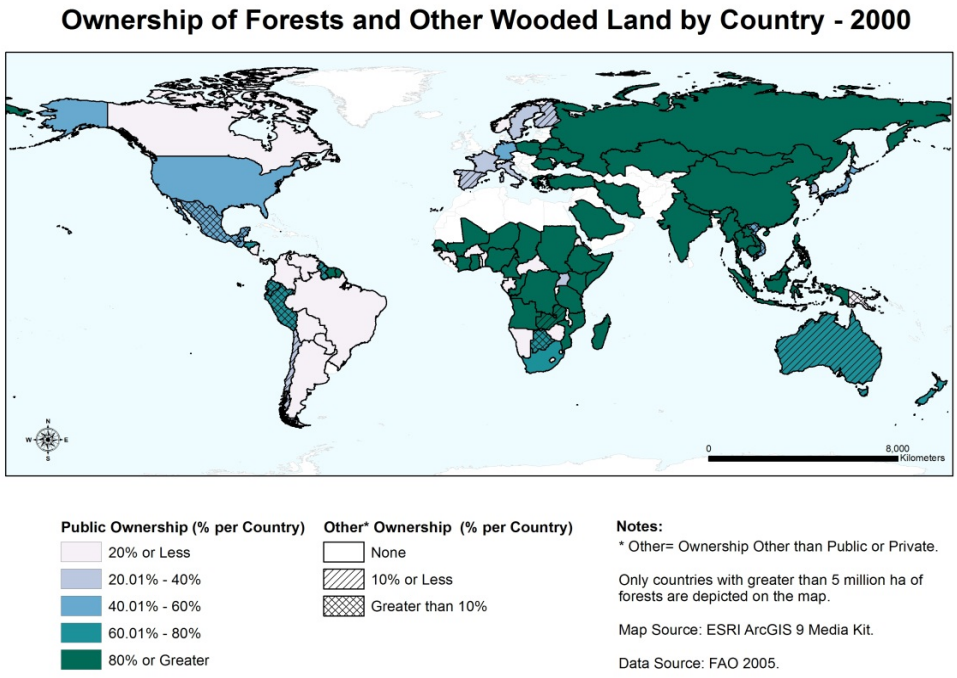
Country name	Public		Private		Total
	Government administered	Community administered	Community/ Indigenous	Individual/ Firm	
Africa					
Angola#	59.7	0	0	0	59.7
Botswana#	33.4	3.0	8.4	2.3	47.2
Cameroon#	37.1	0	0	0	37.1
C. African R.#	33.0	0	0	0	33.0
DR Congo#	218.1	0	0	0	218.1
Gabon#	21.8	0	0	0	21.8
Mali#	29.5	0	0	0	29.5
Mozambique#	60.9	0	0	0	60.9
Nigeria#	20.0	0	0	0	20.0
South Africa#	24.0	0	0	7.5	31.5
Sudan*	40.6	0.8	0	0	41.4
Tanzania*	47.9	0.4	0	0	48.3
Zambia#	44.7	0	3.5	0	48.2
Total	*670.8*	*4.2*	*11.9*	*9.8*	*696.7*
Asia					
China*	58.2	0	70.3	0	128.5

India*	53.6	11.6	0	5.2	70.4
Indonesia#	97.8	0	0	0	97.8
Lao PDR#	20.5	0	0	0	20.5
Malaysia#	20.1	1.4	0	0	21.5
Myanmar#	45.1	0	0	0	45.1
PNG#	1.1	2.1	31.3	0	34.5
Total	*296.4*	*15.1*	*101.4*	*5.2*	*418.5*
Latin America					
Argentina#,*	71.5	0	0	22.2	93.7
Bolivia*	28.2	16.6	2.8	5.4	53.0
Brazil*	423.7	74.5	0	57.3	555.5
Chile#	7.4	0	0.6	21.6	29.6
Colombia#,*	54.6	0	24.5	0	79.1
Guyana#	12.3	5	1.8	0	19.1
Mexico#	44.2	27	14.5	0	85.7
Paraguay#	19.4	0	0	0	19.4
Peru#,*	59.8	8.4	22.5	0	90.7
Venezuela#	56.5	0	0	0	56.5
Total	*777.6*	*106.5*	*66.7*	*106.5*	*1057.3*
Developed Countries					
Australia#	118.5	1.5	0	44.6	164.6
Canada*	388.9	1.4	0	27.2	417.5
Japan*	10.5	0	0	14.6	25.1
Russian Fed.*	809.3	0	0	0	809.3
Sweden*	6.1	0	0	24.1	30.2
United States*	110.0	17.1	0	164.1	291.2
Total developed	*1443.3*	*20.0*	*0*	*344.6*	*1737.9*
Total developing	*1744.8*	*125.8*	*180.0*	*121.5*	*2172.1*
Total	**3188.1**	**145.8**	**180.0**	**466.1**	**3910.0**

Notes: # refers to FAO 2005, and * refers to White and Martin (2002).

The figure below presents information on the distribution of forests under different forms of tenure visually.

Figure 9: Distribution of forests under different tenure arrangements
(Source: Agrawal et al. 2007)



Before assessing the implications of the figure in table 5 above, a few qualifying statements are necessary. The figures almost certainly understate the area of land under communal arrangements. In several countries where the official statistics report the absence of any forest land under communal management of control – such as Cameroon, Mali, South Africa, Tanzania, and Zambia in Africa, and Indonesia and Lao PDR in Asia – we know that communities have at least the informal rights to administer significant areas of forests (Wily 2001). Case study evidence from these and other African countries demonstrates the presence of community-based governance in forests even if official agencies report a different story to international organizations. The data also does not reveal forms of governance such as concessions for logging that in many countries would lead to higher areas of forests under de facto private use and management. Again, case study evidence and national level reports from Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, Indonesia, and Myanmar show the significant levels of logging in forests nominally under government control but in reality under the control of market actors (White and Martin 2002: 9). The

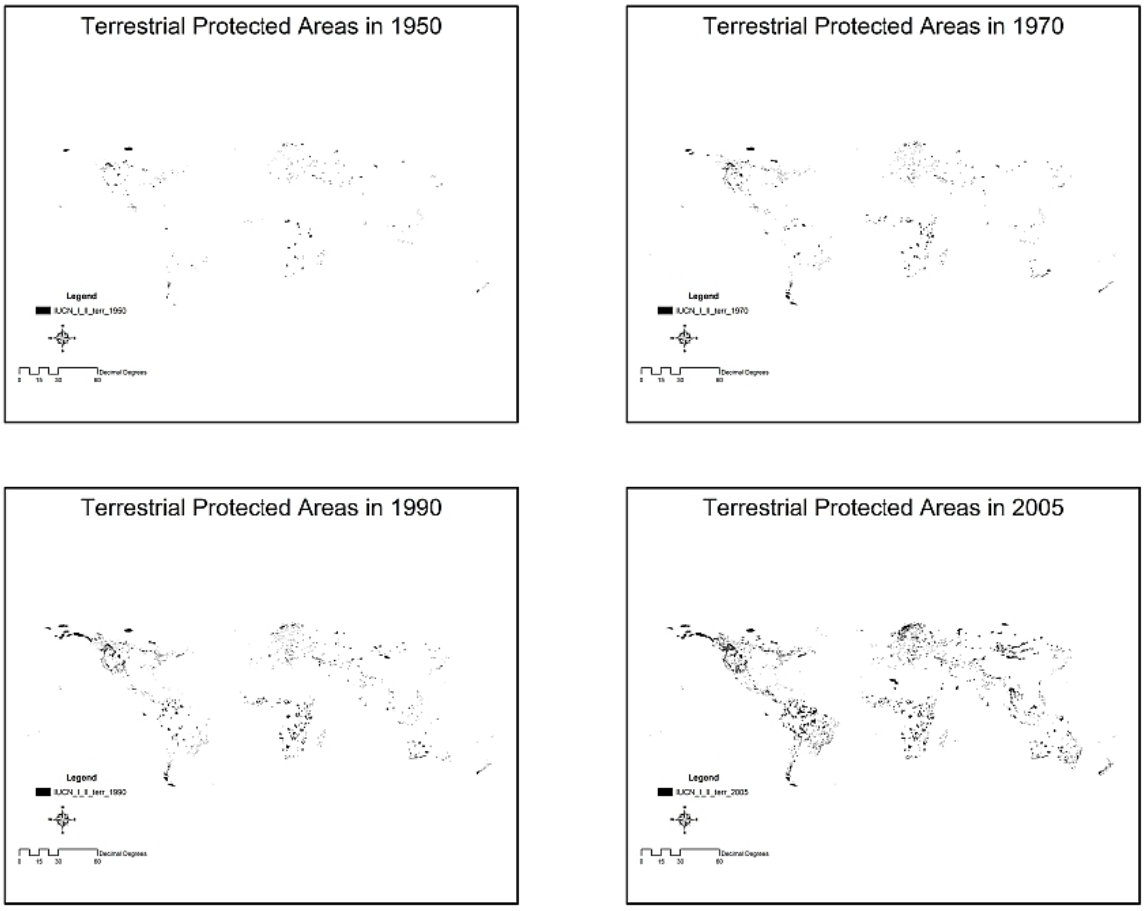
numbers in the table thus under-represent the impact of private/corporate and community-level actors in forests in the listed countries.

Despite inaccuracies the figures also reveal much. When the proportion of forest area under the control of different actors is compared, government agencies own most of the world's forests: nearly 82 percent. Private and communal/indigenous tenure covers 11.9 and 8.3 percent respectively. Collective ownership and use is more common in the developing rather than the developed world. Private actors possess only about 5.6 percent in contrast to the 14.1 percent of forests characterized by communal tenure. The greater prevalence of collectively owned forests in the developing world, for example by indigenous groups and communities, explains why much of the research on local forest governance has focused on the developing world (Haenn 2006, Maskey et al. 2006, Pagdee et al. 2006). Since a billion people or more may be dependent on forests for some part of their livelihoods, the total area communities own and control seems quite low.

5.2 Recent changes in forest governance: decentralization and devolution

The nature of forest governance is central to improved forest cover and change outcomes. In the early 21st century, changing forest governance is for the most part a move away from centrally administered, top-down, regulatory policies that characterized forest governance for much of the nineteenth and twentieth centuries. Many government-owned forests are managed as common property for multiple uses by local communities and community-based organizations (Hayes 2006). Many other forests classified under public ownership are effectively governed as private timber concessions by logging companies (Karsenty 2007). Civil society organizations and market incentives increasingly play a role in forest governance through certification processes and changing consumer preferences (Cashore et al. 2006).

Figure 10: Change in coverage of protected areas between 1950 and 2005
Source: Agrawal et al. 2007



At the same time, the growth in the number and size of strict protected areas in the latter half of the 20th century has also meant that approximately 6.4 million km^2 of publicly owned forests are now under governance regimes that involve stricter restrictions on human use and habitation (West and Brockington 2006; West et al. 2006, Zimmerer 2004, see figure 10 above).

Three important forest governance and tenure trends stand out: i) decentralization of management, especially for commercially low-value forests that nonetheless play an important role in the livelihoods of hundreds of millions of rural households in developing countries; ii) the substantial role of logging companies in forest concessions, typically for selective logging in tropical forests; and iii) the growing

importance of market-oriented certification efforts, mainly in temperate forests in the developed world.

Decentralization of forestry policies began in the mid to late 1980s, and had become a prominent feature of forest governance by the mid 1990s (Andersson et al. 2007, Ribot et al. 2006). It was impelled in part by infusions of material and technical support from bilateral, multilateral, and private donors who sought better forest governance from recipient countries. These external pressures coincided with domestic demands for a greater recognition of local communities' needs for forest products and role in influencing the management of local forests for multiple needs. They also worked in the same direction as the desire of many governments to reduce the financial burden of forest governance in an economic context characterized by significant fiscal and budgetary pressures. An emerging body of scholarly work on local participation, resource institutions, governance, and accountability helped provide some justification for decentralization reforms (Dietz et al. 2003, Ostrom 1990). Through decentralization reforms in the last two decades that have often also promoted local, more democratic participation in governance, local communities and organizations have come to govern close to an additional 200 million hectares of forests (Molnar et al. 2004, White and Martin 2002).

Table 6 below presents information to show how claims and tenurial rights over forests have changed since the 1990s.[2] Additionally, the set of countries for which information could be collected is smaller than that in table 5. Therefore, the area currently under community governance through legislation passed in the past two decades is likely higher than reported in the table below.

[2] The information in table 5 and 6 has been collected from several different sources, and therefore the numbers may not be strictly comparable across countries.

Table 6: Forest areas recognized as being under Community Management in the Developing World since 1985

(Source: ITTO 2005, White and Martin 2002, Wily 2001).

Country	Area in Million Hectares		Year of Reform	Nature of Legal Reform
	Community Administration	Community Ownership		
Bolivia	16.6	2.8	1996	Ancestral rights of community groups have precedence over concessions; municipal governments gain control over forest lands; Indigenous groups have reserves over which they exercise governance rights.
Brazil	74.5	0.0	1988	Ancestral rights of indigenous groups and communities recognized
Colombia	0.0	24.5	1991	Framework for collective territorial rights of indigenous groups and Afro-Colombians
India	11.6	-	1989	Joint Forest Management with state forest agencies recognizing community governance
Indonesia	0.6	N/A	2000	Regulatory process for customary ownership and community concessions
Mozambique	?	N/A	1997	Titles for customary tenure available
Nepal	1.2	N/A	1996	Community forestry legislation to recognize governance rights
Philippines	N/A	N/A	1997	Constitution protects ancestral domain rights, 1997 Act recognizes indigenous tenure
Peru	8.4	22.5	1999	Rights of communities recognized by law
Sudan	0.8	N/A	N/A	
Tanzania	0.4	N/A	1999	Customary tenure available and protected
Uganda			2000	2000 draft under revision, strong program to promote devolution
Zambia			1995	Customary tenure recognized but titles not available
Total	114.1	49.8		
In addition, the following countries either have plans to recognize community rights to administer or manage forests, or already do so at least on paper: Botswana, Cameroon, CAR, Mali, Kenya, Senegal, Nigeria, Guatemala, Guyana, Mexico, Paraguay, Venezuela, Bhutan, Lao PDR, Malaysia, and Thailand.				

The private concession model in forest governance has long been in existence. Under concessionary forest governance central governments or forest departments provide long-term resource extraction rights in commercially valuable forests to logging interests in exchange for a stream of revenues. Concessions continue to be a dominant form of forest governance in many tropical forests in Southeast Asia, parts of the

Amazon, and especially in Central and West Africa where at least 75 million hectares of forests are under concession to logging companies (Karsenty 2007). Governance through forest concessions is prompted by demand for logs and timber – often in distant markets, and governments' need for revenues. The limited enforcement of concession agreements in most countries in Southeast Asia and Africa has also meant that legal logging in concessions exists side by side with costly and unsustainable levels of illegal logging (Keller et al. 2007). The World Bank estimates US$ 15 billion to be lost to developing countries every year as a result of illegal logging.

5.3 Role of non-state market driven instruments

Apart from direct ownership and management of forests under private, communal, or public forms of tenure, a number of other, market based approaches are also highly relevant to the way forests are managed and what happens in forests. One of the most important tasks facing those seeking to understand, and promote, economic contributions of forests, is to identify pathways that reinforce, rather than detract from, important environmental and social objectives. The purpose of this chapter is to understand the past and future potential of two related policy interventions: forest certification (eco-labeling) systems initiated a generation ago that seek to embrace market incentives and economic globalization as a way to promote and reward responsible forest stewardship; and more recent efforts to weed out "illegal logging" from global markets through legality verification initiatives. These efforts are important because, proponents argue, realizing their full potential means reshaping debates of environment versus development towards an integrated effort in which a range of stakeholders share a common endeavor to build, and render durable, institutions that promote sustainable development of forest management.

Understanding past and present potential requires answering paying attention to the following puzzle: unlike global certification systems that continue to be marked by internal polarization and relatively weak, through growing, support in the tropics; legality verification is gaining widespread support including forest firms in the

developed and developing world, international aid agencies, international trade advocates, environmental groups, and governments in the North and South.

To review the growth and polarization of global certification systems in the last 20 years, it is important to attend to two overall trends: widespread support among companies and forest managers in many industrialized nations while important, but more limited efforts, in the global south; and increasing debates and polarization over which certification programs are most appropriate. It is also important at the same time to understand the growing interest in legality verification as a means to address global forest degradation. Even modest standards that reinforce, rather than detract from, national sovereignty, have generated unparalleled coalitions around supply chain tracking. Strategic efforts to "ratchet up" modest legality verification standards may do more to promote sustainable forest management, and prepare the foundations for, more wide ranging standards in ways that reward, rather than punish, forest firms and managers.

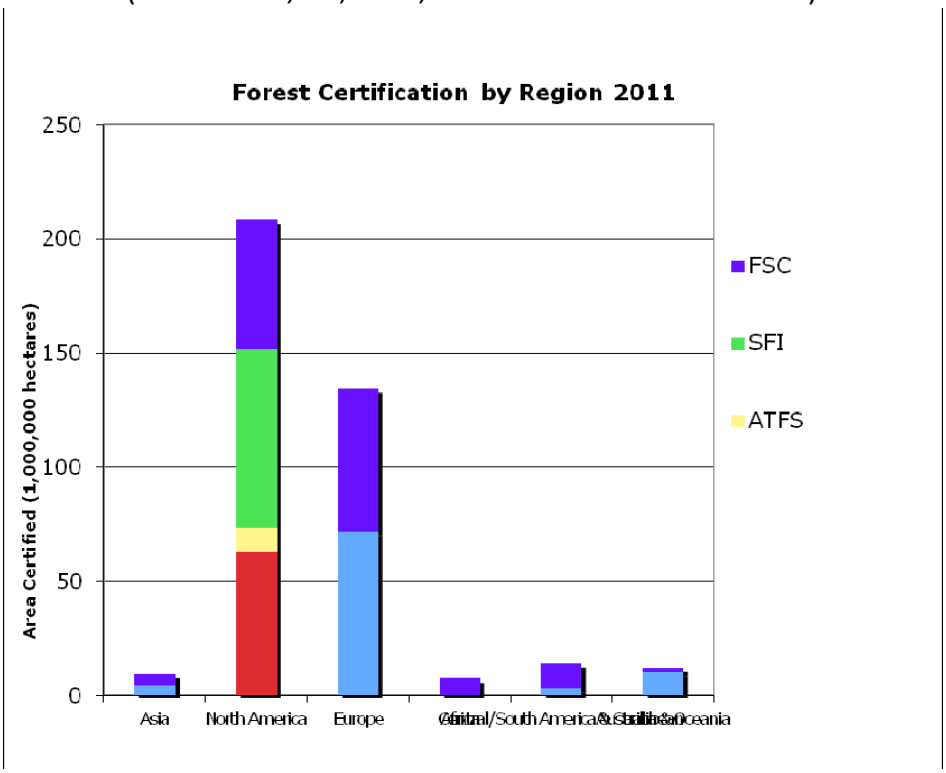
5.3.1 Forest Certification

Forest certification emerged on the global scene following the creation of the Forest Stewardship Council (FSC) in 1993, which was promoted heavily by the world's leading environmental groups following failed efforts to develop a binding global forest convention at the 1992 Rio Earth Summit. The idea behind certification was relatively straightforward: develop a set of wide ranging rules governing sustainable forest management and mobilize customers of forest products to encourage adherence to the standards. Strategists reasoned that by drawing on carrots (price premiums) and sticks (shaming campaigns of companies not undertaking certification), economic incentives might provide more enduring support than short lived and ineffective boycotts of tropical wood products prominent in the 1980s; while providing more purposeful rules than international efforts that many NGOs felt amounted to "logging charters." Five key features have been identified as key to understanding forest certification as "non-state market driven" (NSMD) global governance: domestic sovereign states do not require

adherence to the rules; wide ranging policies governing social and environmental practices are developed; third party auditing is used to promote verification/compliance, and tracking of eco-certified products is undertaken along global supply chains (Cashore (2002), Cashore Auld and Newsom (2004) and Bernstein and Cashore (2007).

Over the last 17 years, efforts to promote responsible stewardship through certification have been mixed. There is now considerable support for third party certification among most commercial forestry operations in North America. However, two challenges still characterize efforts to build global uptake. First, considerable debate continues over support for the NGO supported FSC, and the domestic, government/ industry/landowner initiated, "FSC competing" programs. These competing programs, housed under the international umbrella of the Program for the Endorsement of Forest Certification (PEFC), emerged to provide global scope comparable to the FSC for domestic programs.

Figure 11: Area under different forms of forest certification
(Source: FSC, SFI, PEFC, accessed in on October 2012)



They are asserted to be more flexible and "business friendly" because they gave more discretion to the forest sector and firms in implementing policy goals. Second, support, though growing, is weakest in tropical developing countries where so much scrutiny was first placed (figure 11). This relatively weaker uptake can be traced to the enduring challenges facing tropical forest degradation and the rather limited economic incentives from the EU and the US compared to the costs involved in implementing certification. Of course, there is some evidence that certification already has market based incentives for certification. Some studies have found price premiums for participation in certification in Malaysia (Kollert and Lagan 2007) while others have demonstrated that benefits such as increased market access, access to new markets, increased firm's reputation are also generated (Bouslah, M'Zali et al. 2010). While these studies are useful in explaining certifications growth, the limited presence of certification in much of the developing world demonstrates that certification still has challenges to overcome regarding global adoption (see figure 11).

5.3.2 Emergence of legality verification

Partly as a result of concerns regarding the effectiveness of global certification systems "legality verification" is now gaining increased interest a new policy instrument with which to combat the forest degradation and deforestation associated with illegal logging, which has been asserted to constitute some of the worst forest practices around the world (FAO 2001, Kaimowitz 2005), especially in tropical developing countries where biodiversity loss is seen as a global challenge (Tacconi 2007).

Legality verification is similar to certification as it relies on third party verification. Like forest certification, it also requires tracking products along supply chains, focusing greater attention on both the technical challenges and innovations for undertaking such an effort.

However, unlike certification, proponents do not have to rely on altruistic customers' support of eco-friendly practices, but can turn to trade law and other

intergovernmental mechanisms that will have the effect of removing illegal supply (or a portion of it) from global forest products. In addition, legality verification is generally viewed not as challenging sovereignty with additional rules and obligations, but instead as helping governments enforce their own domestic requirements. Similarly, legality verification efforts tend to be much more limited in policy scope focusing on a relatively narrower set of problems—illegal timber harvesting rather than prescribing a wider set of environmental and social standards through broader sustainable forest management solutions.

Despite, or because of, these more modest approaches, the current and potential support for legality is much greater and wider than that of forest certification. Those interested in promoting legality verification now comprise developed and developing country governments including their forest, foreign, international trade and development agencies, as well as environmental groups, forest research organizations, and forest industry associations.

Within the US and EU, legality verification has been championed for two primary reasons. First, there is growing recognition that, even if successful, a legally binding international agreement will have little "on the ground" effects in those countries with poor capacity, training and enforcement. Second, efforts to certify the best forest practices led, some critics asserted, to simply separating markets rather than improving on the ground results. Hence, legality verification emerged by drawing on similar ideas as certification, but emphasizing adherence to national laws and regulations.

6. IMPROVING THE RETURNS ON THE INVESTMENT: FINANCING FOR FORESTS FOR LONG-TERM RETURNS

One of the four Global Objectives of the Forest Instrument endorsed by the UN General Assembly is to "reverse the decline in official development assistance for sustainable forest management, and mobilize significantly increased, new, and additional financial resources from all sources for the implementation of sustainable forest management" (AGF 2012: Preface). To do so requires reliable knowledge about current sources of financing and the magnitude of flows from different sources. Indeed, sustainable flows

of increasing economic contributions from forests – both for the household and local and at the regional to national levels will require improvements in financial flows to improve data and management systems, promote technological innovations, and ensure the continued provision of non-economic ecosystem services. It is useful to consider the different sources of financing to assess prospects for enhanced financial flows for forest-linked economic development. Two dimensions – scale at which financing is feasible, and the social groups with an interest in forest-related investments – help consider the different possible sources for forest financing systematically. Table 7 below represents a way to conceptualize the different forms and scale of sources of forest financing.

Table 7: Sources of Forest Financing by Type and Governance Scale
(Adapted from AGF 2012 and Lemos and Agrawal 2006)

	International	**National**	**Regional/Local**
Public	--Bilateral aid agencies --Multilateral & intergovernmental financing institutions --Research institutions	--Central government revenue --Revenue from state-owned forests --Forest sector fiscal revenue --Trust funds --Research institutions	--State or Provincial government revenue --Municipal government revenue
Private	--Private forest owners --Forest industry --Institutional and individual investors	--Private forest owners --Forest industry --Institutional and individual investors	--Individual or family forest owners --Forest industry --Institutional and individual investors
Community	--Philanthropic funds and donors --NGOs	--Philanthropic funds and donors --NGOs	--Community forest owners --Philanthropic funds and donors --NGOs

Note: The table builds on a similar discussion in AGF 2012, but includes additional possible sources that provide substantial support to forest sustainability and management.

6.1 Financial flows related to forests

Given the large number and diversity of sources for forest financing, it is not easy to identify either the total financial flows to the forest sector, or the relative levels of different contributions. As in the case with economic contributions of forests,

particularly difficult to assess are financial and material flows at the local level and through non-government sources – whether these come from civil society organizations or from private market actors. The best data available provide a reasonably good picture for funding from international public sources (i.e. official development assistance).[3] But the poor quality of financial data for many other sources is a key gap. Without systematic knowledge about funding from these latter sources, estimates of total financing are at one level underestimates, and at another unreliable if the goal is to identify areas of greatest returns and potential improvements within the forest sector.

Further, existing OECD figures on funding flows include support for activities aiming towards sustainable use and conservation of forests, as also those that lead to deforestation. Such activities include road building, support for logging, and subsidies to forest products industries that distort incentives for industry actors, and encourage deforestation in areas where it is not economically remunerative (Sizer et al. 2000). In many cases, the same financial flow or project may include some funds that subsidize deforestation, and others that support forest sustainability.

Estimates of total forest financing needs globally suggest that this need ranges "between US$70 and US$ 160 billion per year" (AGF 2012). Globally, resources remain insufficient to address all the different areas of sustainable forest management in a balanced way, as defined in the forest instrument" (AGF 2012: vi). Other assessments put high price tags on costs of reducing deforestation. A recent report predicts that $40bn annually will be needed to halve global deforestation by 2030 (UNEP 2011). If the goal is to support higher than business-as-usual levels of afforestation and forest cover growth, additional funds will be necessary as well. These estimates are important not necessarily for the accuracy of the amounts being cited – indeed, the range of these estimates shows the limits of our existing knowledge base. But the numbers are certainly useful as indicators of the gap between funding available for forests from existing sources and even the most conservative estimated needs.

[3] The analysis of financial flows in the AGF is based on data from the OECD. In this paper, we complement the work with an analysis using the AidData database which is more comprehensive in its coverage of source and recipient countries.

6.1.1 International public investments in forests:

In developing estimates of international public investments for forests, it is important to distinguish between forestry ODA and forest ODA. Forestry ODA refers specifically to the forestry sector, including aid for forestry development, policy and administration management, research, education and training. The OECD, which uses this definition of forestry aid in their Creditor Reporting System (CRS) database, reports that the "vast majority of aid activities in the forestry sector target the objectives of the Rio Conventions (Biodiversity, Climate Change and Desertification)" (OECD-DAC 2008: 1). Forestry ODA may include newer kinds of forest-related aid, such as REDD+. Forest ODA, by comparison, includes forestry ODA as well as other financing activities related to forests. For example, a project classified as forest ODA may focus on major infrastructure construction that involves clearing forest land, which may or may not include support for reforestation or protection of some forest land. Thus, forest aid is a broader category that likely includes a greater proportion of aid that has negative impacts on forests. To identify all forest-related aid (not just forestry aid) we used the AidData compilation, which is the most comprehensive source of information on international aid currently available (Tierney et al. 2011). We searched for the word "forest" in the title or description of each project in AidData to identify all forest-related aid for the years 1970-2011. We also performed the same search in a subset of the database of projects (covering the years 1970-2008) coded as having a positive or neutral environmental impact in order to identify forest aid projects that were not likely to be detrimental to forests.

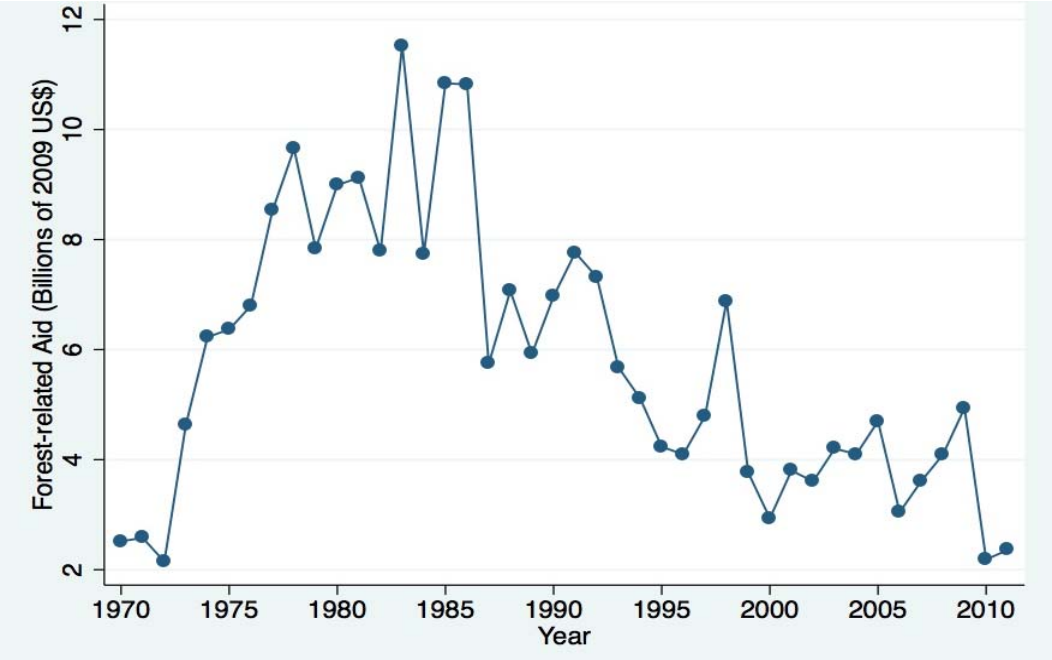
In general, forestry ODA, as classified as by the OECD-CRS, has been a major source of financing for capacity building, technology improvement, infrastructure development, and conservation in many African countries. Yet, only about 20% of the total forestry ODA is allocated to African countries. More than two-thirds of such assistance has gone to Asian countries, with the remaining 11% allocated to Latin American countries (AGF 2012). A review of OECD figures suggests that over the last decade, support for forestry activities has increased. Thus, total forestry ODA

disbursements more than doubled (from approximately US$ 560M to US$ 1.26B) between 2002-04 and 2008-10. The rise is most likely attributable to increases in REDD+ related activities and pilot programs.

A longer-term view of overall forest aid reveals a different picture, however. Our analysis of forest-related projects in the AidData database (AidData 2012) suggests that development support relating to forests has declined in recent years (Fig. 12). After a high of nearly US$12 billion in the mid-1980s and after renewed interest in forests around the formation of the GEF and the Rio Earth Summit in the early 1990s, forest-related aid has decreased by nearly 70% to an average of about US$3.5 billion annually since 2000. However, the overall amounts of aid we identify far exceed those reported by the OECD and AGF (US$1.26B in recent years). The difference in reported amount is due to the more comprehensive number of donors (Tierney et al. 2011)[4] included in AidData and our method of keyword searching to identify all forest-related aid projects not just those coded by the OECD or other donors as being in the forestry sector.

[4] Some notable bilateral donors included in AidData but not in the OECD Creditor Reporting System (CRS) database are Brazil, India, Kuwait, Poland, Saudi Arabia, and the United Arab Emirates. Some important multi-lateral donors either not included at all in the OECD-CRS database or with limited information (e.g. only for recent years) include the African Development Fund, African Development Bank, Congo Basin Forest Fund, Global Environment Facility, Islamic Development Bank and units of the World Bank.

Figure 12: All forest-related international aid, 1970-2011
(Source: AidData, 2013)

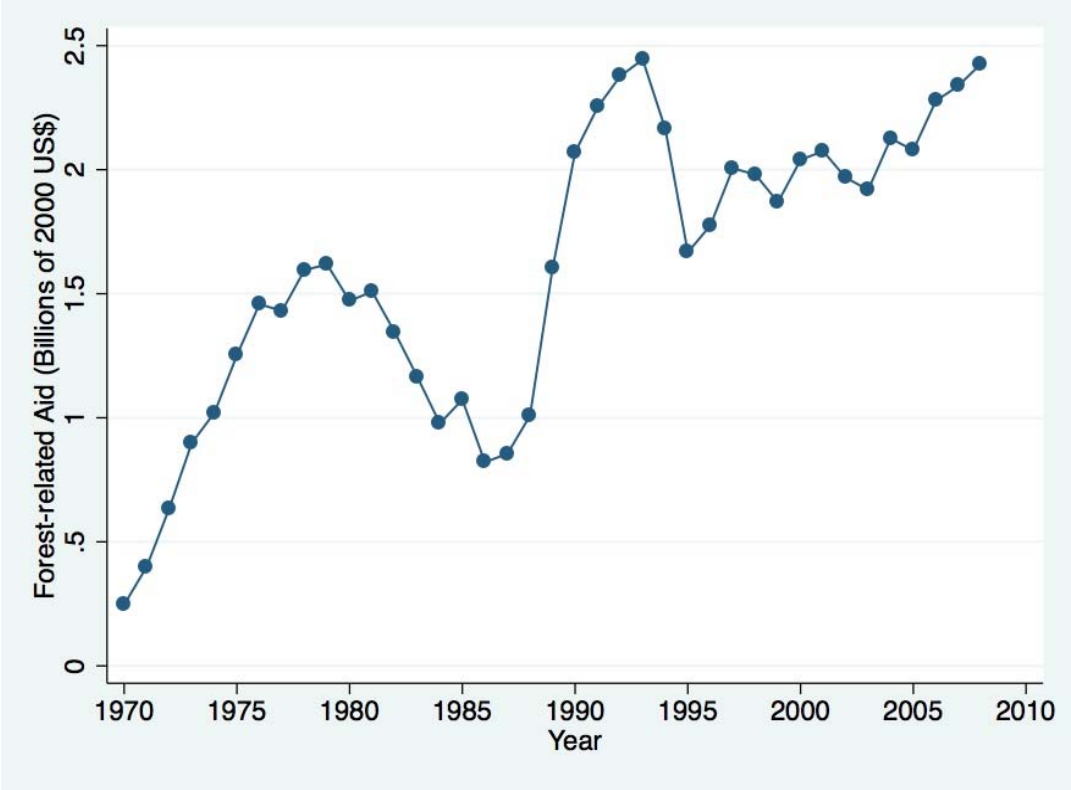


We also used the AidData database to identify the subset of aid projects likely to have either a positive or neutral impact on forests (i.e. does not harm forests).[5] The results are likely more comparable to those contained in the AGF report, which concludes that the fourth Global Objective on Forests, to "reverse the decline in official development assistance for sustainable forest management," has been achieved (2012: 24). We find that forest-related aid that does not harm forests has increased in the past five years and overall amounts (nearly US$ 2.5 billion annually) are approaching what

[5] Our method of identifying forest related aid likely to have a positive or neutral impact on forests involved a keyword search of all projects coded in one of three ways: 1) "environmental aid, broadly defined" – projects that are preventive in nature or that produce less immediate, more long term environmental benefits (e.g. disaster prevention, biodiversity conservation, and industrial reforestation), 2) "Environmental aid, strictly defined" – projects expected to produce significant, immediate environmental benefits (e.g., mitigation of transboundary air or water pollution) or 3) "environmentally neutral" – projects that are not likely to have an immediate or significant environmental impact (e.g., education and health aid). We excluded "dirty" projects or those coded as causing significant and immediate environmental harm (e.g., resource extraction & heavy industry) or causing moderate environmental harm over the long term (e.g., electricity distribution, hydro power). This coding methodology is explained in more detail in Hicks and colleagues (2008).

they were at the high water mark of aid for sustainable forestry in the early 1990s (Fig. 13).

Figure 13: Environmentally positive or neutral forest aid, 1970-2008[6]
(Source: AidData, 2013)



The increase in environmentally positive or neutral forest aid in comparison to trends in overall forest aid (Fig. 12) suggests that forest-related aid has become more "green" in recent years with considerably less aid given to projects detrimental to forests. However, the conclusion is inescapable that aid likely to have a positive impact on forests is still far less than estimated needs for sustainable forest management. Further, it is substantially less than either private sector or domestic government spending on forests.

6.1.2 Forest expenditures by national Governments

[6] Note: This figure shows forest-related aid using a five-year moving average to smooth frequently large inter-annual fluctuations in aid and better illustrate trends over time.

Aggregate numbers for national expenditures and investments in forests are hard to identify even as it is true that in most countries, domestic expenditures are higher than external support. As Tomaselli (2011: 11) puts it, forest financing is predominantly a domestic phenomenon in many countries.

The best publicly available compilation of such information, despite gaps for many countries, continues to be the Global Forest Resources Assessment produced by the FAO (2010). But this information is more incomplete than that on external ODA, with data on expenditures availably for only about half of the countries in the world. For the countries that there is information, it is evident that domestic expenditures are higher than are external funding flows, and that most countries generate more revenues from their forest estate than then invest in it. Revenue sources include fees on contracts, licenses, harvested products, processing and marketing of timber, taxes, export duties, fines, and ecotourism revenues from protected areas.

Table 8 below provides regional estimates of forest revenues and domestic *vs.* external public expenditures (including expenditures through civil society and research organizations) in the forest sector. It should be noted that the these estimates grossly under-represent the actual amounts because FAO data are reported for just about half

Table 8: Estimates of regional public revenues and expenditures on forests (in US$ M)
(Source: FAO 2010)

Region	Forest revenues	Domestic funding		External funding		Total	
		Opera-tional	Transfer	Opera-tional	Transfer	Opera-tional	Transfer
Africa	277	409	31	117	52	526	83
Asia	3733	1705	4997	12	42	1717	5039
Europe	5416	2271	1603	259	263	2530	1866
North America+ Caribbean	1340	5490	751	29	17	5519	768
Oceania	145	16	1	0	15	16	16
South America	3290	98	59	5	2	103	61
Total	14201	9989	7442	422	391	10411	7833

the countries in the world. For example, revenues from forests in the United States

were not reported – hence the unexpectedly low figure for North America! Even with the underreporting, it is evident that public revenues from forests are only a small proportion of the total economic contributions of forests. At UD$ 14 billion or so, they are less than 5% of the formal economic contributions of forests to national economies. Even if the actual revenues are double those reported and represented in table 8, the vast bulk of economic contributions of forests are privately appropriated. There is therefore a tremendous need to improve private investments in forests in the future.

6.1.3 Private investment including international flows (FDI)

Direct Investments (DI) are far and away the most important source of finance to support economic activities and employment in different sectors and forest-based activities are no exception. Direct investments can be divided in Foreign Direct Investment (FDI) and Domestic Direct Investments (DDI). In the case of forests, private sector involvement is mostly in the form of investments in forest managed for wood production – whether these be natural or plantation forests.

Over the last few years, there has been a significant shift in some FDI flows, particularly in terms of increasing origination within developing regions. Thus, in addition to the conventional flows of forest-related investments from developed to developing countries, there are also some erstwhile developing countries that are also investing in other developing countries: Chile in other LAC countries, China in Asia and Africa, and Malaysia in S. E. Asia and Africa. Thus, the pattern is rapidly changing to more south-south relationships (AGF, 2012: 35). Concrete information on the scale of these changes remains inconsistent and limited.

The World Bank and IMF have produced studies of private sector investment (FDI) in forests worldwide (e.g., IMF 2012). According to the World Bank (2006: Ch. 2), "Private investment in the forestry sector in developing countries and countries in transition is estimated at US$15 billion per year, or up to nine times more than current official development assistance flows. Others peg the level of private investment higher. Stuart Maginnis of IUCN (2012) argues that **"**global investment in commercial forestry is

over $150 billion per year… far more than the $12 billion or so spent on the forest sector each year by governments and aid agencies combined." Tomaselli (2011) also reports that the amount of DI in the forest sector (forestry, industry and trade) on a global scale exceeds US$ 60 billion a year, representing approximately 1% of total DI in the world.

The above numbers do not include domestic direct investments (DDI). If these are included in the financial flows for the forest sector, overall private financing may be several orders of magnitude larger than international flows for forests. But information on DDI in the forest sector is almost non-existent despite its importance in many countries (Tomaselli, 2006).

Substantial coordination of efforts to collect and extract national data on private sector investments is clearly warranted. Certainly, at least in some African countries, the forest sector's contributions to the economy, including through trade, are likely to be ten to twenty percent of the GDP (Gondo, 2012).

6.1.4 Philanthropy/NGOs

The scale of finance available from foundations and private NGOs is not large on a global scale, particularly in comparison to public and private investments but it can "represent a significant source of forest financing in some countries and regions. For example, during the period 2001-2010 the investments of the main philanthropic organizations in forest programmes/projects achieved an average of USD 47 million per year in LAC." (AGF, 2012: xii). This estimate, of course, included funds provided by NGOs many of whom depend of substantial injections of support from bilateral and multilateral organizations as well, leading at least to some double counting.

Examples of philanthropic support to forestry in Africa include forestry conservation in Zambia by the Bill & Melinda Gates foundation and small-scale forest enterprises and community forestry by the Ford Foundation in several countries in eastern and southern Africa (Gondo 2012). The Moore Foundation is a leading donor for forest conservation in the Amazon and in British Columbia. MacArthur Foundation focuses forest investments in biodiversity-rich areas in Asia, Africa, and Latin America.

NGOs, especially large international conservation NGOs like WWF, TNC, and CI, provide substantial amounts of financing for forests. "The combined annual budget of five international environmental NGOs was estimated as USD 2 billion in recent years" (AGF, 2012: 38) although much of this budget comes from public donors and private foundations.

6.1.5 Community/local forest owners

Although conventional studies of forest financing do not consider the investments made by local communities and users in forests, in fact such organizations invest substantial resources in effective forest management, and in translating forest products into livelihood benefits. Community-conserved forest landscapes in Africa, Asia, and Latin America aggregate to a minimum estimate of 370 million hectares, roughly 9% of the total forest area in the world (Molnar et al, 2004). Community members spend significant time, labor and financial resources on protecting and using these forests, and on developing forest management and conservation procedures. Molnar et al (2004) estimate that community forestry includes investments of about US$1.2-2.6 billion per year in forests. These are comparable to forest ODA flows for forests, but almost invisible because of their dispersed and informal nature.

6.1.6 Overall portrait of funding

Most of current international financial support for forests is delivered through traditional non-market sources including government budget allocations in the developed world and official development assistance (ODA) and philanthropy. But a substantial amount of support also occurs through market channels, primarily in the form of international and domestic capital flows and investments. Developing country budgetary allocations and local community level support for forest protection and use are other major sources of support for leveraging the economic contributions of forests.

6.2 Gaps and obstacle to higher financing

The above review of available financial flows and needs that can substantially improve economic contributions of forests in the medium to long run make it clear that current investments are insufficient in industrialized and developing countries, in high and low forest cover countries, as also in countries where the population depends on forests to higher degree vs those where the dependence is low. Gaps in financing for forests are particularly critical in many regions of Africa, but they can also be identified thematically around biodiversity conservation (Miller et al. 2013), environmental protection, enhancing ecosystem services, technological improvements, and support to smallholders. No major biodiversity rich nation allocates more than 1% of public expenditures to environmental protection (Parker and Cranford 2010). Although ecosystem services and biodiversity are under greatest threat in developing countries, it is in those countries that investments are the smallest. The access of small forest owners to needed finance remains limited (AGF 2012). And major technological improvements in forest industries receive only limited support.

6.2.1 Gaps in forest financing

A number of scholars have estimated the need for financing effective protected area management: their estimates range from US$ 12 to 30 billion (Balmford et al. 2002, Bruner et al. 2004, Dudley et al. 2008, James et al. 1999, UNEP 2012). These estimates typically include the cost of managing the existing network of protected areas, improving effectiveness of enforcement, and instituting new systems of compensation and payments to those whose economic livelihoods are adversely affected by the existence or creation of protected areas. Assuming that forests constitute 60 per cent of terrestrial protected areas (UNEP 2012), this would suggest a cost of US$ 7-18 billion per year for effective management of protected forests.

Apart from needed financing for forests in protected areas, the Informal Working Group on Interim Finance for REDD+ (IWG-IFR) estimates that a 25% reduction in global deforestation rates will require financing of USD 23-38 billion during the 2010-2015

period for results-based incentives and capacity building (IWG 2009). It is worth noting in this regard that despite high expectations, the promise of REDD+ and the anticipated funds supporting it have not materialized beyond the initial commitments. There has been a huge increase in work on forests in past few years driven by interest in climate change and forest contribution to mitigation, but actual action has been slow despite commitments. Some of the assumptions made in past years about sources of finance for forests are unlikely to turn out to be correct. Carbon markets have been to materialize than initially anticipated. Carbon trading based on credits based on avoided emissions or sequestered carbon in forests or agriculture is farther away than might have seemed a few years ago. And yet, a number of international agencies have yet to make that adjustment. The new World Bank environmental strategy, for example, focuses especially on carbon finance in the context of financing for forests.

Another major area of finance gap concerns investments in forests and related industries in countries with low forest cover and in small island nations, and for trees outside forests. High forest cover countries, particularly with high rates of deforestation, have substantial opportunities to tap into emerging opportunities related to forests such as those around REDD+, through payments for ecosystem services, and for afforestation and reforestation (Simula 2008). But countries with low forest cover such as Niger or other Sahelian nations have less potential to benefit from climate change related financing for forests (INdufor 2010). But financing may be especially important in those countries given limited forest cover and the importance of forests for addressing desertification and forest degradation from wood-based energy production.

Further, although carbon, biodiversity, and soil and erosion related services of forests have found public attention and financing, other aspects of sustainable forest management receive limited attention and funding. The significance of the multiple functions and dimensions of sustainable forest management are recognized only in a few quarters. It is not surprising therefore that “dry forests, trees outside of forests and agroforestry still constitute major gaps… as other types of forests, notably tropical rainforests” (AGF, 2012: 98). As forested landscapes increasingly resemble mosaics of

intact forests interspersed with farms with trees (AGF, 2012), the potential for smallholders to increase investments in and benefit from farm trees also continues to rise.

Investments in technologies that can improve the use and management of forests and forest products by increasing efficiencies, transparency, information sharing, and training and education have enormous future potential. Such technology, including remote sensing and geographic information systems (GIS) technologies, pulp and paper technology, bioenergy production technology and biotechnology development for a wide range of forest products, is likely to be critical in managing forests in a socially, environmentally and economically sound manner. But the wider availability of such technologies will require that users are able to secure needed financial resources, that appropriate institutional and policy structures are present, that there are trained and skilled human resources, and that information is more broadly and easily available.

6.2.2 Obstacles to increased support for forests

Obstacles to higher levels of forest financing include many factors that differ in relation to the source of financing streams. Where private investments in forests are concerned, such obstacles include lack of capacities and limited knowledge, inhospitable policies that discourage investment and allow corruption, outdated laws, constraining institutional arrangements, underdeveloped human capacities, and governance arrangements that subsidize and encourage inefficient forest management. In addition to these factors that clearly influence public funding flows, international assistance for forests may also be constrained by prevailing priorities of donor country governments and changes in priorities of foundations that may provide support for forests. Finally, support to forests from national governments and even at the local level by communities may be constrained by the specific institutional structures within which forest policies are implemented and the extent to which forests are regarded as a source of short term revenues *vs.* longer term assets whose efficient management will generate sustained incomes.

A longer term view of forests as national assets would require that the budgets of forest department reflect need for investments rather than needs for immediate economic returns. Given the slow growth rates of most forests, the market returns on commercially harvested products do not reflect all the social, ecological, and environmental benefits forests produce. Even where forests are owned privately, therefore, supplementary public investments are likely to be necessary. In general, there is no single solution that can address the need for forest financing. A mixture of measures is likely to be necessary to address the different kinds of obstacles to increased levels of needed support.

In terms of more specific obstacles to forest financing, two key factors to note are those related to governance and lack of information. Perceptions that a country is well governed and stability of the policy and institutional architecture is likely to enhance investor confidence, promote the belief the available finances will be utilized transparently and for intended purposes, and increase the credibility of the government as it solicits funds for the forest sector. Indeed, as the AGF points out, law enforcement is an essential function of a government, and "a flawed policy and legal framework and minimal law enforcement capacity" can impede both governance and flows of forest finance (2012: 95).

In a similar fashion, lack of information about the forest estate, its potential, and the best avenues towards which to direct funds for achieving social, environmental, and economic goals related to the use of forests will likely hinder financial flows. Indeed, both developing and developed countries often lack the financing needed to manage forests efficiently, especially owing to the absence of useful information about how forests are linked to other sectors such as agriculture, energy, tourism, and industry. Without such information, it is hard to know how supporting forests can also yield employment and economic benefits, leading to a low interest in supporting forests. Clear and reliable policies for allocating funds for forests and for attracting forest sector investments are likely to strengthen investor confidence and reduce the gap between estimated needs and actual flows. Clear tenure, tax incentives, and safeguards for forest

rights can both enhance sustainability and improve efficiency in the forest sector. But where legal arrangements are complex, poorly designed, or remain unenforced, the opposite is likely to occur.

6.3 Opportunities for investments

Although this section has elaborated on the gaps between needed forest finance and available flows, and described the different obstacles that prevent enhanced investments in the forest sector, it is important also to examine some of the major opportunities including some that have emerged recently. Higher economic payoffs by utilizing ecotourism opportunities around forests and in forest landscapes have already proved to be a winner a number of countries such as Costa Rica, Tanzania and Kenya, and Nepal. But many countries share this resource and can learn from the successful examples in this regard. Payments for ecosystem services programs, including ongoing efforts to develop improved mechanisms for carbon payments are another source of higher economic benefits from forests. Changes in how new lands are brought under expanding commodity agriculture by encouraging the planting of crops on degraded forest lands on which restoration is going to be difficult may simultaneously enhance some ecosystem services, improve livelihoods and incomes, and at the same time reduce the threat of deforestation in dense forest areas. Finally, mobilizing forest investments from small forest owners and supporting small and medium forest enterprises may be another path to improved economic benefits from forests.

7. Conclusion and Recommendations

Over the past millennia, material contributions from forests to household economies, community livelihoods, national incomes, and global output have been consequential and what is more, critical to continued economic development. Today, as they have for much of the last hundred years, forests stand at the intersection of continued economic development in a large swathe of tropical countries, global plans to craft an effective response to climate change mitigation and adaptation, and the conservation of

biodiversity. And yet, the general lens through which they are viewed by many forest agencies continues to be a holdover from colonial times promoting visions of forests as resources to be mined in the short run.

Attempts such as those undertaken in this paper to develop a systematic assessment of the full economic and financial contributions of forests run up against persistent problems of comparable data on forest cover, human dependence and use of forests, cash and non-cash flows from harvested forest products, and valuation of tourism that depends on forested landscapes. Nor is it possible in most countries to match available data on forests against data on poverty, different health indicators, indicators of economic activity, or institutional data on tenure and property rights at sub-national levels.

Thus data on various aspects of forests in relation to other social, economic, and institutional indicators are patchy in space and time, are very difficult to compare across countries and regions, and are insufficient as a firm basis for policy action. But even if the available data allow only a blurry picture of the extent of non-cash economic benefits forests provide and of the relative magnitude of cash *vs.* non-cash benefits, the information is sufficient to allow the inference that non-cash forest benefits are far larger than those derived from high-visibility forest products such as logs, timber, paper, and pulp that are exchanged for monetary gain. If the value of forest contributions exchanged for cash in the developing world is in the neighborhood of US$ 250 Billion, it is likely to be two to three times greater for benefits that are not exchanged for cash. If the total number of people employed in the formal forestry sector is around 13 million, the numbers of people employed in the informal sector for forests is nearer 45 to 50 million. These indicative numbers for the relationship between the size of the formal vs. the informal forest sector are sufficient for the conclusion that the informal sector is far larger than the formal, cash-valued forest sector.

Further, available evidence is also sufficient for the inference that non-cash benefits from forests are distributed far more widely than are cash benefits, and that they make a real difference in addressing poverty globally. Additionally, such benefits

are of particular importance to the poor during seasonal periods of food scarcity or when shocks occur as a result of crop failures, the death of a key household member, loss of employment and so on.

Two key recommendations flow from these observations. Better forest data must be collected systematically, particularly on the non-cash and informal benefits forests generate through NTFPs and NWFPs. Because the value of these products is likely to be two to three times greater than that of products exchanged for cash incomes (based on available evidence), and because these products are critically important as buffers during periods of scarcity and as nutrition for the cash poor, better information on them is needed to manage their supply and distribution more effectively. Second, even without a globally coordinated effort to collect this data, it is clear that forest agencies and decision makers in specific countries and localities can do better to address the needs of forest-dependent peoples – numbering between 1 to 1.5 billion - by clarifying the institutional arrangements, improving participation, and strengthening governance around the allocation of these forest products.

The economic contributions that forests make are a global public good of tremendous importance and value, and better data on them is needed. Emerging data collection technologies based on mobile devices and citizen science-based efforts to gather information can be mobilized to create a better picture of the distribution of non-cash benefits from forests in space and time as also across different social groups. Collaboration across different government agencies to integrate datasets, and create a more systematic picture of the role of forests will also be necessary. And there is an obvious role here for catalytic donor funding to create the data and digital infrastructure within which new data can be housed and on the basis of which the analysis of such data can be undertaken. Such multi-pronged efforts are critical to improved measurement, calculation, and analysis of the economic contributions from forests. More importantly, better and more efficient governance of the global forest estate depends on advances in knowledge that such data will make possible. Without such additional data, it is more than likely that the current focus of forestry agencies on

timber, logs, and paper will continue indefinitely into the future. Without better information, better decisions are not possible.

Despite gaps in data, it is also evident that the measurable economic contributions of forests, as a proportion of the overall size of the global economy and of various national economies, have been falling during the past four decades. Thus, the absolute value of forest-based economic output has increased, but at the same time the relative value of forest-related economic benefits has declined along a number of important dimensions, often by as much as 50 percent. Thus, forest output has fallen from being more than 1.6% to less than 1% of formal global GDP. The share of the forest sector in formal employment has declined from 0.7% to a little less than 0.4% of the global labor force. And forest products as a share of merchandise exports have gone down to 2.4% of global exports from being more than 3.5% - all in the space of the last thirty years. This decline has been more rapid than that in the area of forests (through deforestation), and is mainly the result of growth in other economic sectors outstripping that for forests.

The lessons from this decline are evident: professionals in the forest sector must come up with strategies to connect their concerns more integrally with those of decision makers in other sectors of the economy, environment, and the polity. The critical role of forests in buffering the poor, , enabling a more equitable distribution of resources, and in the greater efficiency of various social safety net programs needs to be brought to the fore better. If there is a need for forestry agencies to move out of the silos in which they are located so as to create better data, the same need to look and engage outwards is also of basic importance to strengthen the role and relevance of forests to a rapidly changing economic and social landscape.

Investments in forests and forest financing have conventionally focused on international flows and development assistance. But even a brief survey of reported data shows that the bulk of economic contributions of forests are privately appropriated. Of the reported US$ 280 billion or so in formal economic contributions of forests, less than 10% is received as public revenues – most of the rest goes to market

and civil society organizations. Nearly all non-cash contributions are appropriated privately. Future improvements in the forest sector must mobilize private investments and information to strengthen governance, increase output, and create greater efficiencies.

In this context, a greater focus on improving employment possibilities in the informal forest sector can yield rich dividends by helping formalize the recognition of forests in promoting employment opportunities, and by doing so at relatively low levels of investment per job created. Clarifying and streamlining the legal environment for small and medium forest enterprises, financial incentives and skill development for promoting them, improving their products, and strengthening their performance, and incentivizing exports of processed forest products are all steps that can help improve the performance of the forest sector in formal terms.

References

Adhikari, J. and Hobley, M., (2011) The Effects of Migration from Khotang District to the Gulf and Malaysia. Switzerland, SDC

Advisory Group on Finance (AGF), C. P. o. F. (2012). *2012 Study on Forest Financing*. New York, Collaborative Partnership on Forests.

AidData (2012). www.aiddata.org.

Alexiades, M.N and Shanley, P., Eds (2005). *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems*. Volume 3 - Latin America. Bogor, CIFOR.

Allen, J. and Barnes, D. 1985. The causes of deforestation in developing countries. *Annals of the Association of American Geographers* 75(2): 163-184.

Andam, K. S., P. J. Ferraro, P., Pfaff, A. Sanchez-Azofeifa, G and Robalino, J. 2008. Measuring the effectiveness of protected area networks in reducing deforestation. *Proceedings of the National Academy of Sciences* 105:16089-16094.

Andersson, K. and C. C. Gibson (2007). "Decentralized governance and environmental change: local institutional moderation of deforestation in Bolivia." *Journal of Policy Analysis and Management* 26(1): 99-123.

André, M. F. (1998). Depopulation, land-use change and landscape transformation in the French Massif Central. *Ambio*, *27*(4), 351-353.

Angelsen, A. and Kaimowitz, D. (1999). Rethinking the causes of deforestation: Lessons from economic models. *World Bank Research Observer* 14(1): 73-98.

Angelsen, A., & Kaimowitz, D. (Eds.). (2001). *Agricultural technologies and tropical deforestation*. CABI.

Angelsen, A. (2007). Forest cover change in space and time: combining the von Thunen and forest transition theories. *World Bank policy research working paper*, (4117).

Angelsen, A. (2010). Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences*,*107*(46), 19639-19644.

Arce-Nazario, J. A. (2007). "Human landscapes have complex trajectories: reconstructing Peruvian Amazon landscape history from 1948 to 2005." *Landscape Ecology* 22: 89-101.

Arnold, M (2004) Introduction. *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Volume 1 - Asia*. (eds Kusters, K and Belcher, B).

Bogor, CIFOR

Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J., and Mathys, E. (2009) “The economic contribution of forest resource use to rural livelihoods in Tigray, Northern Ethiopia” *Forest Policy and Economics* 11 (2009) 109–117

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., and Turner, R. (2002). "Economic Reasons for Conserving Wild Nature." *Science* 297(5583): 950-953.

Balmford, A., Fisher, B., Green, R., Naidoo, R., Strassburg, B., Tuner, R., and Rodrigues, A. (2011). "Bringing ecosystem services into the real world: an operational framework for assessing the economic consequences of losing wild nature." *Environmental and Resource Economics* 48(2): 161-175.

Balslev, H., (2011) “Palm Harvest Impacts in North-Western South America.” *Botanical Review* 77: 370-380. The New York Botanical Garden

Barik, S. and S. Mishra (2008). "Assessment of the contribution of forests to the economy of the northeastern states of India." *International Forestry Review* 10(2): 349-361.

Barton, G. (2001). "Empire forestry and the origins of environmentalism." *Journal of Historical Geography* 27(4): 529-552.

Belcher, B and Kusters, K (2004). “Non-timber forest product commercialisation: development and conservation lessons“. *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Volume 1 - Asia*. (eds Kusters, K and Belcher, B). Bogor, CIFOR

Bernstein, S. and B. Cashore (2007). "Can non-state global governance be legitimate? An analytical framework." *Regulation & Governance* 1(4): 347-371.

Best, A., Giljum, S., Simmons, C., Blobel, D., Lewis, K., Hammer, M., Cavalieri, S., Lutter, S., and Maguire, C. 2008. *Potential of the Ecological Footprint for monitoring environmental impacts from natural resource use: Analysis of the potential of the Ecological Footprint and related assessment tools for use in the EU’s Thematic Strategy on the Sustainable Use of Natural Resources*. Report to the European Commission, DG Environment.

Blaikie, P. and Springate-Baginski, O., (2007) “Participation or Democratic Decentralisation: Strategic Issues in Local Forest Management”. *Forests, People and Power: The Political Ecology of Reform in South Asia* (Eds Springate-Baginski, O. and Blaikie, P). London, Earthscan.

Bouslah, K., M’Zali, B., Turcotte, M., and Kooli, M. (2010). "The impact of forest certification on firm financial performance in Canada and the US." *Journal of business ethics* 96(4): 551-572.

Bruner, A. G., Gullison, R., and Balmford, A. (2004). "Financial Costs and Shortfalls of Managing and Expanding Protected-Area Systems in Developing Countries." *BioScience* 54(12): 1119-1126.

Carr, M., Chen, M., and Tate, J. (2010). “Globalization and Home-Based Workers”. *Feminist Economics* 6(3), 2000, 123–142

Cashore, B., Auld, G., and Newsom, D. (2004). *Governing through markets: Forest certification and the emergence of non-state authority*. New Haven: Yale University Press.

Cashore, B. (2002). Legitimacy and the Privatization of Environmental Governance: How Non State Market-Driven (NSMD) Governance Systems Gain Rule Making Authority. *Governance* 15(4): 503-529.

Cashore, B., Gale, F., Meidinger, E., and Newsom, D. (2006). "Forest certification in developing and transitioning countries: part of a sustainable future?" *Environment: Science and Policy for Sustainable Development* 48(9): 6-25.

Chhatre A. and Agrawal, A. (2009). Tradeoffs and synergies between carbon storage and livelihood benefits from forest commons. *PNAS* 106(42): 17667-17670.

Chomitz, K. M. and Gray, D. A. (1996). Roads, landuse, and deforestation: A spatial model applied to Belize. *World Bank Economic Review* 10(3): 487-512.

Chomitz, K. and Kumari, K. (1998). The Domestic Benefits of Tropical Forests: A Review. *The World Bank Research Observer* 13(1): 13-35.

Coomes, O. T., Takasaki, Y., and Rhemtulla, J. (2011). "Land-use poverty traps identified in shifting cultivation systems shape long-term tropical forest cover." *Proceedings of the National Academy of Sciences* 108(34): 13925-13930.

Cropper, M., Puri, J., and Griffiths, C. (2001) ‘How the location of roads and protected areas affects deforestation in North Thailand’. *World Bank Policy Research Paper no 2583*. Development Research Group, Infrastructure and Environment. World Bank Washington.

Daviron, B. and S. Ponte (2005). *The coffee paradox: Global markets, commodity trade and the elusive promise of development.* Zed books.

Delang, C. O. (2006). "Not just minor forest products: The economic rationale for the consumption of wild food plants by subsistence farmers." *Ecological Economics* 59(1): 64-73.

Delang, C. O. (2006). "Indigenous systems of forest classification: Understanding land use patterns and the role of NTFPs in shifting cultivators’ subsistence economies."

Environmental management 37(4): 470-486.

Deninger, K. and Minten, B. (2002). Determinants of Deforestation and the Economics of Protection: An Application to Mexico. *American Journal of Agricultural Economies*. 84(4): 943-960.

Dev, O.P., and Adhikari, J. (2007) "Community Forestry in the Nepal Hills: Practice and Livelihood Impacts". *Forests, People and Power: The Political Ecology of Reform in South Asia* (Eds Springate-Baginski, O. and Blaikie, P.) London, Earthscan.

Dietz, T., Ostrom, E., and Stern, P. (2003). "The struggle to govern the commons." *Science* 302(5652): 1907-1912.

Dlamini, C.S., and Geldenhuys, C.J., (2011) "Towards a theoretical framework for the management of non-timber forest products (NTFPs) in Swaziland: A review" *Journal of Geography and Regional Planning* 4(14): 715-730.

Drake, W. D. 1993. Towards building a theory of population-environment dynamics: A family of transitions. In *Population-environment dynamics*, eds. Ness, G. Drake, W. D. and Brechin, S., 305–355. Ann Arbor: University of Michigan Press.

Dudley, N., Mansourian, S., Stolton, S., and Suksuwan, S. (2008). *Safety net: protected areas and poverty reduction. Arguments for protection*. Gland, Switzerland, World Wildlife Fund and Equilibrium.

Eriksson, S., Skånes, H., Hammer, M., & Lönn, M. (2010). Current distribution of older and deciduous forests as legacies from historical use patterns in a Swedish boreal landscape (1725–2007). *Forest Ecology and Management*,*260*(7), 1095-1103.

Evans, T. P., Donnelly, S., and Sweeney, S. (2010). "Threats to the Forest Transition in the Midwest United States." In *Reforesting Landscapes*: eds. Harini Nagenda and Jane Southworth. pp. 175-203. Springer.

Falconer, J., (1990) *The Major significance of 'minor' forest products: The Local Use and Value of Forests in the West African Humid Forest Zone*. FAO Rome

Falconer, J and Arnold JEM, (1991). *Household food security and forestry: an analysis of socio-economic issues*. Community Forestry Note 1, FAO, Rome.

FAO (2006). *State of the World's Forests 2006*. Rome, FAO

FAO (2006). "Forests and Human Health." *Unasylva* 57(2): Special Issue.

FAO (2007). *State of the World's Forests 2007*. Rome, FAO

FAO (2008). *State of the World's Forests 2008*. Rome, FAO

FAO (2009). *State of the World's Forests 2009*. Rome, FAO

FAO (2010). *State of the World's Forests 2010*. Rome, FAO

FAO (2010). *Criteria and indicators for sustainable woodfuels*. FAO Forestry Paper No. 160. Rome, FAO.

FAO (2011). *State of the World's Forests 2011*. Rome, FAO

FAO (2012). *State of the World's Forests 2012*. Rome, FAO

Ferraro, P. J., Lawlor, K., Mullan, K., and Pattanayak, S. (2012). "Forest Figures: Ecosystem Services Valuation and Policy Evaluation in Developing Countries." *Review of Environmental Economics and Policy* 6(1): 20-44.

Fold, N. (2002). "Lead Firms and Competition in 'Bi-polar'Commodity Chains: Grinders and Branders in the Global Cocoa-chocolate Industry." *Journal of Agrarian Change* 2(2): 228-247.

Foster, D. R. (1992). Land-use history (1730-1990) and vegetation dynamics in central New England, USA. *Journal of Ecology*, 753-771.

Fredericks, P., Radzik, V., Macqueen, D., (2012) "Report on Forest Connect Guyana experiences. North Rupununi District Development Board, Annai, North Rupununi, Guyana" Supporting small forest enterprises. Reports from the field: Guyana IIED Series.

Fu, Y., Chen, J., Guo, H., Chen, A., Cui, J., and Hu, H (2009a) "The role of non-timber forest products during agroecosystem shift in Xishuangbanna, southwestern China. *Forest Policy and Economics* 11 (2009) 18–25

Fu, Y., Chen, J., Guo, H., Hu, H., Chen, A., and Cui, J. (2009b) "Rain forest dwellers' livelihoods: income generation, household wealth and NTFP sales : a case study from Xishuangbanna, S W China". *International Journal of Sustainable Development and World Ecology* 16(5): 332-338

Geist, H. J. and E. F. Lambin (2002). "Proximate causes and underlying driving forces of tropical deforestation." *BioScience* 52(2): 143-150.

Gilbert, C. L. (2006). International commodity agreements: An obituary note. *World Development* 24(1): 1-19.

Gilbert, C. L. (2008). "Value chain analysis and market power in commodity processing with application to the cocoa and coffee sectors." *Commodity market review*: 5-34.

The Global Environment Facility (GEF). (n.d.) A New Climate for Forests: GEF Action on Sustainable Forest Management. Washington, DC: The GEF.

Godoy, R., D. Wilkie, H. Overman, A. Cubas, G. Cubas, J. Demmer, K. McSweeney, and N. Brokaw. (2000). Valuation of consumption and sale of forest goods from a Central American rain forest. *Nature* 406:62–63.

Gondo, P. (2012). *Forest Financing in Africa*. New York: UNFF.

Grainger, A. (1995). "The forest transition: an alternative approach." *Area:* 242-251.

Grainger, A. 1993. *Controlling Tropical Deforestation*. Earthscan: London.

Greig-Gran, M., Guijt, I., and Peutalo, B. (2002) "Local perspectives in forest values in Papua New Guinea. The search for participatory methods". Hidden Harvest Research Series Vol 3 (5) London, IIED.

Guha, R (2000) *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya, Expanded Edition*. Berkeley: University of California Press.

Gutiérrez-Vélez, V. H., DeFries, R., Pinedo-Vasquez, M., Uriarte, M., Padoch, C., Baethgen, W., Fernandes, K. and Lim, Y. (2011). "High-yield oil palm expansion spares land at the expense of forests in the Peruvian Amazon." *Environmental Research Letters* 6(4): 044029.

Haenn, N. (2006). "The changing and enduring ejido: a state and regional examination of Mexico's land tenure counter-reforms." *Land Use Policy* 23(2): 136-146.

Haggblade, S., Hazell, P and Reardon, T. (2002). "Strategies for stimulating poverty-alleviating growth in the rural non-farm economy in developing countries". EPTD Discussion Paper No 92. Washington, Environment and Production Technology Division IFPRI, and Rural Development Department, The World Bank.

Hayes, T. M. (2006). Parks, people, and forest protection: an institutional assessment of the effectiveness of protected areas. *World Development 34*(12), 2064-2075.

Heidhues, F., Atsain, A., Nyangito, H., Padilla, M., Ghersi, G., and Le Vallée, J-C (2004) "Development Strategies and Food and Nutrition Security in Africa: An Assessment". 2020 Discussion Paper 38. *International Food Policy Research Institute.* Washington.

Hicks, R. L., Parks, B. C., Roberts, J. T., & Tierney, M. J. (2008). Greening aid. *Understanding the Environmental Impact of Development Assistance*. Oxford University Press.

Huber, F., Ineichen, R., Yang, Y., Weckerle, C. S., (2010) "Livelihood and Conservation Aspects of Non-wood Forest Product Collection in the Shaxi Valley, Southwest China." *Economic Botany* 64(3), 189–204.

IIED (2012) "Forest Connect in-country experiences in Nepal." Asia Network for Sustainable Agriculture and Bioresources (ANSAB). London, IIED

IMF (2012). IMF Data and Statistics. http://www.imf.org/external/data.htm.

Ingram, V., Ndoye, O., Iponga, D.M., Tieguhong, J.C., and Nasi, R. (2005) “Non-timber forest products: contribution to national economy and strategies for sustainable management” CIFOR, FAO and IRET

Ireson, C. (1991) “Women’s forest work in Laos” *Society and Natural Resources* 4: 23-86.

IWG. (2009). Report on the Informal Working Group on Interim Finance for REDD+ (IWG/IFR), Informal Working Group on Interim Finance for REDD+.

James, A. N., Gaston, K., and Balmford, A. (1999). "Balancing the Earth's accounts." *Nature* 401(6751): 323-324.

Johannessen, S. and H. Wilhite (2010). "Who Really Benefits from Fairtrade? An analysis of value distribution in Fairtrade coffee." *Globalizations* 7(4): 525-544.

Joppa, L., and Pfaff, A. (2009) High and far: Biases in the location of protected areas. *PLoS ONE* 4(12):e8273

Kaimowitz, D. (2005). "Useful myths and intractable truths: the politics of the link between forests and water in Central America." *Forest-water-people in the humid tropics* (eds Bonell M, Bruijnzeel LA): 86-98.

Kar, S.P., and Jacobson, M.G., (2012) “NTFP income contribution to household economy and related socio-economic factors: Lessons from Bangladesh”. *Forest Policy and Economics* 14: 136–142

Karsenty, A. (2007). Overview of Industrial Forest Concessions and Concession-based Industry in Central and West Africa: And Considerations of Alternatives, CIRAD.

Keller, M., Asner, G., Blate, G., McGlocklin, J., Merry, F., Pena-Claros, M., and Zweede, J.(2007). "Timber production in selectively logged tropical forests in South America." *Frontiers in Ecology and the Environment* 5(4): 213-216.

Kerkhof, P., (2000) *Local Forest Management in the Sahel: towards a new social contract*. (DFID-FRP project R6510) London, SOS Sahel.

Kozak, R. (2007) “Small and Medium Forest Enterprises: Instruments of Change in the Developing World.” Rights and Resources Initiative.

Kumar, P., Ed. (2012). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. London, Earthscan-Routledge.

Kusters, K and Belcher, B., Eds (2004). *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems*. Volume 1 - Asia. Bogor, CIFOR

Laird, S,A., McLain, R.J. and Wynberg, R,P., (2010). *Wild Product governance: finding policies*

that work for non-timber forest products. London, Earthscan.

Lebedys, A. (2008). Contribution of the Forestry Sector to National Economies, 1990-2006. FAO, Rome.

Legesse, G., Teklewold, H., Alemu, D., and Negassa, A. (2008). "Live animal and meat export value chains for selected areas in Ethiopia: Constraints and opportunities for enhancing meat exports." International Livestock Research Institute. Improving Market Opportunities Discussion Paper 12.

Lemos, M. C., & Agrawal, A. (2006). Environmental governance. *Annu. Rev. Environ. Resour.*, *31*, 297-325.

Lewis, J., (2005). "Whose Forest is it anyway? Mbendjele Yaka Pygmies, the Ndoki Forest and the Wider World" *Property and Equality, Vol. 2 Encapsulation, Commercialisation, Discrimination.* (Eds Widlok, T., and Tadesse, W) Oxford and New York, Berghahn Books.

Macedo, M. N., DeFries, R., Morton, D., Stickler, C., Galford, G., and Shimabukuro, Y. (2012). "Decoupling of deforestation and soy production in the southern Amazon during the late 2000s." *Proceedings of the National Academy of Sciences* 109(4): 1341-1346.

Macqueen, D. (2008) *Supporting small forest enterprises – A cross-sectoral review of best practice*. IIED Small and Medium Forestry Enterprise Series No. 23. IIED, London, UK

Marcoux, C., Peratsakis, C., Roberts, T., and Tierney, M. (2012). Environmental Impact Codes for AidData 2.0. at College of William and Mary. Mary. Williamsburg, VA.

Margulis, S. 2004. *Causes of deforestation in the Brazilian Amazon*. World Bank: Washington DC.

Marshall, E and Newton, A., (2003) "Non-Timber Forest Products in the Community of El Terrero, Sierra de Manantlán Biosphere Reserve, Mexico: Is Their Use Sustainable?" *Economic Botany* 57(2): 262-278.

Maskey, V., Gebremedhin, T., and Dalton, T. (2006). "Social and cultural determinants of collective management of community forest in Nepal." *Journal of forest economics* 11(4): 261-274.

Mather, A. (1992). The forest transition. *Area* 24: 367-379.

Mather, A. and C. Needle (1998). The forest transition: a theoretical basis. *Area* 30: 117-124.

McGee LaRue, H. and A. Agrawal. 2013. Drivers of deforestation and forest governance: Explaining changes in forests. *IFRI working paper* #2013-2. Ann Arbor, University of Michigan.

Menton, M. C. S., Merry, F. D., Lawrence, A., Brown, N., (2009) "Company–community logging contracts in Amazonian settlements: impacts on livelihoods and NTFP harvests" *Ecology and Society* 14(1): 39.

Michaelowa, A. and K. Michaelowa (2011). Coding Error or Statistical Embellishment? The Political Economy of Reporting Climate Aid. *World Development* 39(11): 2010-2020.

Miller, D., Agrawal, A., and Roberts, T. (2013). "Biodiversity, Governance, and the Allocation of International Aid for Conservation." *Conservation Letters*: 12-20.

Molnar, A., Scherr, S., and Khare, A. (2004). *Who Conserves the World's Forests? Community-Driven Strategies to Protect Forests and Respect Rights*. Washington, DC, Forest Trends and Ecoagriculture Partners.

Nagendra, H. (2010). "Reforestation and regrowth in the human dominated landscapes of South Asia." *Reforesting Landscapes*: 149-174.

Naylor, R. L. (1996). "Energy and resource constraints on intensive agricultural production." *Annual review of energy and the environment* 21(1): 99-123.

Negassa, A. and M. Jabbar (2008). Livestock ownership, commercial off-take rates and their determinants in Ethiopia, ILRI (ILCA and ILRAD).

Nketiah, K., Owusu, K.A., Macqueen, D., (2011) Forest Connect Ghana – progress and impact. Tropenbos International Ghana, Kumasi

Ojea, E., Martin-Ortega, J., and Chiabai, A. (2012). "Defining and classifying ecosystem services for economic valuation: the case of forest water services." *Environmental Science and Policy* 19-20(0): 1-15.

Organization for Economic Development and Co-operation Development Assistance Committee. (OECD-DAC 2008). Measuring Aid to Forestry. http://www.oecd.org/dac/stats/41699327.pdf

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

Pagdee, A., Kim, Y., and Daugherty, P. (2006). What makes community forest management successful: A meta-study from community forests throughout the world. *Society and Natural Resources* 19(1): 33-52.

Parker, C., Cranford, M., Oakes, N., and Leggett, M., Eds. (2012). The Little Biodiversity Finance Book. Oxford, UK, Global Canopy Programme.

Paumgarten, F. and Shackleton, C. (2011) "The role of non-timber forest products in household coping strategies in South Africa: the influence of household wealth and gender" *Population and Environment* 33:108–131

Peluso, N. L. and P. Vandergeest (2001). "Genealogies of the political forest and customary rights in Indonesia, Malaysia, and Thailand." *The Journal of Asian Studies* 60(3): 761-812.

Persha, L., Agrawal, A., and Chhatre, A. (2011). "Social and Ecological Synergy: Local

Rulemaking, Forest Livelihoods, and Biodiversity Conservation." *Science* 331(6024): 1606-1608.

Perz, S. G. and S. D.L. (2003). "Secondary forest expansion in the Brazilian Amazon and the refinement of forest transition theory." *Society and Natural Resources* 16: 277-294.

Pfaff, A., Robalino, J., Sanchez-Azofeifa, G., Andam, K., & Ferraro, P. (2009). Park location affects forest protection: Land characteristics cause differences in park impacts across Costa Rica. *The BE Journal of Economic Analysis and Policy*, *9*(2), 5.

Phelps, J., Webb, E., and Agrawal, A. (2010). Does REDD+ Threaten to Recentralize Forest Governance? *Science* 328(5976): 312-313.

Polasky, S. (forthcoming). Conservation Economics. *Conservation Social Science: Understanding People, Conserving Biodiversity.* M. B. Mascia. Malden, MA, Wiley-Blackwell.

Ponte, S. (2002). The latte revolution'? Regulation, markets and consumption in the global coffee chain. *World Development* 30(7): 1099-1122.

Ponte, S. and P. Gibbon (2005). Quality standards, conventions and the governance of global value chains. *Economy and society* 34(1): 1-31.

PROFOR (2008) *Poverty and Forests Linkages: a Synthesis and Six Case Studies*. Washington, World Bank

Rattanasorn, T., Fisher, R., and Kugel, C (2012) Unusual partnerships: lessons for landscaper and livelihoods from the Doi Mae Salong Landscape, Thailand. IICN, Gland, Switzerland.

Ribot, J. C., Agrawal, A. and Larson, A. (2006). "Recentralizing While Decentralizing: How National Governments Reappropriate Forest Resources." *World Development* 34(11): 1864-1886.

Rich, K. M., Ross, R., Baker, A., and Negassa, A. (2011). "Quantifying value chain analysis in the context of livestock systems in developing countries." *Food Policy* 36(2): 214-222.

Richards, J. F. and R. P. Tucker (1988). *World deforestation in the twentieth century*. Durham: Duke University Press.

Robalino, J., & Pfaff, A. (2011). Eco-payments and Forest Loss in Costa Rica: all dressed up but nowhere to avoid deforestation. *Unpublished manuscript, CATIE and Duke University*.

Rudel, T. K. (2010). "Three Paths to Forest Expansion: A Comparative Historical Analysis." *Reforesting Landscapes:* 45-57.

Rudel, T. K., DeFries, R., Asner, G., and Laurance, W. (2009). "Changing drivers of deforestation and new opportunities for conservation." *Conservation Biology* 23(6): 1396-1405.

Rudel, T. K. (2005). *Tropical forests: regional paths of destruction and regeneration in the late*

twentieth century. New York: Columbia University Press.

Rudel, T., Coomes, O., Moran, E., Achard, F., Angelsen, A., Xu, J., and Lambin, E. (2005). Forest transitions: towards a global understanding of land use change. *Global Environmental Change* 15: 23-31.

Rudel, T. K. (2001). Did a green revolution restore the forests of the American South. *Agricultural technologies and tropical deforestation*: 53-68.

Rudel, T. (1989). Population, development, and tropical deforestation: A cross national study. *Rural Sociology* 54(3): 3270338.

Saigal, S., and Bose, S. (2003), *Small-scale Forestry Enterprise in India*, Small and Medium Forest Enterprises Series, No. 6, Winrock International India (WII) and International Institute for Environment and Development (IIED), London, UK.

Senaratne, A., Abeygunawardena, P., and Jayatilake, W. (2003) "Changing role of NTFPs in rural household economy. The case of Sinharaja World Heritage Site in Sri Lanka" *Environmental Management* 32(5): 559-571

Seuring, S. and M. Müller (2008). "From a literature review to a conceptual framework for sustainable supply chain management." *Journal of cleaner production* 16(15): 1699-1710.

Shackleton, S., Shanley, P., and Ndoye, O . (2007) "Invisible but viable: recognising local markets for non-timber forest products." *International Forestry Review* 9(3): 697-712

Shackleton, C., Shackleton S., and Shanley, P., (2011) *Non-TImber Forest Products in the Global Context*. Tropical Forestry. Berlin, Springer-Verlag.

Shackleton, S., Paumgarten, F., Kassa, H., Husselman, M., and Zida, M. (2011b) "Opportunities for Enhancing Poor Women's Socioeconomic Empowerment in the Value Chains of Three African Non-Timber Forest Products" *International Forestry Review*, vol 13(2):136-151.

Sheil, D., and Liswanti, N. (2006) "Scoring the importance of tropical forest landscapes with local people: patterns and insights". *Environmental Management* vol 38 (1): 126-136.

Sheil, D., Puri, R., Wan, M., Basuki, I., van Heist, M., Liswanti, N., Rukmiyati, Rachmatika, I., and Samsoedin, I. (2006) "Recognizing Local People's Priorities for Tropical Forest Biodiversity" *Ambio* 35(1): 17-24.

Shepherd, G., with NGOs PEMALI, Kaimana, and PERDU, Manokwari. (2009). "People and forest-based livelihoods in Kaimana District, West Papua: planning a sustainable future". Gland, IUCN.

Shepherd, G. (2010). *The ecosystem approach in Anjouan, Comoro Islands: managing the integration of diverse landscape choices*. Bristol Conservation and Science Foundation, and Darwin Initiative, Bristol and London, UK.

Shepherd, G., (2012) Rethinking Forest Reliance: findings about poverty, livelihood resilience and forests from IUCN's 'Livelihoods and Landscapes' strategy. Gland, IUCN.

Shepherd, G., Kazoora, C., and Müller, D. (2012) Forests, Livelihoods and Poverty Alleviation: the Case of Uganda. FAO, Rome

Simula, M. (2008). Financing Flows and Needs to Implement the Non-Legally Binding Instrument on All Types of Forests. New York: UNFF.

Sizer, N., Gale, R., Gale, F., Okazaki, T., Wolf, R., Cardoso, C., and Fukuda, M. (2000). Perverse Habits: The G8 and Subsidies that Harm Forests and Economies. *WRI Forest Notes*

Song, C. and Y. Zhang (2010). "Forest cover in China from 1949 to 2006." *Reforesting Landscapes*: 341-356.

Staaland, H., Holand, Ø., Nellemann, C., & Smith, M. (1998). Time scale for forest regrowth: Abandoned grazing and agricultural areas in southern Norway.*Ambio*, 456-460.

Sunderland,T and Ndoye,O., Eds (2004). *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Volume 2 - Africa*. Bogor, CIFOR

Sunderland, T., Harrison, S and Ndoye, O., (2004) "Commercialisation of non-timber forest products in Africa: history, context and prospects". *Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Volume 2 - Africa* (Eds Sunderland,T and Ndoye,O). Bogor, CIFOR

Sunderlin, W.D., Angelsen, A., Belcher,B., Nasi, R., Santoso, L., and Wunder, S. (2005). "Livelihoods, Forests and Conservation in Developing Countries; an Overview" *World Development* 33(9): 1383-1402 Washington, USA.

Sunderlin, W.D., Dewi, S., Puntodewo, A., (2007). "Poverty and Forests: multi-country analysis of spatial association and proposed policy solutions". CIFOR Occasional paper no 47. Center for International Forestry Research, Bogor, Indonesia.

Sunderlin, W.D., Dewi, S., Puntodewo, A., Müller, D., Angelsen, A., Epprecht, M. (2008). 'Why Forests are important for Global Poverty Alleviation: A Spatial Explanation'. *Ecology and Society* 13, 24.
URL: http://www.ecologyandsociety.org/vol13/iss22/art24/.

Tacconi, L. (2007). *Illegal logging: law enforcement, livelihoods and the timber trade*. Earthscan/James & James.

Talbot, J. M. (1997). "Where does your coffee dollar go?: The division of income and surplus along the coffee commodity chain." *Studies in Comparative International Development* 32(1): 56-91.

Talbot, J. M. (2004). *Grounds for Agreement: The Political Economy of the Coffee Commodity Chain*. Rowman & Littlefield.

Tangem, E.P., (2012) "Forest Connect Country Report, Burkina Faso" Supporting small forest enterprises. Reports from the field: Burkina Faso Tree Aid and IIED Series

TEEB (2010). The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB.

Tierney, M. J., Nielson, D., Hawkins, D., Roberts, J. T., Findley, M., Powers, R., Parks, B., Wilson, S., and Hicks, R. (2011). "More Dollars than Sense: Refining Our Knowledge of Development Finance Using AidData." *World Development* 39(11): 1891-1906.

Tomaselli, I. (2006). Brief Study on Funding and Finance for Forestry and Forest-Based Sector Curitiba, Brazil, UNFF.

Troup, R. S. (1940). *Colonial Forest Administration*. CabDirect.

Tucker, R. P. and J. F. Richards (1983). *Global deforestation and the nineteenth-century world economy*. Durham: Duke University Press.

UBOS Government of Uganda Bureau of Statistics (2009-2010) Uganda National Household Survey.

UN Environment Programme (UNEP). (2008). UnChaining Value: Innovative approaches to sustainable supply. Paper produced by SustainAbility Ltd, UNEP and the UN Global Compact.

UNEP (2011). *Forests: Investing in Natural Capital. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. www.unep.org/greeneconomy: 151-193.

UNEP. (2012). *Inclusive Wealth Report 2012. Measuring Progress Toward Sustainability*. Cambridge, Cambridge University Press.

Vedeld, P., Angelsen, A., Bojo, J., Sjaastad, E., and Berg, G. (2007). "Forest environmental incomes and the rural poor." *Forest Policy and Economics* 9(7): 869-879.

Volker, M and Waibel, H. (2010) "Do rural households extract more forest products in times of crisis? Evidence from the mountainous uplands of Vietnam" *Forest Policy and Economics* 12: 407–414

Walker, R. T. 1993. Deforestation and economic development. *Can. J. Regional Sci.* 16:481–497.

West, P. and D. Brockington (2006). "An anthropological perspective on some unexpected consequences of protected areas." *Conservation Biology* 20(3): 609-616.

West, P., Igoe, J., and Brockington, D. (2006). "Parks and peoples: the social impact of protected areas." *Annual Review of Anthropology* 35: 251-277.

White, A., & Martin, A. (2002). *Who owns the world's forests? Forest tenure and public forests in transition*. Washington, DC, USA.

Williams, M. (2002). *Deforesting the Earth: From Prehistory to Global Crisis.* University of Chicago Press.

Wily, L. A. (2001). *Forest management and democracy in East and Southern Africa: lessons from Tanzania*. London: International Institute for Environment and Development.

Wilson, E. O. (1989). Threats to biodiversity. *Scientific American*, *261*(3), 108-116

Wollenberg, E., Campbell, B.M., Holmgren, P., Seymour, F., Sibanda, L. and Braun, J. von. 2011. Actions needed to halt deforestation and promote climate-smart agriculture. CCAFS Policy Brief 4. Copenhagen, Denmark: CCAFS.World Bank (2012). http://data.worldbank.org/.

Zimmerer, K. S. (2004). "The Reworking of Conservation Geographies: Nonequilibrium Landscapes and Nature-Society Hybrids." *Annals of the Association of American Geographers* 90(2): 356-369.

Annex 1. Major forest valuation strategies and their strengths and limitations

Conceptual Approach	Valuation strategy	Advantages	Disadvantages
Preference-based approaches: conceptualize values as arising from individual preferences and ecosystem values as being commensurable in monetary terms, which enables analysis of trade offs involved in alternative uses of ecosystems. This is the approach to valuation is most commonly used by contemporary economists.	**Direct market valuation approaches**		
	1. Market price-based approaches: assume that prices in well-functioning markets provide accurate information on the value of commodities (e.g. timber, NTFPs). The price of a commodity times the marginal product of the ecosystem service is an indicator of the value of the service. Thus, market prices can also serve as indicators of the value of a given ecosystem service. 2. Cost-based approaches: based on estimations of the costs that would be incurred if ecosystem service benefits needed to be recreated through artificial means. Techniques include (a) the avoided cost method, which relates to the costs that would have been incurred in the absence of ecosystem services, (b) replacement cost method, which estimates the costs incurred by replacing ecosystem services with artificial technologies, and (c) mitigation or restoration cost method, which refers to the cost of mitigating the effects caused by to the loss of ecosystem services or the cost of getting those services restored. 3. Production function-based approaches: estimate how much a given ecosystem service contributes to the delivery of another service or commodity which is traded on an existing market. This approach generally consists of a two-step procedure in which a) the physical effects of changes in a biological resource or ecosystem service on an economic activity are determined and b) the impact of these changes is valued in terms of the corresponding change in marketed output of the traded activity.	• Use data from actual markets, and thus reflect actual preferences or costs to individuals. • The data on which they are based (e.g. prices, quantities and costs) exist and thus are relatively easy to obtain.	• Data required for these approaches are often not available because markets for many ecosystem services or for goods and services indirectly related to such services do not exist. • For many ecosystem services, markets do exist, but are distorted (e.g. due to a subsidy scheme or because the market is not fully competitive), so that prices will not accurately reflect preferences and marginal costs resulting in biased estimates of values and unreliable information for policy-making. • Lack of adequate data on and understanding of the cause-effect linkages between the ecosystem service being valued and the marketed commodity often limits the utility of production function-based approaches. • Risk of double-counting ecosystem services due to interconnectivity and interdependencies of ecosystem services.

Conceptual Approach	Valuation strategy	Advantages	Disadvantages
	Revealed preference approaches		
	4. Travel cost method: based on the rationale that recreational experiences are associated with a cost (direct expenses and opportunity costs of time). The value of a change in the quality or quantity of a recreational site (resulting from changes in biodiversity) can be inferred from estimating the demand function for visiting the site that is being studied. This method is mostly relevant for determining recreational values related to biodiversity and ecosystem services. 5. Hedonic pricing: uses information about the implicit demand for an environmental attribute of marketed commodities. For example, houses or property in general consist of several attributes, some of which are environmental in nature, such as the proximity of a house to a forest or whether it has a beautiful landscape view. Hence, the value of a change in biodiversity or ecosystem services may be reflected in the change in the value of property. By estimating a demand function for property, the analyst can infer the value of a change in the non-marketed environmental benefits generated by the environmental good.	• Rely on actual (observed) behavior.	• Market imperfections and policy failures can distort the estimated monetary value of ecosystem services. • Requires good quality data on each transaction, large data sets, and complex statistical analysis that may be unavailable or costly to access/undertake. • Inability to estimate non-use values • Dependence of the estimated values on the technical assumptions made on the relationship between the environmental good and the surrogate market good.
	Stated preferences approaches		
	6. Contingent valuation method: Uses questionnaires to ask people how much they would be willing to pay to increase or enhance the provision of an ecosystem service, or alternatively, how much they would be willing to accept for its loss or degradation. 7. Choice modeling: Attempts to model the decision	• Can be used to estimate both use and non-use (often only way to estimate the latter kind of values) values of ecosystems and when no surrogate market exists from which the value of	• Questionable validity of the estimates derived due to doubt about hypothetical answers given by respondents will correspond to their behavior if they were faced with costs in real life. • Divergence between willingness-to-pay

Conceptual Approach	Valuation strategy	Advantages	Disadvantages
	process of an individual in a given context. Individuals are faced with two or more alternatives with shared attributes of the services to be valued, but with different levels of attribute (one of the attributes being the money people would have to pay for the service). 8. Group valuation: Combines stated preference techniques with elements of deliberative processes from political science. Is increasingly used as a way to capture value types that may escape individual based surveys, such as value pluralism, incommensurability, non-human values, or social justice.	ecosystems can be deduced. • It is easy to obtain other important data types for the assessment of ecosystem services, such as stated perceptions, attitudinal scales, previous knowledge, • These methods could be a good approximation of the relative importance that stakeholders attach to different ecosystem services • These methods can also reveal potential conflicts among stakeholders and among alternative management options	and willingness-to-accept in practice. • Respondents to contingent valuation surveys may be insensitive to scope (e.g. people may be willing to pay the same amount to prevent deforestation in one small area of a province as in all of the province). • Controversial question of whether non-use values are commensurable in monetary terms (e.g. whether religious or bequest value attributed to a forest can be considered within the same framework as the economic value of logging or recreation in that forest—such an extreme range of values may not be equally relevant to all policy problems). • Respondents may not be able to provide accurate responses due to complexity or unfamiliarity of many public goods
Biophysical approaches: use values derived from measure-ments of the physical costs (in terms of labor, surface require-ments, energy or material inputs) of producing a	**Materials/Surface/Landcover**		
	1. Ecological footprint analysis: Compares consumption and lifestyles across different contexts and checks these against the capacity of nature to provide for this consumption. Enables analysis of the sustainability of individual lifestyles, goods and services, organizations, industry sectors, neighborhoods, cities, regions and nations by measuring how much biologically productive land and water area is required to provide the resources consumed and absorb the wastes generated by a population, factoring in prevailing technology. The standard unit of measurement is a global hectare,	• Biophysical measures, like ecological footprint analysis, are generally more useful for the valuation of natural capital stocks • These measures can be especially useful for calculating depreciation of natural capital within a strong sustainability	• Overall, biophysical approaches are less useful for valuation at the margin of flows of ecosystem services, especially when ecosystem services have no direct biophysical expression as in the case of some cultural services. • Ecological footprint analysis shows pressures that could lead to degradation of natural capital (e.g. reduced quality of land

Conceptual Approach	Valuation strategy	Advantages	Disadvantages
given good or service or maintaining a given ecological state.	which is equal to one hectare with global average bio-productivity. Using this normalized unit ecological footprints to be compared even with differences in bio-productivity among land types, regions and countries. Humanity's Ecological Footprint can also be expressed in terms of the "number of planet Earths" required to support human resource use and waste generation. Forest area is one of six categories of productive areas used to track the Ecological Footprint, which also include cropland, grazing land, fishing grounds, built-up land, and carbon demand on land.	framework (which posits that no substitution is possible between human-made and natural resources). • Ecological footprint analysis allows assessing the impacts of natural resource use on the regenerative capacity of ecosystems. • It is relatively easy to understand and communicate, so can raise awareness about relative consumption of goods and services, including from forests. • Calculations can take advantage of readily available data, including indicators from the United Nations or a household's consumption patterns. • The approach can be applied in a variety of settings and at different scales from the individual to the nation-state. • Allows comparability across disparate units of analysis, which enables identification of inequalities of resource use.	or reduced biodiversity), but does not predict this degradation. • Further improvements in data quality, methodologies and assumptions are required. • There remains a lack of transparency regarding certain aspects. • The aggregated form of final ecological footprint measures makes it difficult to understand the specific reasons for the unsustainability of the consumption of a given population, and to formulate appropriate policy responses.
	2. <u>Human Appropriation of Net Primary Production (HANPP):</u> Measures how intensely humans are using ecosystems, which can be defined as the amount of terrestrial net primary production required to derive food and fiber products consumed by humans, including the organic matter that is lost during the	• Provides an illustrative and spatially explicit indicator on human pressures on ecosystems. • Can serve as early warning indicator for land degradation	• No endogenous definition of • benchmarks / sustainable levels. • No consideration of trade and trade-related demand on biosphere.

Conceptual Approach	Valuation strategy	Advantages	Disadvantages
	harvesting and processing of whole plants into end products.	and pressure on biodiversity. • HANPP complements the Ecological Footprint approach as it measures how much bio-productivity is appropriated in a given territory, whereas the Ecological Footprint measures how much bio-capacity a country utilizes wherever that bio-capacity is located in the world. • HANPP can thus illustrate the "depth" of the Footprint by tracking how intensively given ecosystems are being harvested.	
	3. Land and Ecosystem Accounts (LEAC): developed and used by the European Environmental Agency to account for the interactions between nature and society on the basis of a detailed grid (1km x 1km) for land use and land cover changes within the European Union. It is based on CORINE land cover data and its goal is to provide information on land cover and related land use changes. Within LEAC, ecosystem accounts incorporate material and energy stocks and flows, health of ecosystems counts and ecosystem services measurements. The ultimate goal is to measure the resilience of natural capital, its services and maintenance costs.	• Provides an accounting for impacts of resource use on land cover and land use and changes over time. • Provides geographically explicit indicators (like HANPP). • Bridges with monetary valuation of ecosystem services and maintenance costs of ecosystems.	• Sectoral information (in particular, industry and service sectors) highly aggregated. • No endogenous definition of benchmarks / sustainable levels. • No consideration of trade.

Adapted from: Kumar 2012; Best et al, 2008

*Note: biophysical and the preference-based approaches are generally not compatible as they are based on different theories of value and axiomatic frameworks (Kumar 2012). Another category of valuation strategies under biophysical approaches is known variously as Energy, Emergy, or Exergy. This kind of valuation appears to be less relevant to forests, so is not covered in depth here. For a review of these three valuation strategies see: http://www.eoearth.org/article/Net_energy_analysis