

Policies to promote household based plantation forestry and their impacts on livelihoods and the environment: cases from Ethiopia, China, Vietnam and Sweden

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SUMMARY

The growing economies in the South, market globalization, population growth, social conflicts and climate change increase the strain on land and forest resources, and require a cost effective and ecologically sound production of goods and services to meet public needs. Based on global assessment data, four country level (Ethiopia, China, Vietnam, Sweden) and six local case studies and using a multi-scale approach, this paper examines trends and drivers in household based plantation forestry and reviews how policies affecting forest plantation and land use are interpreted and implemented at the local level. It discusses how sustainable forestry systems and policies can be developed which provide industrial supplies, promote environmental objectives and support the livelihoods of people. Besides reflecting characteristics and diversity of current trends in plantation forestry, the paper illustrates that local landscape studies could help in explaining trends revealed by national inventories in a way relevant to policy and research.

Keywords: change assessment, land use, trends, household based forestry, multi-scale approach

Politiques pour promouvoir la foresterie de plantation basée sur les foyers et leurs impacts sur les revenus et l'environnement: cas de l'Éthiopie, de la Chine, du Vietnam et de la Suède

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Les économies en expansion du sud, la globalisation du marché, la croissance de la population, les conflits sociaux et le changement climatique accroissent la pression sur les ressources de la terre et de la forêt et requièrent une production de marchandises et de services rentable et écologiquement viable pour assouvir les besoins du public. Cet article examine les courants et les acteurs actifs dans la foresterie de plantation basée sur les foyers en se basant sur des données d'une évaluation globale, quatre niveaux de pays (Éthiopie, Chine, Vietnam et Suède) et six études-cas locales, en utilisant une approche à plusieurs échelles, et il examine comment les politiques affectant la plantation forestière et l'utilisation des terres sont interprétées et mises en exécution au niveau local. Il débat de la manière dont des systèmes et des politiques de foresterie durables capables de produire des fournitures industrielles, de promouvoir des objectifs environnementaux et de soutenir les revenus des populations peuvent être développés. Au-delà d'une réflexion sur les caractéristiques et la diversité des courants actuels dans la foresterie de plantation, ce papier illustre le fait que les études du paysage local pourraient aider à expliquer les courants révélés par les inventaires nationaux, d'une façon appropriée à la recherche et à la politique.

Políticas de promoción de plantaciones forestales familiares y sus impactos sobre los medios de vida y el medio ambiente: los casos de Etiopía, China, Vietnam y Suecia

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Las economías en expansión en el Sur global, la globalización de los mercados, el crecimiento de la población, los conflictos sociales y el cambio climático están aumentando la presión sobre los recursos relacionados con el suelo y los bosques, y requieren una producción rentable y ecológicamente racional de los bienes y servicios para satisfacer las necesidades públicas. Mediante datos de la evaluación global, cuatro estudios de caso a nivel de país (Etiopía, China, Vietnam, y Suecia) y seis a nivel local, y el uso de un planteamiento multi-escalar, este artículo examina las tendencias y los elementos que impulsan las plantaciones forestales familiares y revisa cómo se interpretan y aplican a

nivel local las diferentes políticas que afectan a las plantaciones forestales y al uso del suelo. Se discute cómo se pueden desarrollar los sistemas y las políticas forestales sostenibles para que proporcionen insumos a la industria, fomenten los objetivos ambientales y apoyen los medios de vida de las personas. Además de reflejar las características y la diversidad de las tendencias actuales en las plantaciones forestales, el artículo ilustra cómo los estudios de paisaje a escala local podrían ayudar a explicar las tendencias que muestran los inventarios nacionales de manera que sean relevantes para la política y la investigación.

INTRODUCTION

The growing economies in Asia, the globalization of markets, population growth, social conflicts and climate change increase the strain on land and natural resources, and require a production of goods and services that is cost effective and which addresses the needs of the public (Held *et al.* 1999). There is also a growing call to managing landscapes in a different way to achieve twin objectives of economic development and ecological sustainability (Sunderland 2011). With population expansion, urbanization and economic growth, the demand for industrial wood will increase but availability of land to produce wood is not secured. The challenge associated with land availability needs to be seen at different levels – at global and national level (to meet the growing demand for food and wood for energy and for industrial use) and at household levels (to meet subsistence wood and food needs while also responding to market demands). The question to be addressed is how can forest policies be made effective to promote sustainable smallholder forestry systems which contribute to meeting the growing demand for wood at local, national and global levels while also assisting the efforts of climate change mitigation, biodiversity conservation and combating of desertification (Szulecka *et al.* 2014).

The natural forest cover is decreasing globally and particularly in tropical regions. In some countries, there is a reverse trend of increased forest plantation by private households driven by global demand for timber, paper and other commodities (FAO 2006). These trends are well in line with current forest transition theories and concepts (Barbier *et al.* 2010). During 1990–2010 world's productive planted forest area increased by 2% per year and smallholder plantations increased significantly, while globally, planted forests are expanding at an average of 5 million ha per year (FAO 2011a). The trend was stronger in Asia and Latin America than in Africa and is seen as a result of changing policies on land and property rights, and marketing of products to benefit producers (Kanowski 2010).

The rapid transition of land use towards plantation of trees and other cash crops on private holdings has implications for the livelihoods of rural people. While private land titles mean investment opportunities for those who have capacity, the less resourceful people become excluded from the land that they could previously use for cultivation, grazing and fuel wood collection. The role of forestry and forest plantation in changing poor people's life is increasingly being discussed (Sunderlin and Ba 2005, Varis 2008). Natural forest provide benefits to the society including environmental services, non-timber forest produce, timber and other assets with commercial values (Hou and Wu 2004, Vedeld *et al.* 2004). On the

other hand, forest devolution (and tree plantation) holds the potential to benefit local people in rural areas by enhancing their endowments and entitlements and contribute to poverty alleviation but it may not benefit the poorest group (Sikor and Nguyen 2007).

The expansion of smallholder plantation forestry increases the amount of industrial wood on the market. In order to safeguard sustainable supplies and minimize societal conflicts, forest industries will take other societal and environmental concerns than if they rely on a forest estate under their own management. Plantation forestry is often viewed as large, fast growing monoculture units with a state or private operator, having the objective to provide industrial raw material. Historically, this approach has been favoured by many governments and it is still commonly used by the private sector e.g. in Brazil and in Indonesia (Cossalter 2003). The new household based forestry in Vietnam and China with multiple small units is seen in the light of a changing, more diversified forest policy. Farm based, small scale plantation forestry, is in a global context a rather recent phenomenon. At local level it has been present in numerous countries for a long time, but by and large not recognized as a forest and tree production system of importance and impact. In many countries, the output from farm based plantation forestry was previously not included in the national statistics. Studies in e.g. Bangladesh showed that farm based forestry, contributed to some 75% of all industrial wood and also firewood, and further that trees on agricultural and urban land represented about 67% of the total tree biomass (FAO 2013). In India trees outside forests (TOF), mainly growing on private land, are the main domestic source of wood for industrial and fuel wood (Pandey 2008). In Malaysia, Burma and parts of Indonesia, farm based plantations in the lowlands have since long been an important forestry and tree production system sometimes referred as homestead tree husbandry (FAO 1982). In upland Vietnam, farm based forestry often appears on former natural forest land, which in most cases is land previously used for shifting cultivation (Ohlsson 2005). The practice of planting trees on farm lands is influenced by tenure security, farm size, proximity to markets and to natural forests and woodlands. As farm sizes shrink and farmers face wood shortages they tend to plant more trees on agricultural landscapes (Bewket 2003).

The growing concern for global climate change has brought additional expectations on forest land, e.g. setting it aside for carbon sequestration and producing energy crops that could replace petroleum products. In the UN Collaborative Programme REDD, the issue of using forests for carbon storage has been the focus of a heated debate. Those promoting REDD see it as a means of supporting forest conservation

and a low-cost mechanisms for reducing carbon emissions. Those against REDD are worried about its effects for forest-dependent communities, primarily the weakening of their land and resource rights and that the expansion of REDD may have impacts on the supply of food and other agricultural products (IIED 2009). The mechanisms by which payments and benefits are shared will be critical (Wu 2007). The major question is how to maximize carbon sequestration, carbon revenue and generate benefits to local people, and this remains a key issue for policy makers (He *et al.* 2009).

Recent forest policies have had great impact on forestry development in China and Vietnam (Meyfroidt and Lambin 2008, Wu 2009, Sunderlin 2008). The outcome of similar reforms in many African countries are not equally well understood but of great interest considering globalization and increased trade and cooperation between Asia and Africa. The expansion of farm forestry in Vietnam is a result of the combined effect of supportive policies, markets, economic development, improved infra-structure and communication, tenure reforms and changing conditions for agriculture (Sandewall *et al.* 2010). In China state sponsored land conversion programs followed by voluntary tree planting by farmers without financial support have led to increased tree plantation on cropland (Fraye *et al.* 2014). Rural households have become a major driving force of forest development, managing around 60% of the productive plantation area of both China and Vietnam (FAO 2006). The forest transition is the outcome of economic and other developments and multiple political objectives (Barbier *et al.* 2010). Both countries have been successful in increasing forest cover. The complex impacts on livelihoods and equity as well as on biodiversity conservation are not conclusive. Further, the socio-economics driven expansion of trees outside forest, e.g. former crop land and in home gardens, is changing the landscape in many countries. The area of agriculture land with a tree cover exceeding 10% equals a quarter of the world's forest area (FAO 2013).

The brief background highlights several issues requiring attention and better understanding. This study suggests that there is significant global knowledge on the biophysical trends and changes in forestry and land use, e.g. through FAO assessments, and ample information on existing forest related policies. The understanding of the links between those changes, policies and their local societal drivers and impacts, and their effects in a global context has been widely studied and conceptualised in current land change science (e.g. Barbier *et al.* 2010, Mather 2007) but for addressing current and emerging issues in policy and land management additional knowledge will be required.

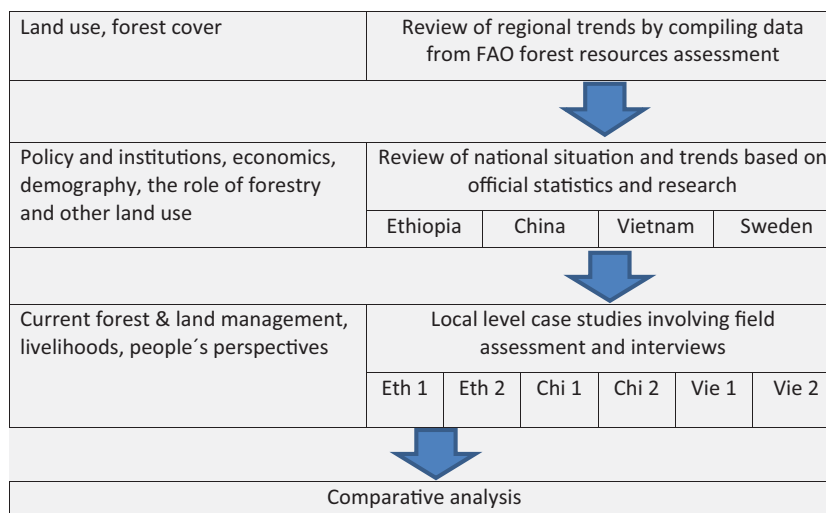
Based on global assessment data, country level evaluation and local case studies this paper examines some trends in plantation forestry, land use and forest policy development. It aims at learning from country and local experiences and exploring emerging issues which need to be addressed in policies aimed to promote sustainable management and socio-economic development in the context of forests plantation.

METHODOLOGY AND CHOICE OF STUDY AREAS

The study combined regional, national and local scale analyses (Figure 1). The purpose was linking the internationally and nationally reported trends with observed situations on the ground, not for verifying figures (the local case approach would not allow that) but for identifying features, trends and aspects which were not reflected by national data and/or required an integrated societal context.

In a first step global and regional trends in plantation forestry were derived from FAO/FRA data. Three countries, Ethiopia, China and Vietnam, were chosen for primary case studies, and a fourth country Sweden, was used for comparison, aimed to put findings in a wider historical context. For each country, the national situation and trends of forestry

FIGURE 1 *The study approach*



related policies and its various roles was reviewed based on official data and research literature. Authors of all four countries contributed in the work.

Subsequently, six local study sites in Northern Vietnam, Southeast China and Northwest Ethiopia were identified by administrative boundaries. A similar methodology was used in all those local studies. In China and Ethiopia the sites covered about 1000–3000 ha each and included administrative villages. The study sites in Vietnam were those of a previously published study (Sandewall *et al.* 2010) and represented natural villages of 100–200 ha. The selection criteria were primarily the presence of a diversified land use including household based forestry, an external wood market and agriculture production for subsistence and sales. To address the need for various types of data a multi-disciplinary study team applied a set of complementary methods for acquiring certain land use and socio-economic data (Table 1). The field work by teams of experts from the case study countries was made as a condensed team exercise over a period of about two weeks per site.

In order to describe and quantify external and internal trends, dynamics and local livelihoods, an integrated landscape approach was applied for analysing the management of natural resources (Gundersson *et al.* 1995, Sayer and Maginnis 2005). The interaction between spheres of social and natural systems was analysed based on the framework proposed by Berkes and Folke (1998). The spheres refer to physical and biological entities, and the socio-economic and institutional/policy processes. By using a spatial and temporal perspective, linking the different spheres and processes and the land use trends connected with expansion of private plantation forestry over time, the development and experiences of

the different countries could be compared and analysed. The study reviewed and examined a number of research questions that focus on trends of plantation forests and the role of policies in influencing these trends. The observed land use changes were analysed in the perspectives of different stakeholders, situations, and spatial and temporal dimensions (Table 2).

FINDINGS

Trends of planted forests in a regional perspective¹


Over the last 20 years the world's planted forest area has increased at a mean annual rate of 2% and significantly contributed to "balance" the simultaneous loss of natural forest (Table 3). As a result, the cultivated share of the forests has increased worldwide. It is currently 6.5% globally and approaching 40% in China (FAO 2011a). In the tropics, tree plantation for economic production purposes depends strongly on a limited number of significant introduced short rotation species, such as *Eucalyptus spp*, *Acacia spp* and *Pinus spp* while indigenous species dominate among planted forests for protective purposes (FAO 2006). Official statistics on species composition are however incomplete, especially regarding household based forestry.

There are great variations in reported trends among nations with different policies and market situation. In half of the nations that provide information to Forest Resources Assessment (FAO 2011a), e.g. 61 out of 125 countries in Asia, Africa, Latin America, the planted forest area had only expanded marginally during 1990–2010 (in some cases it had decreased). Meanwhile, in 40 countries it had increased

TABLE 1 Data collection approach applied in the local case studies

(1)	A review of secondary sources, including a) available global, national and local statistics, b) policy and legislative documents and c) remote sensing data of different dates.
(2)	Key informant interviews among different actors and on the various spatial levels.
(3)	Systematic field observations with local key informants, named field point sampling (Sandewall 2010). Observations made on points along transect lines. About 50 points per study sites was obtained by initial adjustment of distance between points. Additional information on current and historical land use was obtained from accompanying villagers. The method is statistically robust and generates a complete record of past and current land use and auxiliary data.
(4)	Interviews with 25–50 households per site distributed in different income categories, and sampled from list of household heads in the area, for understanding the land use and livelihood situation and its distribution within the village.
(5)	Verification and follow-up of initially collected data and outstanding issues during stakeholder workshops.

TABLE 2 The context of the study

Land use		Forest plantation, other farm based land use, other land use
Stakeholders, actors		Farmers, state, industry
Situation		Physical, economic, socio-economic, policy framework
Spatial dimension		Household-village-district-national-global
Temporal dimension		Past, present, future

¹ The results in this subchapter are mostly derived from FAO sources.

TABLE 3 *Planted forest trends in the various case study countries and tropical regions (FAO 2011a)*

	China	Ethiopia	Vietnam	Africa	Asia	Latin America	World
Land area (Mha)	942.6	109.6	31.0	2974.0	3091.4	1860.3	13010.5
Total forest area 1990 (Mha)	157.1	15.1	9.4	749.2	576.1	978.1	4168.4
Total forest area 2010 (Mha)	206.9	12.3	13.8	674.4	592.5	890.8	4033.1
of which for productive purpose	41%	4%	47%	30%	39%	14%	30%
Rate of forest cover 1990	0.17	0.14	0.30	0.25	0.19	0.53	0.32
Rate of forest cover 2010	0.22	0.11	0.43	0.23	0.19	0.48	0.31
Planted forest area 1990 (Mha)	41.9	0.5	1.0	11.7	76.3	9.1	178.3
Planted forest area 2010 (Mha)	77.2	0.5	3.5	15.4	122.8	15.0	264.1
of which introduced species	28%	95%	25%	80%	30%	98%	30%
Annual change of planted forest area 1990–2010 (%)	3.1	0.2	6.5	1.4	2.4	2.5	2.0
Planted/total forest area 2010	0.373	0.040	0.255	0.022	0.207	0.017	0.065
Planted forest area/land area	0.082	0.005	0.113	0.005	0.040	0.008	0.020

between 10% and 100% and in 24 countries, it had more than doubled (implying an annual increase exceeding 3.4%). In Asia, the increase is confined to relatively few countries e.g. China, Vietnam, India, Thailand, Myanmar, while in South Korea and Sri Lanka the planted forest area has gone down. In Africa, the situation is similar. Most of the reported increase occurs in a few countries on the continent e.g. Sudan, Tunisia, Mali, Ghana, Malawi and Madagascar. In Latin America, Brazil and Mexico are the most dominant players in this regard. In some cases plantations have replaced the natural forest.

A common pattern is that natural forest is cleared for cattle grazing and that some of the cattle pasture is later converted to plantations of cash crops, such as oil palms in Latin America (Butler 2011). In many countries including Ethiopia official national statistics have so far failed to account for smallholders' tree planting activities. One aspect is that official statistics often account one land use activity to any specific area, while farmers tree planting is often integrated with other use on the same land, e.g. in agroforestry systems and/or occurs on non-forest land (Pandey 2008, FAO 2013).

Forest related policies and societal trends in Ethiopia, China, Vietnam and Sweden

The case of Ethiopia

Economic development: Although its economy is growing rapidly since 2006, Ethiopia with per capita income of 392 USD, is among the most populous and poor countries in Africa. 83% of its 84 million people live in rural areas (FAO 2011a), of which one third in absolute poverty. The UNDP ranked Ethiopia 171st out of 182 countries on the Human Development Index (UNDP 2012). With an economy largely dependent on rain-fed agriculture, its agriculture sector accounts for 46% of GDP (predominantly crop production), industrial production for 10% and distributive and other services 44% (Central Statistics Agency 2012). Agriculture production fluctuates heavily with rainfall distribution to

the extent that the growth in GDP is associated with the distribution of mean annual rainfall.

Forestry and policy: A history of institutional shortcomings and over exploitation of forest resources has left the country almost devoid of dense Afro-montane natural forests. During 2010/11 Ethiopia imported wood and wood products worth 112 Million USD while wood export income was only 1.3 Million USD (Central Statistics Agency 2012). Instability of rural institutions and unfavourable policies has discouraged farmers from growing trees outside homesteads (Kassa *et al.* 2011). To address the problems the Government adopted a forest policy and enacted a new forest proclamation in 2007. The former envisages tax incentives for farmers who plant trees. Recognizing that issues of carbon trade, market mechanisms and environmental services will influence the way people manage their plantations and nearby natural forests, two regional states have established public enterprises for facilitating forest management and assisting tree growing farmers to be linked with markets. The climate resilient green economy strategy of Ethiopia launched in December 2011 identified the forestry sector as one its pillars and some 3 million ha of land is planned to be under reforestation and afforestation activities (FDRE 2011).

Planted forests and their use: In the 1980s, the government promoted large scale plantations, estimated at 0.5 million ha. Over the last two decades, no major state or private large scale plantation took place. Only smallholders plant trees and the extent of this is not properly known. Tenure insecurity was said to be one of the factors that discouraged farmers from expanding tree growing activities (Kassa *et al.* 2011). Since 2009 farmers are obtaining land use certificates. Despite strengthened individual land rights to farmers and improved infrastructure, credit- and marketing support, many farmers have been unable to exploit the growing market opportunities. In some areas, though, farmers are increasingly planting trees when being stimulated by markets and favourable policies to such extent that former crop land is now being converted to woodlots (Jenbere *et al.* 2011) through tree planting and

reduced dependence on annual crop farming. Bluffstone *et al.* (2008) reported that the income from trees and related products has become the third most important source of household income in some parts of the Amhara Regional State. Thus, trees, crop production, and livestock rearing are becoming increasingly linked in the major agricultural systems of the country (Lemenih 2010, Teketay *et al.* 2010).

Livelihoods: The drivers of the expanding trends, its determinants and extent of smallholder plantations remain poorly understood. Simultaneously the farm size is shrinking. Sixty percent of the 15 million landholders in the Ethiopian highlands possess one hectare of land or less, and a third of them own less than 0.5 hectare (Central Statistics Agency 2012). In the face of climate variability and growing market demand, tree growing is expanding even in the face of shrinking farm sizes. In some drought prone areas of the Amhara the role of trees as assets has overtaken that of livestock (Bluffstone *et al.* 2008). As tree growing requires less labor than annual crop production, the observed shift from annual crops to tree growing facilitates diversification of livelihood options.

Environment, energy and climate: Deforestation for agricultural land, forest degradation due to fuel wood consumption and formal and informal logging respectively contribute to 50%, 46% and 4% of emissions from the forestry sector in Ethiopia (FDRE 2011). The Climate Resilient Green Economy strategy recognises and plans to build on the forest-energy link through improving availability of hydroelectricity and improving efficiency of biomass energy use. Afforestation and reforestation will increase availability of biomass energy while also sequestering more carbon. Consequently, tree plantation will obtain a strongly increased focus in the years to come for its link with climate change.

The case of China

Economic development: China's economy generated an unprecedented level of growth of 9.9% during three decades (1979–2010), bringing a tenfold increase in per capita net income and reduced national poverty rate from about 65% in 1981 to currently 10%. The agriculture sector's share of GDP decreased from 32% in 1980 to 9.2% in 2010, while the service sector increased from 22% to 43% during the same period (National Bureau of Statistics of China 2011). As a result of the changing livelihoods base and rapid urbanization, the rate of people living in rural areas fell from 81% in 1980 to 50% in 2010. This development has driven up the demand (and prices) for wood products. Chinese imports have quadrupled over the past decade from an estimated 12 to 45 million m³ for meeting its escalating domestic demands while supporting the world's largest export of timber products. (McDermott *et al.* 2011). Half of all traded timber in the world is destined for China (Laurance 2008).

Policy and forestry: Until the 1950s, most of China's forests were naturally regenerated. From the 1950s until the 1970s, timber production was the sole concern of the forest industry. It reflected the dominance of wood as the raw material of choice in economic production. Along with the 'mass campaign' model of that period, hundreds of thousands of

people were mobilized to set up state-owned forestry enterprises in the northeast, the inner north and the southwest (Keeley and Yisheng 2011). As a result, the forest industry became one of the top contributors to GDP growth. Triggered by agricultural land reform (known as household responsibility system), the forest decentralization policy was initiated in south China in the early 1980s, which allowed individuals legal access to forests. At the time, a huge market demand for timber, lax supervision, timber market liberalization and lack of confidence in policy stability led to widespread deforestation (Wang *et al.* 2004, Zhang *et al.* 2000). In the 1990s while China increasingly embraced market economy, depletion of natural forests continued. Major floods in the Yangtze River basin in 1998 were regarded to be the consequence of forest loss. It shifted the strategies towards rehabilitation of damaged forest ecosystems and a ban of natural-forest logging.

Change in forest tenure is recognized as a crucial driver in China's forestry development (Richardson 1990), and a new wave of tenure reform has emerged since 2004 which aims to alleviate rural poverty, improve forest conservation and stimulate local investments. Flexibility for provinces to promote household based or more collective tenure arrangements has allowed implementation to vary among provinces (Xu *et al.* 2008). The reform is voluntarily-based with expanded rights to individuals in the redistribution of plots. The expanded rights including land transfer, inheritance and mortgaging, are enabled by the adoption of the Rural Land Contract, announced to be valid for up to 70 years. From early 1990s to 2013 the forest cover in China increased from 14% to 21.6% (SFA 2014). By 2011, 173 million ha of collective forest land which accounts for 95% of the total collective forestland area had been contracted to individual households, averaging 2.7–3.3 ha per household across the country.

Planted forests and their use: With the rapid decline in primary forest area, tree planting became an urgent matter and massive reforestation campaigns have been undertaken. The planted forest area in China of 77 million ha (FAO 2010) exceeds by far any other country in the world. The commercial plantation program is one measure intended to reduce China's heavy reliance on wood imports. It aims to supply 40% of China's commercial timber consumption by 2015. Southeast China is the dominant region for production forest plantation. Monocultures of *Cunninghamia*, *Pinus*, *Populus* and *Eucalyptus spp.* account for 60% of the plantation area (Mc Dermott *et al.* 2011). While individual households are managing nearly two thirds of the total plantation area, farmers' incentives are mainly on production forests. Through a scheme of "classified forest management", promoted by the government in the early 2000s, a certain rate of collectively owned forestland was classified as eco-reserve forests prohibited from commercial use. The financial support to farmers for their ecological forests under the policy of forest ecological compensation is very small when compared to the value from those forests, which has placed high risk for ecological forest being converted to commercial use in remote areas.

Livelihoods impacts: Besides changes in tenure and property rights of land and forests, a coherent policy reform has

been implemented to support the farmers. The central government has removed or reduced forestry taxes to encourage tree planting and manufacturing of forest products. Local governments have removed provincial taxes and some fees on forest products. Simultaneously, the government is using transfer payments to support local governance organizations that used to be financed by forest taxes and fees. As a direct result of this change, the average annual cash income for each farmer increased by 13%, or just over \$10 (Wang *et al.* 2007). Some surveys indicate increased timber harvests and forest shares in household income after the reform (Xu and Jiang 2008). According to Monitoring Report of Collective Forest Tenure Reform 2011 (SFA 2012), farmers are diversifying the use of their forestlands, and there was a significant increase of rural per capita net income from forestry, with the proportion increasing from 13% in 2009 to 19% in 2010.

Environment, energy and climate: Half a century of forest exploitation and monoculture plantation in China has had serious environmental consequences, including landscape and forest degradation, biodiversity loss, and unacceptable levels of soil erosion and flooding (Zhang *et al.* 2000). Climate change impacts are of growing significance, e.g. in the north-west an increasing number of people face acute water shortages and depletion of aquifers. The Chinese Government has launched its national strategy in response to climate change. One of its four pillars is to increase forest area by 40 million ha and forest stocking volume by 1.3 billion m³ by 2020 from the 2005 levels; another to increase the share of non-fossil fuels in primary energy consumption to around 15% by 2020. Tree planting and sustainable management of existing forests obtains continuous attention for its role in providing ecosystem services and addressing climate change.

The case of Vietnam

Economic development: With a GDP of about 2 800 USD and a growth rate in GDP (2006–10) of 6–7%, Vietnam is sometimes seen as a regional “tiger economy”. The annual population growth rate in Vietnam has decreased from 1.6% to modest 1.1% over the last ten years as an effect of a changing livelihoods base, state policies and urbanization. Out of its current population of 87 Million 72% still live in rural areas (FAO 2011a) but migration to urban centres by the young generation is changing the demography in the countryside. Poverty has decreased remarkably along with economic reforms in recent decades, but among ethnic minorities, who represent 15% of the population and most of them living in forest areas, 66% are still poor (World Bank 2012). The Vietnamese economy has become increasingly diversified, with the agriculture sector expected to contribute 16% of GDP in 2010, industries and construction 44% and services 41% (Anon 2010). In recent years, changes in economic, forest and land tenure policies have promoted commercial forestry investment and plantation of fast growing trees by households and business entities.

Policy and forestry: State Forest Enterprises (SFEs) were established in the 1960s to manage Vietnam’s forests and to supply the industry with raw material. The SFEs often imported their own workers from other provinces, while the

local population used the forest land for other needs (Sandewall *et al.* 2010). A strategic decision by the government in 1986 to adopt an open market policy “Doi Moi” initiated a wave of reforms such as decentralized state management, a market oriented monetary system, broadened foreign economic relations, long-term land use rights for farm households and a new forest policy (Sam and Trung 2001). The State now supports various forestry and tree production systems, including farm forestry within an ambitious reforestation policy (MARD 2006).

Planted forests and their use: Since 1987, the SFE-managed plantations are being replaced by private household plantations, which now supply a significant share of industrial needs. By 2003 some 3.7 Mha of forest land, of which 2.7 Mha with forest cover, had been allocated to households, although most of them had very small plots (De Jong *et al.* 2006). The expansion of planted forests of 6.5% annually during 1990–2010 (Table 3) is among the fastest worldwide and millions of farmers produce trees on their own land. The current planted forest area is around 3.5 Mha. Some 70% of that is production forest (mostly Acacia and Eucalyptus) while the rest is forest for protection purposes and other use (MARD 2011). On top of that, rubber trees of 0.7 Mha and various cash crops (e.g. cashew nut, fruit trees and coffee) have expanded in recent years in line with current policies. However, the management and low productivity of the planted forests, the short rotation cycles and its social and biodiversity impacts with a strong focus on a few exotic species (Thulstrup 2014) gives room for concern. Timber harvests from planted forests for pulp, woodchips, board and forest products for export and domestic use is currently low and the production is not enough to balance domestic consumption. Further, poor farmers have difficulty raising funds for the needed production investments.

Livelihoods impact: Forestry has contributed to economic development but less to reducing poverty. For many households having forest land life has improved, while the poorest groups have not benefitted from the reforms and the economic growth (Thulstrup 2014). Poverty among ethnic minority groups in upland areas, is still very high and for many households without forest land, access to forests they previously used for subsistence needs, has decreased (McElwee 2009, Sunderlin and Ba 2005).

Environment, energy and climate: With urbanization, energy needs are increasingly covered by other sources than wood. Bio-fuels are seen as an interesting optional energy source to mineral oil, gas and electricity but plantation has yet been minor. Flooding of productive and densely populated lowland plains are frequently occurring in Vietnam. UNFCCC has recognized Vietnam as one of the world’s five most vulnerable countries in respect to global warming. Nationally, forest cover is seen as an important policy issue in this context. In 2012 Vietnam approved a National REDD+ Action Programme through a Prime Ministers Decision.

The case of Sweden

Economic development: During the 19th century, Sweden was mainly an agrarian economy. In the northern part, the

emerging forest industry was spearheading industrialization. In southern Sweden, the mining industry, a mainstay in Swedish economy since around 1600, required charcoal. It finally led to severe deforestation. A pioneer in development of forestry, af Ström (1853), wrote; “in some areas, deforestation was so massive that even ...peat and also dried cow dung must be used for cooking and heating of the abodes”. Sweden then underwent a development, based upon ore, forest and water energy towards being one of the world’s rich nations. The forestry sector’s contribution to employment is however continuously decreasing, as the industry is capital intensive. In 1900, a pulp mill with a labour force of 1,000 persons produced 500 tons of pulp annually. Today 500 persons produce 500,000 tons. Several factors promoted this development. Some of those are clearly related to policies and legislation.

Policy and forestry: In 1850, central and southern Sweden was basically deforested. In the south, this was mainly related to conversions of the land from forest to agriculture and grazing. In the central part, the requirement of charcoal for the mining industry was a major reason. The emerging forest industry, mainly oriented towards the on-going industrialization in Europe, generated a huge market for wood. This was the driving force which led to policies and legislation that could promote sustainable forest and tree production systems. In the 19th century, private companies were allowed to own forest, albeit with limitations, to ensure that farmers did not lose their forest. Around 1850, almost all the State forest had been divested to farmers. This was part of a policy, whereby private owners (farmers) would have a complementary income to agriculture and develop sustainable forest management systems. Legislation on limited companies promoted sustainable institutions and thus sustainable forestry. In the first modern forest legislation (1903) the main paragraph concerned the need to always reforest logged over areas and it remains even today. Production and sustainability were major ingredients in that legislation. In the 1970’s, there was sentiment of a declining forest estate, and possibly raw material shortages. This was viewed as a very serious problem, as forestry was the basis for the Swedish economy. A more detailed and regulatory forest law emerged. International development towards environmental considerations in forest land use, emphasized by the UNCED in 1992, led to the current forestry legislation (1993), where production and environmental objectives have equal status.

Planted forests and their use: Using FAO standards, most of the Swedish forest is defined as semi natural assisted regeneration. That is, although it is planted, there is a vigorous regrowth, which often gives an impression of a natural forest. All forest land in Sweden, about 70% of the land area, is under management, although interventions can be long apart. Although the forest provides environmental and social services it is mainly used for pulpwood, timber and energy. The annual harvest amounts to some 80% of the growth. Forestry is a major foreign revenue earner in the Swedish economy. Sweden is the world’s second largest combined exporter of paper, pulp and sawn wood, after Canada (Skogsindustrierna 2010). In a European context, Sweden is a major producer. In the 1950’s, its forest industry underwent a

dramatic shift in productivity, with the introduction of the chainsaws. Today, most logging is done by harvesters.

Livelihoods impact: Half of the forest land is owned by some 330,000 persons, comprising 230,000 units, with an average area of about 50 ha. About one third is owned by women, alone or in a partnership. Once, the forest was allocated to farmers to supplement their incomes and generate seasonal work. Today, the forestry is a side income for most individuals, but substantial in a national and global perspective. Many forest owners do not live on their estates any longer, but in urban areas (KSLA 2009, Mc Dermott *et al.* 2011). In the 1930’s, many forest owners found it difficult to get reasonable wood prices when being one out of many small scale producers and with few consumers only. The Forest Owner’s Association (FOA) emerged and today, some 50% of all private forest owners are members of a FOA. Forestry has many functions. It is an important part of the culture, as evidenced in poetry and literature, and in the Swede’s relation to nature. Public access to private land enables collection of mushrooms, berries and other forest produce. Recently, commercial berry collection has raised issues about limiting public access to private land. Hunting is an important part of the forestry sector. On one hand, the stable and large moose population causes damage to the forest while on the other it provides opportunities for hunting and a substantial amount of game. Some 10% of all meat consumed in Sweden is game.

Environment, energy and climate: Forestry has been increasingly influenced by environmental policies, at global, EU and national levels. The Swedish environmental policy model combines general conservation considerations in day-to-day forest management and the designation of more strictly protected forest areas. That model is being contested by some researchers and environmental groups. Biomass, mainly from the forest, constitute 32% of all energy production in Sweden, and for district heating, 49% of the energy source is forest. There are substantial amounts of carbon storage in the forest cycle, which is released at harvesting.

Comparing development of household based plantation forestry in the four countries

A number of similarities are observed when comparing the development of plantation forestry and its various aspects in Sweden over 160 years with those of China, Vietnam and Ethiopia over the last 30 years (Table 4). In the table, the marked presence of a trend refers to the observations and perspectives of the authors and should be seen as food for thought.

All four countries initially experienced poverty, rapid population growth and extensive agriculture leading to deforestation. In Sweden, forest land was used for agriculture and grazing. The forest was also used for supplying energy to the mining industry, and eventually for the saw-mills and later on the pulp industry. In Vietnam, poverty, low agricultural productivity and institutional obstacles led to use of marginal (for agriculture) forest land for shifting cultivation. Population growth and state supported immigration from the lowlands to the mountainous areas led to further degradation but also introduction of new cultivation methods. In China,

TABLE 4 Trends related to household based forestry in the four studied countries

Trends in relation to various issues		Sweden	Vietnam	China	Ethiopia
		1850–2011	1980–2011	1980–2011	1980–2011
Situation at the outset	▪ Poverty	x	x	x	x
	▪ Deforestation	x	x	x	x
	▪ Extensive agriculture on degrading lands	x	x	x	x
	▪ Rapidly increasing population	x	x	x	x
Causes for the unsustainability	▪ Mining of resources	x	x	x	x
	▪ Growing need of industrial and household energy	x	x	x	x
	▪ Population growth and expanding crop areas without investment to increase land productivity	x	x	x	x
	▪ Dysfunctional market	x	x	x	x
Factors triggering change	▪ Market demands for industrial wood and energy	x	x	x	x
	▪ Households needs for wood and wood energy	x	x	x	x
	▪ Poverty, innovations and globalization, desire to improve livelihoods	x	x	x	x
Responses	▪ Political and economic reforms	x	x	x	x
	▪ Policies, legislation	x	x	x	x
	▪ Creation of institutions	x	x	x	o
	▪ Infrastructure development	x	x	x	x
	▪ Household based forestry systems	x	x	x	o
Driving forces	▪ Market and globalization	x	x	x	x
	▪ Availability of land for tree production	x	x	x	x
	▪ Forest land lots as income opportunity	x	x	x	x
Outcomes	▪ Forestry important factor in national economy	x	x	x	o
	▪ Household based forestry provides wood to industry and export	x	x	x	x
	▪ Growing concern and foreseen interventions in household based forestry	x	x	x	x
	▪ Perceived positive impact on local livelihoods	x	x	x	x
	▪ Perceived positive impact on landscape	o/x	o/x	x	x
	▪ Perceived positive impact on biodiversity	o	o	o	o

Symbols used: x = presence of the trend/situation, o = absence of trend/situation

shortage of raw materials, political movements and deregulation of forestry industry caused sharp depletion of its stock of forests, followed by more equally balanced concern on cultivation and utilization. The effects of rapid deforestation and ecological concerns aroused a massive investment and policy support in plantation development. Ethiopia had a similar development at the outset, to which must be added institutional and political changes that discouraged farmers from growing trees and managing their natural resources and led to recurrent droughts and hunger catastrophes. When the policy changed and tenure security improved since mid 2000s, household based plantations are expanding rapidly (Lemenih and Kassa 2014).

All the countries are now in various stages of forest transition, partly through plantation, underpinned by economic, institutional and socio-economic development (Barbier *et al.* 2010). In China, a national compulsory tree planting program and several ecological rehabilitation and combating desertification programs were introduced in the early 1980s, as a response to ecological disasters. That initial period was also a

period of economic reforms, combined with mass mobilization. The policy also aimed at promoting household responsibility in rural forestry, albeit with collectivistic components. In Vietnam the broad economic policy change in 1987 was followed by market and tenure reforms, institutions to implement the new policy and legislation and programmes promoting reforestation by individual households and entities. In Ethiopia it has been difficult to implement policies and legislation, partly because of undeveloped forestry institutions to translate policy to practice but private initiatives and new markets has increased tree planting by rural households.

A current trend in many countries, including China, Vietnam and partly Ethiopia, are steps to strengthen formal property and usufruct rights to forest land for individual households through national policy processes, and improved market conditions as a result of economic reforms and globalization (RRI 2014). A similar development, plus similar rights for private companies to own and manage forest, took place in Sweden in the past. In all those countries, there has been a shift from the centralized, State-owned and managed

forestry production. system, towards a more diversified and decentralized forestry, also including private farm households having property rights with varying levels of authority to sale or transfer land. Sunderlin (2008) acknowledged “increasing evidence of a world forest tenure transition whereby ownership and control of global forest land gradually shifts from governments to local communities”. The change has however slowed down in recent years. In China and Vietnam with rapidly expanding forest cover, the tenure transition mostly occurs through the increase of new planted forest (rather than change of tenure rights in existing forest) (RRI 2014).

A long term approach, comprising of policy and legislative interventions was taken both in Vietnam and in Sweden in response to market development and requirements in new economic policies. Both countries also developed institutions that could implement the policies and legislation. Within the framework of policies, legislation and institutions, the private forestry sector has evolved, and fulfils important functions in supplying wood raw material.

Local scale trends in farm based plantation forestry

The various outcomes of the local case studies represent the site specific conditions of each study area. The studies are chosen to identify potential trends and issues and to give food for thought, and they must not be seen as a representative sample of all planted forests of the country. Key observations are presented in Table 5. With reference to those observations, some general findings of the case studies were summarised:

- i. The planted forest area has increased significantly on all sites, including “remote” ones.
- ii. On all sites farmers have obtained forest land use certificates (forest land tenure documents) over the last 15 years, but plantation started to increase before they obtained certificates.
- iii. Simultaneously, the area used to produce food has dropped by half over the last 25 years. Extensive or low producing agriculture has been replaced by forest or other land use.
- iv. Except on one site, the planted species are mainly fast growing timbers (that would be expected in those three cases where the dominating market is pulp and paper).
- v. Most stands are managed on short rotations, partly a consequence of the market forces, partly because of the household’s inability to wait long for return on investments.
- vi. Small wood lots (0.2–0.5 ha per household) are predominant in all studied cases.
- vii. Many households on the studied sites, but not all, possess planted forest. Besides the market situation, it goes back to their capacity to invest, their labour and livelihoods situation and to whether or not they have been allocated forest land.
- viii. For many households, trees are a minor income source among others, while the main advantage is flexibility to harvest and obtain cash when needed. For a few

households, forestry income is apparently much higher, but as it is often linked to long term and integrated investments farmers do not always accurately reveal such incomes.

- ix. Most case study areas have a designated market. In Vietnam (the site near the market) and Ethiopia, farmers have good confidence in the market. In the Chinese cases the pulp market dominates but sub-contracts and other complexities reduce the confidence of producers. In Vietnam (the remote site) there is no secure market, plantation is largely policy driven and farmers are indecisive.
- x. Farmers plant trees for various reasons. Two main groups are identified – 1) households with little resources who run a low-investment forestry as an option to agriculture on declining soils that cannot produce enough food in order to generate cash for immediate and short term needs). 2) More resourceful households who make long-term investments for future needs (house building, children, pension, other) and who may employ others.
- xi. Farmers’ views on environmental and climate issues depended on the local situation. In China Eucalyptus had expanded rapidly over short time and farmers’ main concerns were about water supply for agriculture and drinking. Vietnamese farmers sometimes referred their choice of Acacia to environmental reasons (soil improvement). A few farmers in China and Vietnam expressed worries about biodiversity. In Ethiopia, farmers were aware of various environmental impacts of planting Eucalyptus but still did so because of economic and other advantages. Further, re-curent droughts had serious impact on their livelihood but they did not refer to it in terms of a changing climate.
- xii. There was no formal organization actively supporting or advising farmers interested to plant trees, although they had many technical questions on plantation management.

ISSUES IN FOREST PLANTATION DEVELOPMENT

Most issues of this paper have both global and local dimensions. Through multi-scale and interdisciplinary analysis of situation and trends based upon global resource statistics, national trends and policies, various published research and local level case studies, a number of broad policy issues and trends concerning forest plantation development are identified.

We conclude that plantation forestry is increasing worldwide as part of a forest transition driven by a multitude of exogenous and endogenous factors, with various impacts for society and environment, and that farm households, given the appropriate conditions, do engage and are willing to be engaged in plantation forestry, which essentially to them is just another form of biological production. We find many similarities between the recent change in a number of tropical

TABLE 5 Some observations related to tree plantation on the various sites²

Issue	China		Ethiopia		Vietnam	
	near	remote	near	remote	near	remote
Annual change (increase) in planted forest area on village site 1990–2010	5.6%	7.9%	11.5%	5.4%	5.6%	4.0%
Current planted forest area as share of total area of village site	0.46	0.46	0.07	0.05	0.54	0.31
Year when households were allocated individual holdings (a) and obtained land use certificate (b) for forest land	a) 1986–2010 b) 2010	a) 1982 b) 2010	a) 1975 b) 2011	a) 1975 b) 2011	a) 1990 b) 1999	a) 1991 b) 1998
Area with subsistence food production on village site 1985/1990 and 2010	26% (1990) 12% (2010)	22% (1990) 8% (2010)	54% (1985) 33% (2010)	59% (1985) 27% (2010)	24% (1985) 20% (2006)	65% (1985) 46% (2006)
Dominating planted tree species	<i>Eucalyptus grandis x urophylla</i>	<i>Eucalyptus grandis x urophylla</i>	<i>Eucalyptus camaldulensis</i>	<i>Eucalyptus globulus</i>	<i>Acacia mangium</i>	<i>Mangletia glauca</i>
Rotation cycle for dominating planted tree species applied by farmers	5–14 years	4–10 years	3–6 years	3–6 years	5–12 years	10 years and more
Average forest land area managed by the village households (ha/hh)	0.5 ha	1.7 ha	abt 0.1 ha	abt 0.1 ha	0.4 ha	1.2 ha
Average planted forest area managed by village households (ha/hh)	0.2 ha	0.4 ha	0.3 ha	0.3 ha	0.4 ha	0.4 ha
Percentage of all village households having planted forest	24%	40%	over 50% near roads	significant	68%	42%
Forestry income as percent of total household livelihood	n.a.	n.a.	Second, after crop	Third, after crop and livestock	6–25%	Less than 10%
Dominant market opportunity for trees	Pulp and paper industry		Construction wood for export and domestic market.		Pulp and paper industry	Domestic wood market.
Why farmers plant trees	Investment in future personal expenses and a changing life style.		Improved market. Cash is needed as crop productivity declines.		Cash for personal needs (esp. poor people) Investment for future expenses (well-off)	
Environmental and climate concerns among the farmers	1. water (quantity, quality) 2. biodiversity		Recurrent droughts and declining soil fertility are major agriculture problems		Concerns on water and biodiversity expressed by a few farmers	
External bodies/actors who support and promote forest plantation	Occasionally local leaders and business men		In theory local extension office. Limited knowledge and resources though.		Occasionally local leaders	

countries and the forest transition that occurred in Sweden over a much longer period.

- At a global scale, and in all major tropical regions, forest plantation, mostly by farmers, is increasing steadily. In Latin America and Africa, the increase of planted forests cannot compensate the loss of natural forests, neither in area terms nor in a biodiversity context. In Asia tree plantation exceeds loss in natural forest, and total forest cover is increasing.

Occasionally, plantation has directly contributed to deforestation. On the six local study sites, however, tree plantation expanded on land previously deforested since 20–60 years. Policy changes on land property rights and appearance of new markets contributed to the transition. On the sites in Vietnam and Ethiopia, the afforested land was previously used for crop cultivation or grazing by households, while on the Chinese study sites plantation was on shrub land not economically

² For each country there were two sites, one located near and one more remote in relation to wood market.

used for generations. Other studies in China showed that farmers' expectations on high economic returns, reduced availability of farm labor and secure forest tenure were major causes of farmers' tree plantation (Frayer *et al.* 2014). Farmers convert land to planted forest when it is favourable for them, when a new market occurred and when institutional and policy frameworks allowed it. Much of the new forests in those countries are monocultures of exotic trees and the change is at the expense of biodiversity (McElwee 2009, Jenbere *et al.* 2011). A major policy issue would be how to facilitate households' tree plantation in such way that it promotes environmental objectives while maintaining economic sustainability.

- *Plantation development varies across countries and regions owing to market linkages, policy environment and institutional arrangements.* There are great variations among nations on plantation forest development. There is always an element of misreporting but the general survey quality has been standardized and improved over the years (FAO 2011a). The reasons for this variation among nations can mostly be traced in external factors such as policy, market situation, governance and institutional arrangements. Factors such as economic growth, demographic change, technological and infrastructure development have contributed. In all the case studies, and various other studies, farmers based their land use decisions on a broad range of factors including the exogenous ones mentioned above and local factors linked to their livelihood and labor situation (Sandewall 2010, Jenbere *et al.* 2011, Lambin and Meyfroidt 2010, Frayer *et al.* 2014). In one area studied, plantations were being promoted through policies and incentives without support of a defined market. Those plantations remained uncut for long time and farmers were not well aware of market needs. Balancing supportive policies and incentives with actual market situation and local development is essential to achieve ultimate economic and environmental objectives.

- *Intensified agriculture releases land for smallholder plantation forestry and other use.* At a global level agriculture production increased nearly 3 times since 1961 while the area of cultivated land increased by only 12% and has basically been stable since 1990 (FAO 2011b). Other studies conclude that household plantation forestry is dependent on a reliable food supply, either from own production or a functioning market (CARE International 1994). During Swedish industrialization (after 1870) the farming population decreased, but with increasing agriculture productivity, food supply was sustained for the growing urban population. In the local studies, the area used for food production decreased significantly in the study areas since 1990 (Table 5). The areas "abandoned" were mostly the least productive sites. They were partly converted to plantation of trees and cash crops and in some cases not cultivated at all because of labour shortage and other priorities. The trends have been promoted by land use policies (e.g. on cash crop promotion) combined with urbanization and increased market access, whereby tree cultivation for sales becomes a more attractive option than food crops, esp.

on poor soils and marginal land. Whether or not food supply is maintained by the remaining crop land being managed more intensively or if people have become more dependent on buying food cannot be determined from our data, but it appears their dependency on cash for buying food has increased, making poor people more vulnerable and dependent on external incomes. To find opportunities and policy arrangements for rural people to subsist in their original environment under economic change is a global issue, including all four countries of the study.

- *Productivity and sustainability aspects of smallholder plantation forestry remains to be better understood and acknowledged among farmers, administration and politicians.* Increasing forest plantation at the expense of unsustainable agriculture increases incomes for some, but does not automatically bring farmers out of poverty. In the local studies in Vietnam and China, productivity of wood in farmers' plantations is much lower than in nearby industrial plantations. Poor farmers did not have time and resources to invest in forestry and they did not get adequate extension service. They cut the trees at young age in need for cash and sometimes in response to the fibre industry's needs. Further, they cannot afford to transport heavy timber. In the Ethiopian case the situation is similar. Forestry in the study areas contributes some 10–25% of household cash income but should be able to contribute more. A national concern for Vietnam, Ethiopia and China is shortage of industrial high value timber. The situation is different from Sweden where many farmers invest in their plantations and use them as a pension insurance or bank account. The institutional and policy issue would be how to support households in producing more high value products and thereby establishing a sustainable production of commodities, while maintaining resilience and adaptive capacity to accommodate future changes.

- *Secure access to land, through private ownership, tenure or other legal instruments, are a pre-requisite for development of small holder plantation forestry.* This requires that the society and the State upholds and protects the rights to the land and investments made by the operator. A process of tenure reforms, forest land devolution formalised by individual land tenure certificates has evolved in all studied countries in connection with expanding private tree plantation. As illustrated in this paper, a structure of a large number of smallholders with very small holdings has appeared. A future concern for governments in China and Vietnam is how to improve participation and protect smallholders from negative effects of "local powerful actors controlling the land allocation process and benefitting disproportionately" (Xu *et al.* 2008). Further, an ownership structure with very small holdings may (possibly) promote biodiversity and adaptation to individual preferences, but not contribute to an economically sustainable forestry for local livelihoods unless forest management is well organised for the purpose. Supportive policies and legislation, secure tenure, functioning institutions and markets and good governance are important resources to be provided by the governments.

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