

ASIA-PACIFIC FORESTRY COMMISSION



What does it take? The role of incentives in forest plantation development in Asia and the Pacific



Asia-Pacific Forestry Commission

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The role of incentives in forest plantation development
in Asia and the Pacific

Thomas Enters and Patrick B. Durst

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For copies of the report, write to:

Patrick B. Durst
Senior Forestry Officer
FAO Regional Office for Asia and the Pacific
39 Phra Atit Road
Bangkok 10200
Thailand
Tel: (66-2) 697 4000
Fax: (66-2) 697 4445
Email: Patrick.Durst@fao.org

TABLE OF CONTENTS

Foreword	v
Acknowledgements	vi
Introduction	
1 The role of incentives in forest plantation development in the Asia-Pacific region . <i>Thomas Enters</i>	1
2 Plantations in the Asia-Pacific region: an expanding resource	7
<i>Philip McKenzie, Chris L. Brown and Jim Carle</i>	
3 Incentives: key concepts, typology and rationale	15
<i>Thomas Enters</i>	
Country case studies	
4 Impact of incentives on the development of forest plantation resources in the Asia-Pacific region: Australian case study	21
<i>Clive Catton, Adam Gerrand, Annie Josline and Robert Miller</i>	
5 Impact of incentives on the development of forest plantation resources in China ...	59
<i>Jintao Xu, Nuyun Li and Yiyang Cao</i>	
6 Impact of incentives on the development of forest plantation resources in India	81
<i>S.K. Pande and D. Pandey</i>	
7 Impact of incentives on the development of forest plantation resources in Indonesia, with emphasis on industrial timber plantations in the outer islands	103
<i>Philippe Guizol and Aulia L.P. Aruan</i>	
8 Impact of incentives on the development of forest plantation resources in Sabah, Malaysia	125
<i>Chan Hing Hon and Chiang Wei Chia</i>	
9 Impact of incentives on the development of plantation forest resources in New Zealand	151
<i>David Rhodes and John Novis</i>	
10 Impact of incentives on the development of forest plantation resources in the Philippines	197
<i>Romeo T. Acosta</i>	
11 The development of forest plantations in Thailand	211
<i>Narong Mahannop</i>	
12 Markets, policy incentives and development of forest plantation resources in the United States of America	237
<i>Daowei Zhang</i>	
Summary and conclusions	
13 What does it take? Incentives and their impact on plantation development	263
<i>Thomas Enters, Chris L. Brown and Patrick P. Durst</i>	

FOREWORD

The Asia-Pacific region is endowed with extensive and biologically diverse forests. Hundreds of millions of people depend directly on these forests for their livelihoods. Many more people make use of the products and enjoy the services that the forests provide. Since the middle of the last century, the region's natural forests have provided millions of cubic metres of wood annually, supporting a wood-processing industry that employs millions.

Over the past two decades, political developments, and macro-economic and extra-sectoral policies have affected forests of Asia and the Pacific to an unprecedented extent. Many countries in the region continue to suffer the effects of deforestation and forest degradation, and today the natural forests are treasured as much for the environmental services they provide, as for the wood they produce. Millions of hectares have been protected as parks and reserves, or otherwise declared off-limits to the logging industry. As a result there have been dire predictions of an acute shortage of wood or a timber famine.

Responding to the diminishing capacity of the region's natural forests to produce timber, many countries have turned to forest plantations. Plantations have the potential to be a highly productive and sustainable source of wood and non-timber forest products. They can also provide social and environmental services, including storing carbon, combating desertification and rehabilitating degraded lands.

Historically, public-sector agencies have dominated forest plantation development in most countries in Asia and the Pacific. However, for a variety of reasons, it has been widely accepted that private small- and large-scale producers offer considerable comparative advantages when it comes to growing trees and producing industrial wood in plantations. Consequently, there is a growing interest in involving the private sector directly in the development of forest plantations, and governments and their respective forestry agencies are increasingly asking what it takes to encourage non-government entities to grow trees. In other words, they are looking for the right incentives to make growing trees attractive to small- and large-scale investors.

To date, there has been no comprehensive study of incentives that encourage plantation establishment and management in Asia-Pacific countries, despite the fact that the region leads the world in plantation development. The existing body of analysis is small and fragmented and conclusions are preliminary in nature. As a result, countries of the region have not benefited fully from past experiences and scarce financial resources continue to be spent inappropriately.

To address this knowledge gap, the Asia-Pacific Forestry Commission (APFC) implemented a regional study to assess the impact of incentives on forest plantation development. The findings of the study clearly indicate that a blueprint for engaging non-government investors in forest plantation development does not exist. What has emerged, however, is that clear, consistent and stable policies and a favourable investment climate are essential ingredients to promote the development of forest plantations by small- and large-scale producers.

In presenting the findings of the study, FAO and its partners are pleased to continue their support for sustainable forest management in the Asia-Pacific region. We hope that this publication will help policy-makers and foresters to better understand the key issues, challenges and opportunities concerning the effective involvement of the private sector in forest plantation development.



He Changchui
Assistant Director-General and
Regional Representative for Asia and the Pacific
Food and Agriculture Organization of the United Nations

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THE ROLE OF INCENTIVES IN FOREST PLANTATION DEVELOPMENT IN THE ASIA-PACIFIC REGION

1

Thomas Enters¹

Will we have enough forests and wood to satisfy the growing demand for wood products? The key message of a study by Nilsson (1996), which reviewed the available knowledge in the mid-1990s, was that probably we will not run out of forests but we may run out of wood. Nilsson (1996) forecasted a rather “substantial shortage of industrial roundwood already by 2010” (p. 53). Throughout the last century, similar predictions were made in many countries in the Asia-Pacific region. The first distress signals about an impending domestic timber famine were articulated in the 1920s in New Zealand. These concerns were reiterated in other countries, at first modestly, later fervently, until forest departments in most countries had convinced their governments of the necessity to provide the appropriate budget allocations for forest plantation programmes. Today, forest plantations make up about 16 percent of the forest cover of the Asia-Pacific region and the region accounts for around 61 percent of the world’s plantation forest.

Historically, public-sector agencies have dominated forest plantation development in most countries in Asia and the Pacific. This pattern has changed in many countries over the past ten to 20 years, mainly for four reasons. First, devolution of forest management has led to greater involvement of communities and the private sector in forestry. Second, the performance (financially and biologically) of public-sector plantations – with few exceptions – has been disappointing. Third, shrinking government budgets make it impossible for most forest departments to devote as many resources to forest plantations as they have in the past. Fourth, problems related to weak governance structures are driving many countries to reconsider the role of government in administering forest resources and in directly implementing forest programmes (Gregersen *et al.* 2004).

These developments have been paralleled by a shift in the main objectives of forest management, which traditionally focused on timber production. Although forest policies and forest management objectives diversified and expanded long before the United Nations Conference on Environment and Development (UNCED), since 1992 forestry has become even more multidimensional. Forests are increasingly valued for supporting local livelihoods and helping to reduce poverty, for providing local environmental services and as a reservoir of global biodiversity. In the Asia-Pacific region, this shift in thinking has affected forestry immensely over the last ten years. Perhaps the most far-reaching outcome is that forest areas set aside for conservation have expanded considerably and that the area of production forests has declined even faster, due to unabated deforestation rates and, even more so, due to complete or partial harvesting restrictions – the logging bans (Durst *et al.* 2001).

In environmental or conservation terms, the impact of the various conservation measures, especially logging bans, has been mixed. In terms of wood supply, the impact is clear-cut. Domestic timber supplies derived from natural forests have been reduced substantially, in some countries such as Thailand to a trickle. As a consequence of such developments, the search is on for generating alternative wood supplies. While some countries have turned to imports – at least in the short term – most have attempted to augment forest plantation resources. Today more

¹ National Forest Programme Facilitator, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

industrial roundwood is sourced from plantations and trees outside forests in Asia and the Pacific than from natural forests (Brown and Durst 2003). With the public sector retreating from direct involvement in planting and tending trees, the question is whether the private sector can grow the wood that many expect is needed.

During the 18th Session of the Asia-Pacific Forestry Commission (APFC), held in Noosaville, Australia in May 2000, the Commission reviewed the results of the regional study on the *Impacts and effectiveness of logging bans in natural forests in Asia-Pacific* (Durst *et al.* 2001) and considered issues identified by the study as requiring additional information and analysis for effective policy-making. *Inter alia*, it recommended conducting collaborative activities in the area of commercial forest plantations. In light of the above, the APFC undertook a comprehensive multicountry study on the *Impacts of incentives on the development of forest plantation resources in the Asia-Pacific region*.

THE STUDY'S AIM AND SCOPE

There are several examples in the world where clear, consistent and stable policies, a conducive investment climate and well-programmed incentive schemes have made a significant impact on the success of forest plantation development. In contrast, where initiatives have been ill conceived or poorly implemented, the results have been disappointing despite heavy investment by governments. It is common knowledge that vast plantation areas are of very poor quality. Others exist on paper only, because mismanagement or some disaster led to their premature death in the field. Others were never established, but appear in records only to spuriously indicate that targets have been reached and funds spent.

This regional study was designed to comprehensively examine the reasons for the mixed results and to provide guidance in policy formulation to those countries interested in stimulating investments in tree growing through the provision of incentives to large- and small-scale growers. The study focused on policy instruments and mechanisms aimed at stimulating investment in commercial plantations grown for profits, while recognizing that forest plantations can also be established to meet broader social and environmental objectives.²

This publication is based on country case studies conducted in Australia, China, India, Indonesia, Malaysia (Sabah), New Zealand, the Philippines, Thailand and the United States of America.³ The countries were selected to represent examples of major private-sector involvement in plantation development. In addition, experiences from other countries were reviewed to strengthen the results of the study.

Many governments and their respective forestry agencies are increasingly asking what it takes to effectively involve the private sector and local communities in forest plantation development. Hence, the main purpose of the study was to gain insights into this pertinent question.

² Readers interested in the broader role of incentives in natural resource management should consult Sanders *et al.* (1999) and FAO (1999).

³ The United States of America was included in the study as part of the Asia and the Pacific region, since it borders the Pacific Ocean, has territories in the Pacific and is a member of the Asia-Pacific Forestry Commission. The contribution from Malaysia focuses on the experiences of only one company, Sabah Softwoods Berhad (SSB) in Sabah, East Malaysia.

The principal objectives of the study were to:

- Document plantation development in the Asia-Pacific region;
- Analyse past and current experiences in providing direct and indirect incentives for tree planting;
- Assess the broader socio-economic and political conditions that encourage investments in forest plantations; and
- Provide recommendations for enhancing the involvement of the private sector in plantation development.

KEY CONCLUSIONS

The key conclusions that emerge from the regional study are presented below. The final chapter discusses these issues in greater detail.

1. Very broadly, plantation development in the Asia-Pacific region is at three stages (that is, initiation, acceleration and maturation stages). In Australia, New Zealand and the United States, interest in growing trees has a long history and by the 1990s these three countries had reached the maturation stage. Most Asian countries find themselves still in the initiation or early acceleration stage – especially with regard to involving the private sector – even though plantations may cover extensive areas such as in China (46.7 million ha) and India (32.6 million ha).
2. Broadly defined, incentives encompass anything that motivates people to act. In the context of the regional study, incentives were defined as *policy instruments that increase the comparative advantage of forest plantations and thus stimulate investments in plantation establishment and management* (for a detailed definition see Chapter 3). These include a wide range of interventions from the provision of free seedlings (a common direct incentive) to political and macro-economic stability (in the Asia-Pacific region, a less common indirect incentive). Under this definition, incentives constitute any means that provides encouragement to “do business” (that is, establish plantations). At the disposal of policy-makers is a vast array of incentives and none has emerged as a silver bullet, although some are more effective than others. The effectiveness of a particular incentive changes over time as countries move from one stage to the next.
3. During the initiation stage, direct incentives may be required, in certain instances, to raise awareness and to increase the pace and scale of tree planting, especially to build up raw material supplies for an expanding processing sector. However, as experience is gained and both capacity and infrastructure develop, direct incentives become less important (they can also suffer from very high transaction costs). They are likely to be replaced by variable incentives and complemented by research and development, and extension, during the acceleration stage. In fact, a good sign of success is direct incentives becoming obsolete during the acceleration stage.
4. In the long term, providing a favourable investment climate, technical assistance and well-established markets have greater influence than direct incentives such as free seedlings, subsidized credit or cost-sharing of planting expenses. In all cases, incentive systems must be timely, well-targeted and flexible if they are to successfully engage the private sector in forest plantation development. In deciding on measures that increase the interest of investors it is vital that consideration be given to factors that motivate people to invest in planting trees, rather than focusing on the needs and objectives of governments and their respective forest agencies. Thus, small grants provided with a minimum of administrative complexity tend to be more effective than loans that have bureaucratic repayment requirements.

5. In the countries that have reached the maturation stage, it has been recognized that key measures to maintain private sector interest and investment in plantation development are related to the reduction of barriers to investments and removal of structural impediments and operational constraints. The key to success in forest plantation development lies in providing clear and secure resource and property rights, and coherent and stable policies. An important component of an enabling environment that is supportive of economic activities is healthy debate on the merits of planting trees and particular incentives, and transparent decision-making.
6. Most people agree that forest plantations can help meet increasing demands for wood and provide public goods and services, although there are exceptions to this general statement. Most people also maintain that appropriate incentives – particularly enabling incentives – play a key role in stimulating plantation development. However, proponents of forestry need to recognize that alternative land uses may offer similar – often greater – benefits to society as well as higher returns to investments. Under such circumstances, it may be pointless to offer incentives for plantation development, since it may be more economically efficient to invest in alternative land uses.
7. In a historical context, incentives have largely been applied in an *ad hoc* manner. As improved understanding of the mechanisms and conditions related to economic growth and development has evolved, it has become apparent that, in many instances, plantation incentives have been less successful than they might otherwise have been, had various restrictions on – or disincentives to – plantation establishment, tree harvesting and transport also been addressed.
8. Finally, and not surprisingly, the overriding stimulus for commercial timber planting is real prices and perceptions of future price developments. Investors frequently react vigorously to changes in prices, as the price spike for wood in the early 1990s showed. In many countries in the Asia-Pacific region, it triggered an unprecedented planting boom, without much, if any, intervention from the public sector.

THE CONTRIBUTIONS

Chapter 2 provides an overview of plantation development in the Asia-Pacific region. It highlights the considerable increases in establishment rates during the 1990s and the more mixed results of the past several years.

Chapter 3 introduces the concept of, and the rationale for, providing incentives. It takes the reader through an assortment of diverse and sometimes confusing definitions. If it is agreed that incentives should only be applied for achieving public goals, what then is the justification for providing incentives to potential private investors in plantation establishment? There are a number of reasons that justify the transfer of scarce resources, especially in the nature of direct incentives, to commercial tree growers. There are also circumstances where such transfers should not be made.

Chapter 4, the main body of this volume, introduces the reader to the nine case studies conducted under the regional review. The country studies follow a common format. Dividing the history of plantation development into different phases, which is not always straightforward, they illustrate the use of incentives and the results or impacts. The reader will become aware of the difficulties in making these assessments, since the use of incentives has not been monitored rigorously in most countries.

Chapter 5 summarizes the main insights gained from the case studies. The impact of incentives on plantation development depends on numerous issues. There are considerable differences among the nine countries that were part of the regional study. What works in one country does not necessarily achieve the same outcomes in another country, even if situations are seemingly similar. Notwithstanding the diversity and the different paths taken to expanding plantation

areas, a common theme emerges. Those readers expecting clear guidance may be disappointed. A blueprint for stimulating investors to put their money and/or labour into trees does not emerge. However, the picture that does surface is sufficiently coherent to conclude the chapter and the book with guiding principles for supporting plantation development.

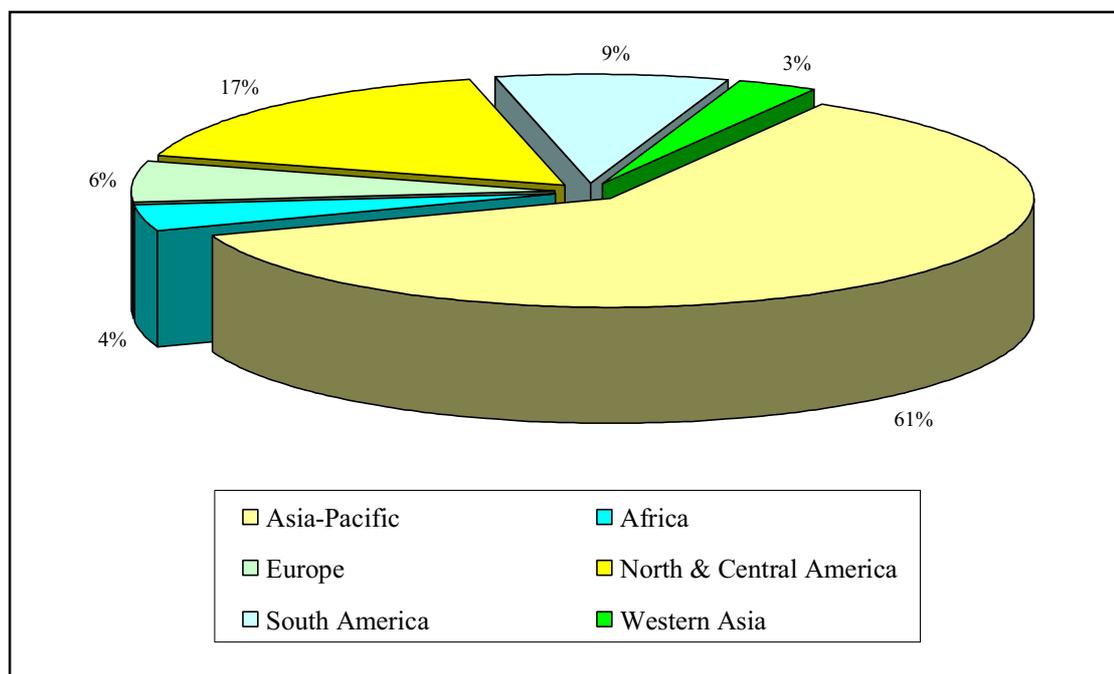
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PLANTATIONS IN THE ASIA-PACIFIC REGION: AN EXPANDING RESOURCE

Philip McKenzie¹, Chris L. Brown² and Jim Carle³

Forests in the Asia-Pacific region cover approximately 699 million ha (FAO 2001). Of this area, some 113.2 million ha are forest plantations, or 16 percent of the total forest resource. This is considerably higher than the global average of plantations, which stands at around five percent. The Asia-Pacific region accounts for some 61 percent of the world's plantation forests (Figure 1).



Source: FAO (2001).

Figure 1: Global distribution of forest plantations by region in 2000

The majority of the global forest plantation resource is held by a small group of countries. Five countries from Asia rank among the top ten plantation countries in the world: China (46.7 million ha); India (32.6 million ha); Japan (10.7 million ha); Indonesia (9.9 million ha); and Thailand (4.9 million ha).⁴ Together, these five countries account for 55 percent of the global forest plantation resource, and 91 percent of the Asia-Pacific plantations.

Forest plantations were established on around 34 million ha in the Asia-Pacific region (excluding Japan, Australia and New Zealand) between 1990 and 2000. This is a marked increase on the 27 million ha established during the 1980s. India (1.5 million ha *per annum*) and China (1.2 million ha *per annum*) currently have the highest plantation establishment rates (Brown and Durst 2003). Trend analysis confirms a significant increase in plantation establishment in the region during the 1990s (FAO 2003). This trend is likely to continue in the coming years,

¹ Associate Professional Officer – FAO Regional Office for Asia and the Pacific, Bangkok Thailand.

² Consultant to the FAO Regional Office for Asia and the Pacific, Bangkok Thailand.

³ Senior Forestry Officer (Plantations and Protection), Forest Resources Development Service (FORM), FAO Rome.

⁴ Please note that most figures are taken from FAO (2001). They have been updated whenever possible.

due to the increasing demand for wood and wood products, although in recent years planting rates in some countries have declined for a variety of reasons (see Chapters 4 and 5).

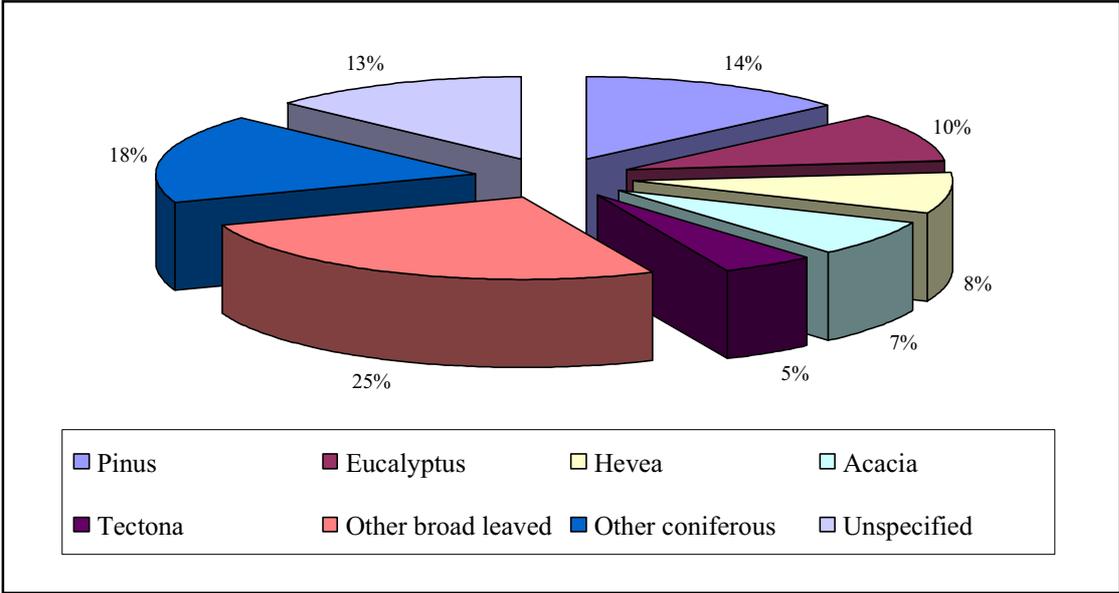
There has been a very rapid acceleration in plantation establishment in China during the past 20 years. China’s forest plantations comprise mainly Chinese fir (*Cunninghamia lanceolata*), poplars and a variety of pines. More than 80 percent of China’s plantations are of industrial species. In Japan, 45 percent of forests are classified as plantations, almost all of which were planted during the postwar reconstruction. The main species are sugi (*Cryptomeria japonica*), hinoki (*Chamaecyparis obtusa*), pine and Japanese larch (*Larix leptolepis*).

Forests plantations in India have, generally, had a markedly different focus, with more than two-thirds designated as non-industrial plantations. Although many of the plantations were established to produce fuelwood, a large percentage have subsequently been harvested for construction purposes and pulp. In recent times, there has been a shift in planting towards industrial purposes. India’s plantations are dominated by fast-growing hardwood species, particularly, acacias and eucalyptus. Teak (*Tectona grandis*) is commercially the most important timber species planted, totalling around one million ha.

Indonesia has 9.8 million ha of predominantly industrial plantations. Rubber (*Hevea brasiliensis*) is the most widely planted species, followed by teak, pines and *Acacia mangium*.

Thailand’s plantations are similarly dominated by rubber, with teak being the second most important plantation species.

Overall, pine, eucalyptus and rubber are the most import plantation species grown in the region (Figure 2).



Source: FRA (2000).

Figure 2: Distribution of species in Asia and the Pacific

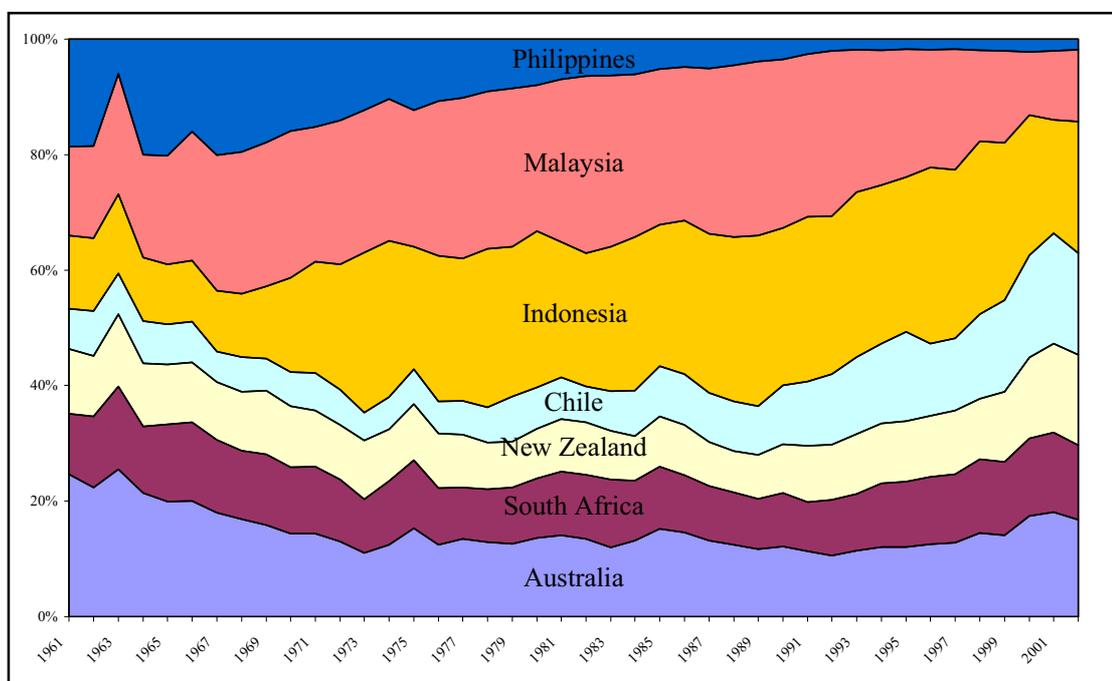
The dominant plantation species in Oceania is *Pinus radiata*. This species accounts for 89.2 percent (MAF 2004) of the plantation area in New Zealand, and 59 percent in Australia (NPI 2004). Other pine species, most notably *Pinus caribaea* in Fiji, and *Pinus caribaea* and *P. oocarpa* in northern Australia make up the bulk of the softwood plantations. *Eucalyptus* species in Australia predominate in hardwood plantations although Fiji also has significant areas of mahogany (*Swietenia macrophylla*).

Both New Zealand and Australia commenced plantation programmes prior to 1930. Significant areas of plantations have now reached maturity and are being harvested. Substantial plantation areas in New Zealand and Australia are in second rotation, with a few in a third rotation. New Zealand, Australia and Fiji all anticipate significant increases in their plantation wood production during the next decade.

PRODUCTION: SHIFTING FROM NATURAL FORESTS TO PLANTATIONS

New Zealand, Australia, Chile and South Africa comprise a group commonly known as the southern plantation countries. These four countries are characterized by large, mainly *Pinus radiata*, plantation estates, with significant export potential and age-class profiles that imply rapid increases in production over the next 15 to 20 years. These new plantation supplies seem likely to significantly alter the composition of Asia-Pacific wood and fibre markets.

Figure 3 illustrates a significant trend in wood production during the past 40 years, with wood production shifting from the natural forests of the traditional Southeast Asian producers to southern plantation countries. Large tracts of natural forests are likely to confer an advantage in the short-run, but that advantage will eventually diminish owing to advantages that plantations offer, that is, the ability to grow uniform trees quickly in accessible areas. Hence, the Philippines, having exhausted its natural forests during the 1960s and 1970s has become a minor player in forest product markets. Malaysia and Indonesia commenced logging in natural forests later and have exploited their natural advantage through the 1970s and 1980s. During the 1990s, the fast-growing plantations of the southern plantation countries began capturing the market share from Indonesia and Malaysia. At present the southern plantation countries account for more than 60 percent of the roundwood production share of the seven countries, up from about 40 percent in the mid-1980s.



Source: FAOSTAT (2004).

Figure 3: Comparative shares of wood production: Southeast Asian countries versus Southern plantation countries

FUTURE PLANTATION WOOD PRODUCTION

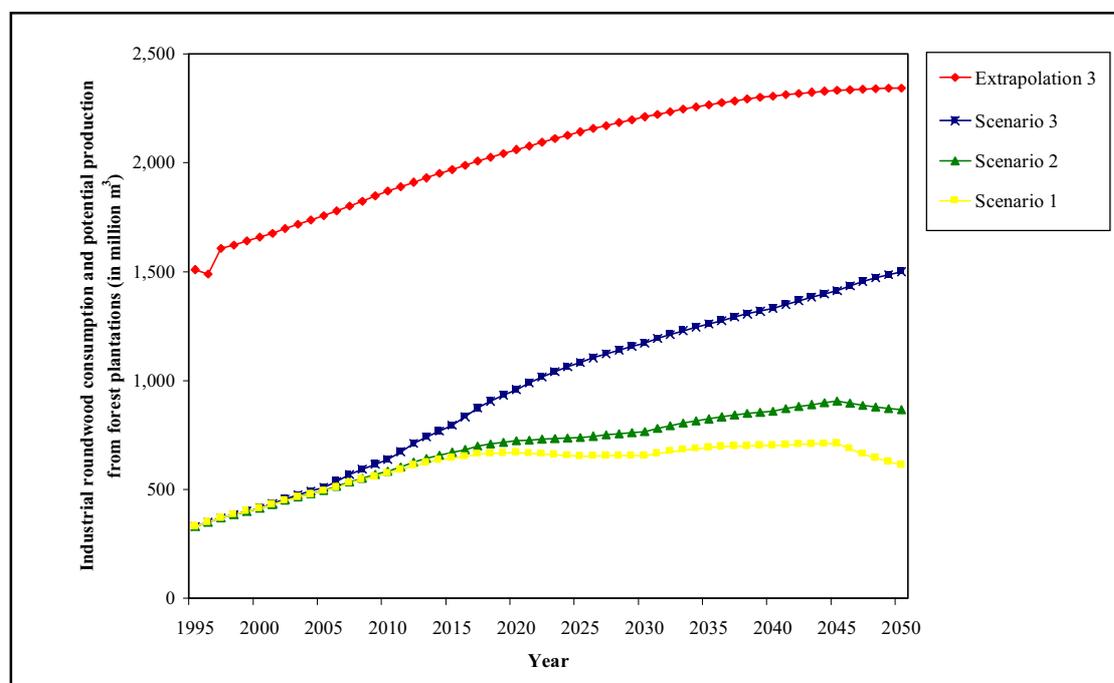
The future production of wood from plantations is of great interest to both the public and private sectors. Brown (1999) modelled three scenarios for future wood supply from forest plantations, as part of the Global forest products outlook thematic study on plantations.

Scenario 1 provides a baseline forecast, by assuming that forest plantations are not expanded beyond their current area and that all areas are replanted after harvesting.

Scenario 2 assumes that new planting will increase the forest plantation area at a constant rate of 1.2 million ha *per annum* in total (equal to one percent of the area of forest plantations in 1999).

Scenario 3 assumes that the annual rate of new planting estimated in 1995 (4.71 million ha in total) is maintained until 2010, after which it is reduced by 940 000 ha at the start of each of the following decades (that is, until it declines to zero in 2050).

Figure 4 compares future wood production from industrial plantations under each of the three scenarios, with a forecast of total industrial roundwood consumption derived using long-term trend analysis, to 2050.



Source: Brown (1999).

Figure 4: Comparison of projections for industrial roundwood production with three plantation scenarios

Several points of interest can be noted from Figure 4.

1. The difference between the three forest plantation scenarios until 2010 is not significant. This is because trees already in the ground will determine production over the next decade.
2. The heavy weighting towards the youngest age-classes in the global distribution means that even Scenario 1 (zero new planting) shows a significant increase in wood production from forest plantations. Scenario 1 shows an increase in production from 331 million to 712 million m³. Note, however, this growth production would be insufficient to keep pace with the forecast growth in roundwood consumption, and additional new sources of wood or fibre would need to be found to meet further new demand.

3. Scenario 2 increases at approximately the same rate as projected new demand for roundwood. It shows an increase in plantation wood production to 906 million m³. Note, however, that current levels of harvesting in natural forests, recycling, etc. need to be maintained if no other new fibre sources are found, or efficiency is not significantly improved. This is, however, unlikely as the levels of harvesting in natural forest are decreasing and are likely to continue decreasing in the future due to the smaller area of available forest resources, increasing inaccessibility of the remaining forests and an increasing number of policies such as logging bans that have been imposed to protect the remaining natural forest resources.
4. Only Scenario 3, with its relatively large land-use implications, would enable forest plantations to substitute for wood production from natural forests. Scenario 3 expands plantation production to 1.5 billion m³, approximately equal to current levels of global industrial roundwood consumption. Under Scenario 3, the forest plantation share of industrial roundwood production is estimated to increase from the current 22 percent, to 64 percent in 2050.

The long-term production forecast from forest plantations is very sensitive to the assumptions made about future forest establishment rates. The future rate of plantation establishment will be determined to a considerable extent by the availability of suitable and affordable land, policies, incentives, profitability of alternative crops, the opportunities that the Clean Development Mechanism (CDM) may offer, and perceptions of supply-demand balances for wood and fibre. In general, it is expected that plantations will supply a high proportion of raw material to fibre-based industries and for the production of utility sawntimber. High-quality hardwood timbers are likely to continue being sourced from natural forests, although plantation-grown teak can be expected to become increasingly important.

ALTERNATIVE SOURCES OF WOOD AND FIBRE

The increasing demand for wood and fibre has resulted in the identification of various alternative sources. There are a number of interesting sources in Asia and the Pacific including coconut palm, oil-palm, bamboo and agricultural residues. Although these sources cannot replace timber, they can supplement traditional wood resources, especially in the form of fibre.

Coconut palm (*Cocos nucifera* L.) has a long history of cultivation in the tropics, spanning some 4 000 years. The main product of the palm is the coconut oil. There are some ten million ha of coconut palm plantations in the Asia-Pacific region (Durst *et al.* 2004). Large quantities of stems become available at the end of a rotation (50-60 years depending on the variety). The anatomical properties of the stem make it difficult to process the stem using conventional tools. Despite the fact that the lumber is not very durable, the relatively low cost of the material make it appealing. Another advantage of coconut is the green image of the product, as it is a plantation by-product.

Oil-palm (*Elaeis guineensis* Jacq.) is a plantation species widely grown for its oil. The area under oil-palm is rapidly increasing and many rubber plantation owners are switching to oil-palm due to the higher profit margins. As of 2001, there were approximately six million ha of oil-palm plantations, of which 80 percent is located in the Asia-Pacific region (Killmann 2001). Unlike the coconut palm, the stem of the oil-palm is not suitable for direct use as a wood substitute. However, research on the use of the empty fruit bunches for the production of Medium Density Fibreboard (MDF) has been completed and subsequently, two plants have been established in Sabah and Peninsular Malaysia (Durst *et al.* 2004). Other potential uses for oil-palm residues include: moulded furniture, sawing and laminating palm stems, particleboard manufacture and the production of activated charcoal (Razak 2000).

Although bamboo has a long history of use in Asia, it is increasingly becoming an important source of raw material for further downstream processing, as new uses for it have emerged. Traditionally the culms were used as a wood substitute for construction and scaffolding and the

shoots of certain species were eaten. New processes use bamboo as raw material for particleboard, fibreboard, plybamboo, laminated boards, bamboo flooring and pulp and paper (Ruiz-Perez *et al.* 2001). Bamboo furniture is also a rapidly growing market segment. China and India have the world's largest bamboo resources, with four million ha and ten million ha respectively (Ruiz-Perez *et al.* 2001; Ganapathy 1997).

Agricultural residues are also becoming increasingly important. Straw, a by-product of grain production, is used extensively for the production of pulp and paper. It is also possible to produce a panel board, with similar characteristics to MDF, using straw. Bagasse, the fibrous residue that is left over after the extraction of juice from sugar cane, is used for producing paper in several countries, including India, the world's largest sugar-cane producer. The use of rice husks for the production of reconstituted panel boards is being investigated in Malaysia.

THE KYOTO PROTOCOL AND THE ROLE OF PLANTATIONS AS CARBON SINKS

The Kyoto Protocol was negotiated in December 1997. It requires developed countries to reduce their greenhouse gas (GHG) emissions by 5.2 percent compared to 1990 levels, between 2008 and 2012. The Kyoto Protocol recognizes forests, their soils and products in climate change mitigation. According to the protocol, reductions can be achieved by two means: (i) reducing the amount of emissions and (ii) increasing storage. Three so-called "flexibility mechanisms" were included in the Kyoto Protocol to help developed countries meet their reduction targets cost-effectively. These include Emission Trading, Joint Implementation and the Clean Development Mechanism (CDM). The latter enables developed countries to achieve a portion of their emission reductions by implementing carbon sequestration projects in developing countries.

Afforestation and reforestation were recognized as the only eligible land uses under the CDM. This offers interesting perspectives for the establishment of plantation forests for sequestering carbon. It has led to a steep increase in the establishment of plantations in developing countries with some four million ha of plantations having been established for GHG mitigation (Carle *et al.* 2002). Most of these plantations have been established by international investors and international development banks, such as the World Bank. Despite the fact that certain aspects of the CDM are still under negotiation and the technical instruments and standards for carbon accounting are still under development, forest plantations have interesting prospects to be utilized as carbon sinks. It is anticipated that forest plantations will play an increasingly important role in carbon sequestration and the implementation of the Kyoto Protocol.

CONCLUSION

The Asia-Pacific region has a large plantation resource, accounting for 61 percent of global forest plantation resources. Five of the top ten plantation countries are located in the region; together these countries account for 91 percent of the total plantation resource in the region. The rate of plantation establishment has increased dramatically during the 1990s. There has been a shift in wood production in the region, from predominantly natural forest production to plantation forest production over the past 40 years.

Modelling exercises for future plantation wood production indicate that the demand for plantation wood is likely to increase in the future. The wood from plantations will be used as feedstock for fibre-based industries and for the production of utility sawntimber. High-quality timbers are most likely to continue being sourced from natural forests, with the possible exception of teak.

Other sources of wood and fibre are becoming increasingly important. Coconut palm, oil-palm and bamboo are a few of the promising alternatives. Although these sources cannot replace timber entirely, they can supplement traditional wood resources, especially in the form of basic fibre.

The inclusion of reforestation and afforestation activities in the Kyoto Protocol offers interesting possibilities for plantation forests. To date, some four million ha of plantations have been established for GHG mitigation.

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INCENTIVES: KEY CONCEPTS, TYPOLOGY AND RATIONALE

3

Thomas Enters¹

THE CONCEPT OF INCENTIVES

While there is no dearth of definitions for incentives, a single agreed definition does not exist (Meijerink 1997). Defined in very broad terms, an incentive is anything that motivates or stimulates people to act (Giger 1996; cited in FAO 1999). Sargent (1994; cited in Tomforde 1995) defines incentives as signals that motivate action. Other definitions refer to the “incitement and inducement of action” (Enters 2001). Within the context of development projects, incentives have also been described as “bribes” and “sweeteners” (Smith 1998).

Two points are illustrated by the various definitions and descriptions. First, incentives can be financial or non-financial in nature. Second, if incentives include “anything” that motivates, then surely they cannot just be policy instruments. In fact, there are incentives that cannot be influenced through intervention or can be changed only with great difficulty. Reliable rainfall and low fire danger are certainly factors – or enabling incentives – that determine investment decisions related to tree growing. While rainfall patterns are virtually impossible to change, the danger of fires breaking out and burning down a plantation can be managed to a certain extent. The following analysis concerns only those direct and indirect incentives that can be provided or withdrawn through policies.

To be of interest and to have an impact, incentives need to affect the cost-benefit structure of economic activities such as plantation management. Hence, in the context of the regional study, incentives can be defined as *policy instruments that increase the comparative advantage of forest plantations and thus stimulate investments in plantation establishment and management.*

This definition is broader than the more narrow definition for subsidies. The latter are of a purely pecuniary nature and usually viewed as payments provided to reduce the costs or raise the returns on an activity. The broader definition includes research and extension, which are important elements in supporting plantation development.² The definition also includes sectoral and macro-economic policies which, as will be argued in the concluding chapter, establish much of the general investment climate and heavily influence the economic behaviour of individuals and corporations. Consequently, the spectrum of incentives is considerably broadened and a distinction is made between direct and indirect incentives (Figure 1).

The distinction between direct and indirect incentives is somewhat blurred. Direct incentives are designed to have an immediate impact on resource users and influence returns to investment directly. Indirect incentives on the other hand have an indirect effect through setting or changing the overall framework conditions within and outside the forestry sector. There are some overlaps. For example, tax concessions for plantation investors are a direct incentive, whereas general tax reductions for fuel are considered indirect incentives, as they lower production and transport costs within as well as outside the plantation sector.

¹ National Forest Programme Facilitator, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

² Extension, awareness raising, and public investments in education and research have been described as social instruments (Enters 2001) but can also be subsumed under the category of “enabling incentives”.

Subsidies for plantation schemes

Subsidies to the forestry industry in the developed world have far exceeded those provided by developing country governments. At present the average subsidy for plantation schemes in 11 EU countries is US\$1 421/hectare, with an additional US\$761/hectare for maintenance. This compares with subsidies of less than US\$400/hectare for most plantation schemes in South America. However, most developing countries with significant plantation interests have used, or continue to use, incentives and subsidies as a means of encouraging the industry. For example, between 1974 and 1994, the Chilean Government spent some US\$50 million on afforestation grants. In Brazil, subsidies and taxation incentives were used to encourage the establishment of plantations, and in recent years Ecuador and Colombia have adopted a similar incentives model to Chile. Ecuador currently provides planting and maintenance incentives amounting to US\$300/hectare. Paraguay provides US\$350/hectare for planting and US\$100/hectare for maintenance for the first three years.

Source: Cossalter and Pye-Smith (2003)

Direct incentives are provided directly by governments, development agencies, non-governmental organizations and the private sector. They include the following:

- goods and materials (for example, seedlings, fertilizers etc.);
- specific provision of local infrastructure;
- grants;
- tax relief or concessions;
- differential fees and access to resources;
- subsidized loans; and
- cost-sharing arrangements and price guarantees.

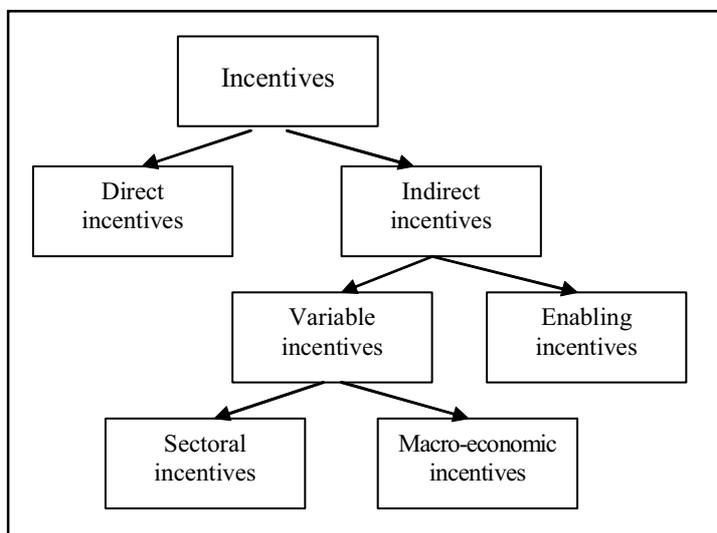


Figure 1: Typologies of incentives

Indirect incentives can be divided into *variable incentives* and *enabling incentives* (Table 1). Variable incentives are economic factors that affect the net returns that producers earn from plantation activities. Enabling incentives on the other hand mediate an investor’s potential response to variable incentives and help to determine land use and management (FAO 1999). They can also be viewed as elements in the investment environment that affect decision-making behaviour. A country’s enabling incentives determine to a considerable extent investment risks, and information on them needs to be constantly updated to guide investors.

Table 1: Distinguishing variable from enabling incentives

Variable incentives		Enabling incentives
Sectoral	Macro-economic	
Input and output prices	Exchange rates	Land tenure and resource security Accessibility and availability of basic infrastructure (ports, roads, electricity etc.) Producer support services Market development Credit facilities Political and macro-economic stability National security Research and development Extension
Specific taxes	General taxes	
Trade restrictions (e.g. tariffs)	Interest rates	
	Fiscal and monetary measures	

In the Asia-Pacific region, virtually all of the incentives in Table 1 have been or are used to stimulate tree growing. As we will see later, there has been a gradual evolution in the way that governments in the region have provided encouragement, with increasing recognition that provision of enabling incentives, the removal of structural impediments and market distortions or the creation of an “overarching climate of enterprise” is the most effective (and economically efficient) incentive in the long run. This shift in thinking has also unfolded in Latin America with a move from subsidies as corrective measures to the removal of impediments (Haltia and Keipi 1997).

The “new” conventional wisdom

The “new” conventional wisdom does not advocate subsidies as corrective measures to offset distortions existing elsewhere in the economy; rather it proposes the direct elimination of those distortions.

Source: Keipi (1997)

JUSTIFICATION FOR PROVIDING INCENTIVES

Why are incentives necessary, or more specifically, what is the rationale for providing incentives to potential investors in forest plantation development? Why should taxpayers be interested in supporting the economic activities of others? Why should the private sector provide support to small-scale growers? If potential investors are dissatisfied with the low returns on their investments in plantations, would it not be more appropriate to suggest they invest in a more profitable land use?

Meijerink (1997) argued that incentives should only be applied for public goods. From the economist’s perspective, incentives are meant to correct a discrepancy between the financial attractiveness and economic (that is, social) desirability of an action (FAO 1999). Gregersen (1984; cited in Pardo 1990) pointed out that incentives from the public to the private sector are justified in an economic sense when one or both of the following conditions exist:

- Social benefits are greater than private benefits associated with a given private action; and
- Social costs are less than private costs associated with the given action and social benefits are at least equal to private benefits.

Where plantations provide environmental services such as watershed protection and carbon sequestration, incentives are appropriate because private net returns are often lower than social benefits. Real world incentives that fall into this category include those offered under the:

- Soil Bank Program, Agricultural Conservation Program and the Conservation Reserve Program in the United States;
- “Grain for Green Project” and the Great West Development Program in China;
- Landcare deductions for capital expenditures on soil conservation, prevention of land degradation and related measures in Australia;
- The Green Isarn Project in Thailand; and
- Benefit-sharing arrangements under joint forest management in India.

In each of these cases, incentives bridge the divergence between public and private goals and support activities that are primarily in the public interest.

Rice for trees

The “Grain for Green Programme” (in full, *Conversion of Farmland into Forests and/or Grasslands Programme*) introduced in western China in 2000 aims to reverse land degradation and soil erosion through the conversion of almost 15 million ha of steep lands that are currently cultivated or barren into forest and pasture by 2010. It will do this by providing a mixture of food and cash subsidies in the first eight years (2 250 kg of grain in South China and 1 500 kg of grain in North China, and 300 yuan [US\$36] for management annually) and 750 yuan for seedlings costs per hectare in the first year.

Source: Liu (2003)

Incentives are not needed when the private returns from plantation management exceed those from other land uses (Haltia and Keipi 1997; Williams 2001). In this case, the provision of incentives translates into a misallocation of public sector resources, merely enabling investors to earn “above normal” returns.

While addressing environmental concerns is an important justification, others include the goal of generating employment (particularly in less developed rural areas), and to jump-start the development of national forest industries in countries with comparative advantages such as Indonesia and Chile (Williams 2001). Incentives may be particularly justified to increase the pace of plantation development where a developing industry requires a minimum supply of raw material (Scherr and Current 1999). A rapid increase in scale is especially critical in commodity industries like pulp and paper, where economies of scale are essential for competitive operation (Clapp 1995).

THE DOWNSIDE OF INCENTIVES

The use of incentives, especially direct incentives, to induce particular behaviour, has been at the centre of intense, and sometimes fierce, debates. Incentives, particularly subsidies³, are not without their critics who contend that incentives can lead to economically incorrect allocation of productive factors.

Programmes pressured to show progress frequently offer incentives to people “to win friends and influence people by resorting to handouts under the guise of incentives” (Smith 1994, p. 8). This should not come as a surprise considering that a hand-out for project desk officers, consultants and on-site project staff defined incentives in the following way (GTZ 1995):

³ In 2001, the World Bank welcomed subscribers to an electronic seminar on “The political economy of persistent and perverse subsidies”.

Incentives are understood to be project measures geared to motivating the local population to use their natural resources on a sustainable basis.

Attractive incentives offered in the early stages of a new initiative or project run the inherent risk of simply “buying” participation; the interest shown is not of a long-term nature and participation is just a pretense. Especially in natural resource management projects, subsidies have often succeeded in stimulating the adoption of conservation measures that were abandoned or even actively destroyed once payments ceased (Lutz *et al.* 1994). The same has been observed for plantations (Sawyer 1993). It should be obvious that particularly with regard to commercial activities, incentives should act as a catalyst and should not be the cause for change. As a cause for behavioural change, the discontinuation of incentives is likely to become a cause for reversal.

Related to the issue of triggering activities for the wrong reason, sometimes people delay desired activities they would normally initiate on their own until they have been given an anticipated incentive. In the worst-case scenario, the provision of incentives might have unintended, perverse side effects. For example, incentives for plantation development may contribute to unplanned conversion of natural forests. A lack of financial support for the management of plantations coupled with incentives limited to plantation establishment may lead to intensive planting activity without any real expansion of the total plantation area in the long run. Young plantations are simple destroyed and the land replanted to capture the financial support.

As Tiffen (1996, p. 168) has pointed out, “even poor people can find capital for what is really profitable...” Hence, low levels of investments in plantations, especially by small-scale farmers, may not be caused by a lack of capital but rather by insufficient information about suitable technologies, market opportunities and legislation, particularly related to environmental issues and taxation. The risk is that the reasons for inaction may not be properly understood and that financial incentives, provided in lieu of advice, are wasted. Technology transfer and extension programmes are the appropriate medicine for lack of knowledge.

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IMPACT OF INCENTIVES ON THE DEVELOPMENT OF FOREST PLANTATION RESOURCES IN THE ASIA-PACIFIC REGION: AUSTRALIAN CASE STUDY

4

Clive Catton, Adam Gerrand, Annie Josline and Robert Miller¹

INTRODUCTION

Most of Australia's highly urbanized population of 19 million is concentrated in the southeast and southwest of the country. Less than five percent of the population is engaged in primary production. However, the sector is highly mechanized and efficient, and accounts for around 25 percent of Australia's exports. After the Second World War, the economy relied mainly on agriculture and mining until manufacturing grew. The service sector has since led growth, rising to about 78 percent of the gross domestic product (GDP). Australia's exports are important for its economy, contributing over 21 percent to the GDP.

Australia has a land area of 7.7 million km². Accompanied by large seasonal variations, 80 percent of the continent has a rainfall of less than 600 mm per year. The northern part of the continent experiences wet tropical summers influenced by tropical monsoons with dry winters, while southern Australia generally has relatively dry summers and cool winters. Due to its extensive geographical isolation, Australia's vegetation and animal species are unique, and have developed tolerance to Australia's climate regime of lengthy droughts and fires. Only 6.5 percent of the land area is considered arable, and is concentrated mostly in a small band along the eastern coastline and the southwest corner of the continent. Australia has substantial areas of natural forests, with eucalyptus and acacia being the most dominant and wide-ranging genera. Forest² covers around 20 percent of the country or 164 million ha, most of it occurring as open savannah woodland. The large area of native forests has long been a source of wood and other forest products but plantations are rapidly increasing in proportion.

Plantations make up less than one percent of the forest area but contribute 60 percent to the timber production each year. Most of Australia's plantations are located in areas with reliable rainfall of more than 700 mm a year and suitable soils for tree growth, and are within reasonable transport distance to a major market or processor. These locations generally correspond to the more habitable parts of the country. The plantations have been divided into 15 National Plantation

¹ This report was co-authored by (in alphabetical order): Clive Catton (Department of Agriculture, Fisheries and Forestry – Australia [AFFA]), Adam Gerrand (Forest and Vegetation Program of the Bureau of Rural Sciences – [BRS]), Annie Josline (AFFA) and Robert Miller (AFFA), with editorial input from Robert Miller. Michael Stephens (AFFA) provided initial guidance, with forest data provided by Mellissa Wood and Geoffrey Dunn (BRS). The authors would also like to thank the various state forest agencies and forest industry stakeholders for the provision of valuable information and reviews of earlier drafts.

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² Forests, as defined by Australia's National Forest Inventory (NFI), include native and plantation trees, and areas of trees often described as woodland.

Inventory (NPI) regions to facilitate quantitative regional and national management, decision-making and strategic-planning by government and industry (Figure 1). The regions reflect wood supply demarcations rather than political boundaries.

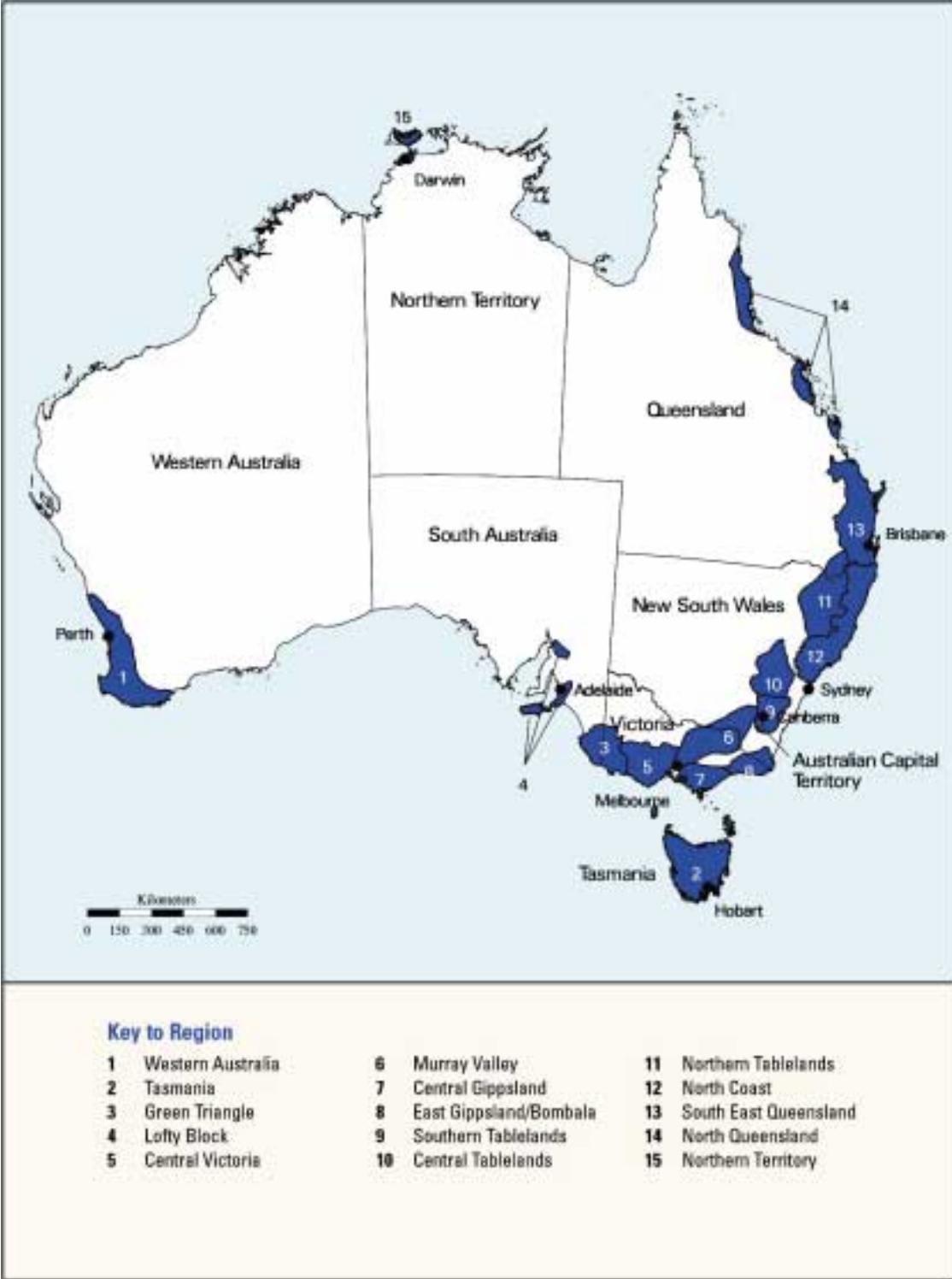


Figure 1: National Plantation Inventory regions of Australia

Table 1: Forest, plantation and population data for Australia, 2001

Total land area in '000 ha*	768 203
Total forest area in '000 ha** (% of total land area)	165 896 (22%)
Total plantation area in ha** (% of total land area)	1 568 900 (0.2%)
Total softwood plantation area in ha** (% of total plantation)	979 633 (62%)
Total hardwood plantation area in ha** (% of total plantation)	587 856 (37%)
Total unknown type plantation area in ha** (% of total plantation)	1 411 (1%)
Population total (million)*	18.97
GDP per person*	A\$32 539

Sources: *Australian Bureau of Statistics 2001; **Wood *et al.* 2002

Role of the forestry sector in the economy

Australia's wood and paper industries (based on plantations and native forests) presently turn over A\$14 billion, and include sawmilling, plywood and panel products, pulp and paper and woodchip exports. Exports are valued at A\$1.8 billion. Woodchips, representing 41 percent by value of total forest product exports, remain the most valuable export product (Table 2). This has steadily fallen in recent years as outputs of other export wood products including paperboard, paper, sawntimber and wood panels have increased. In addition, Australia now produces 82 percent of its sawntimber needs of which softwood plantations provide about 66 percent, with the balance derived from native forests.

Australia remains a net importer of forest products in value terms, mainly due to high imports of paper products. In 2000 and 2001, Australia imported forest products valued at A\$3.83 billion, accounting for three percent of total merchandise imports. Imports for sawntimber, paper and paperboard accounted for 67 percent of the total value of forest product imports (54 percent of paper and paperboard products and 12 percent of sawntimber, mostly coniferous). Most of the imported sawntimber comes from New Zealand, Canada and the U.S.A. with radiata pine, Douglas fir and western red cedar forming the bulk. Malaysia is the main source of imported hardwood timber.

Consumption of sawntimber in Australia generally varies between four and 4.5 million m³ *per annum* and is closely linked to the level of constructing activity (Table 3). Recent increases in new homes raised sawntimber consumption to almost 4.8 million m³. However, as existing plantations come to maturity, Australia is expected to become a net exporter of forest products by 2010 (ABARE-Jaakko Poyry 1999).

The forest and wood product industries, based on native and plantation forests, account for about one percent of the GDP and employment of about 75 000 people. There were 942 sawmills in Australia (674 hardwood and 268 softwood) in 1999 and 2000. The hardwood mills are generally small-scale and scattered, while the softwood mills are large and integrated with other processing facilities. There are also 22 pulp and paper mills and 30 veneer and panel-board mills. The number of sawmills has been declining as the average size increased. Further mechanization and productivity have reduced total employment in processing over time. The greater area of plantations has a significant potential to reverse this trend by creating new processing industries and employment opportunities in rural areas (Ministerial Council on Forestry *et al.* 1997).

Table 2: Australian export of woodchips

Source	Financial year				
	1996/97	1997/98	1998/99	1999/2000	2000/01
Hardwood volume* (kt)	2 470.9	3 270.4	2 851.8	3 582.2	3 904.0
Hardwood value (A\$'000)	400 191	495 719	43 3561	502 818	572 015
Softwood volume* (kt)	852.3	1 044.7	1 033.2	1 046.2	1 114.8
Softwood value (A\$'000)	118 109	150 620	152 432	143 345	173 461
Total volume* (kt)	3 323.2	4 315.0	3 885.0	4 628.4	5 018.8
Total value (A\$'000)	518 310	646 275	585 934	646 099	745 402

*bone-dry tonnes

Table 3: Apparent consumption of sawntimber in Australia ('000 m³)

Source	Financial year				
	1996/97	1997/98	1998/99	1999/2000	2000/01
Domestic production					
Plantation logs	1 954	2 221	2 331	2 528	2 346
Native forest logs	1 430	1 436	1 274	1 455	1 314
<i>Sub-total</i>	<i>3 385</i>	<i>3 657</i>	<i>3 605</i>	<i>3 983</i>	<i>3 660</i>
Imports	756	784	775	970	718
Exports	60	38	51	90	87
Apparent consumption	4 090	4 403	4 281	4 863	4 291

Source: ABARE (2001)

The contribution of softwood plantation sawntimber to the total Australian sawntimber consumption grew from 33 percent in 1990 and 1991 to 56 percent in 2000 and 2001. This increase has been primarily through import. To a lesser extent, it has filled a potential gap resulting from decreased harvesting in native forests. This expansion has only been achieved with very significant investments in processing capacity, illustrating the success of the policies and industry investment in the 1960s and 1970s.

Role of Commonwealth (national), state, territory and local governments in Australian forestry

The Commonwealth of Australia is a federation of six states and two territories, each with its own regional and local government infrastructures, as defined under the Australian Constitution. The national government is broadly responsible for taxation, defence, foreign policy, customs and telecommunications, and the states are responsible for education, health, transport and land administration. While the prime responsibility for land use, forestry and conservation matters rests with the state governments, each level of government has specific interests in, and responsibilities for, forest management.

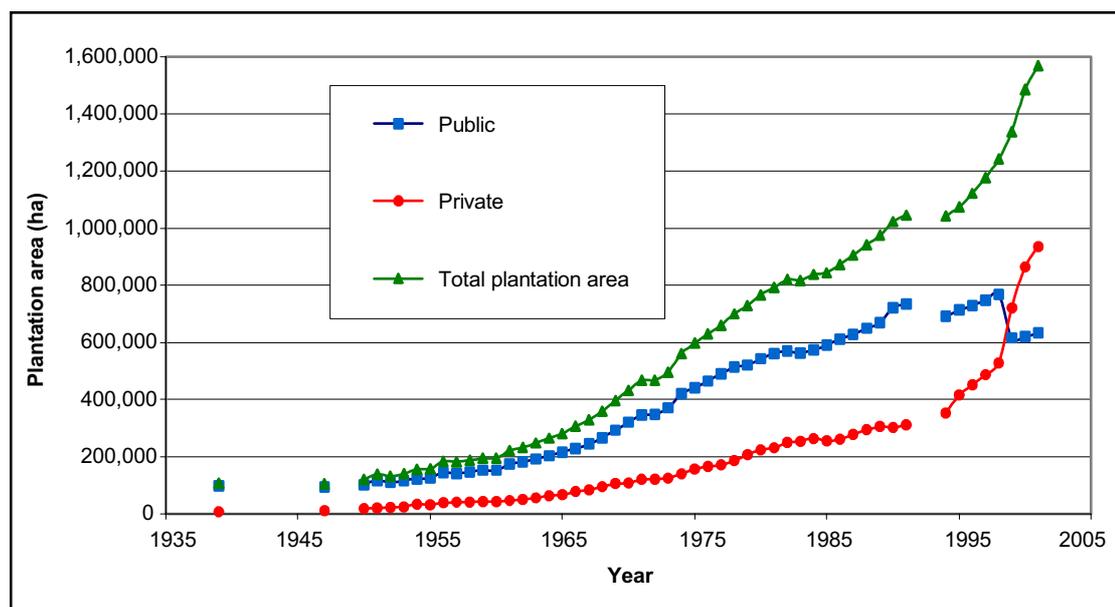
The national government retains certain powers and interests, which can have significant implications for land use and management practices. It is responsible for coordinating a national approach to both industrial development and environmental issues including forest, land and water management. It also has an interest in achieving efficient and effective natural resource management, including a national approach to forest issues.

State governments have primary responsibility for forest management, in recognition of their constitutional responsibility for land use. The states have enacted legislation that allocates forestland tenure and specifies the administrative framework and policies for managing public and private forests. All Australian forest services are run by state forestry agencies, reflecting the constitutional demarcation of responsibilities. For this reason there is no national forest agency. The history of state forest agencies in Australia has been well documented by Carron (1990) and Dargavel (1995). Local governments are responsible for local land-use planning within the limitations set by their respective state governments, which affect public and private forest management and use. In practice, responsibility for policies affecting land use and the environment is shared among national, state and local governments.

Role of public and private sectors in forestry

Australia’s State of the Forests Report has identified that approximately 70 percent of the nation’s forest resources are privately owned or managed (National Forest Inventory 1997). This is a significant milestone as state forestry agencies held the majority until the early 1990s. This shift is due to the privatization of former state-owned pine plantations in several states and the expansion of private plantings.

The number of large-scale private investors is small. Of the plantation estate, 95 percent is considered industrial with only five percent actually held by small-scale landholders and communities (i.e. owners of estates that are less than 1 000 ha) until the early 1990s. Figures 2, 3 and 4 show plantation areas by age class, species and ownership.



The 2000/2001 period was derived from only two years of data and may be higher than the long-term plantation expansion rate.

Figure 2: Australian forest plantation development by tree ownership#

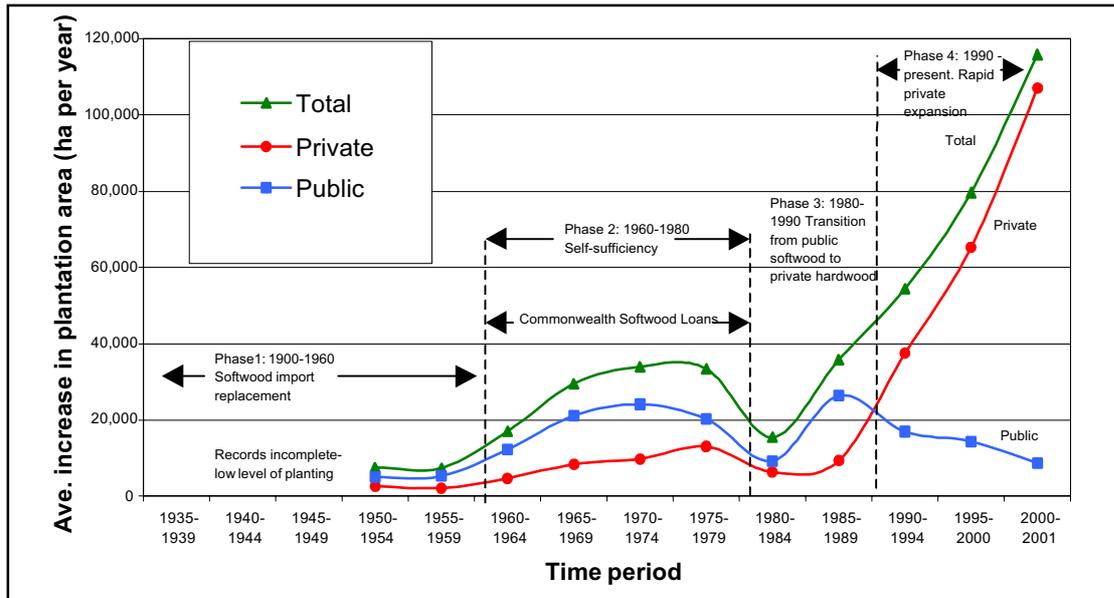


Figure 3: Average increase in Australian forest plantation area by tree ownership, showing four developmental phases

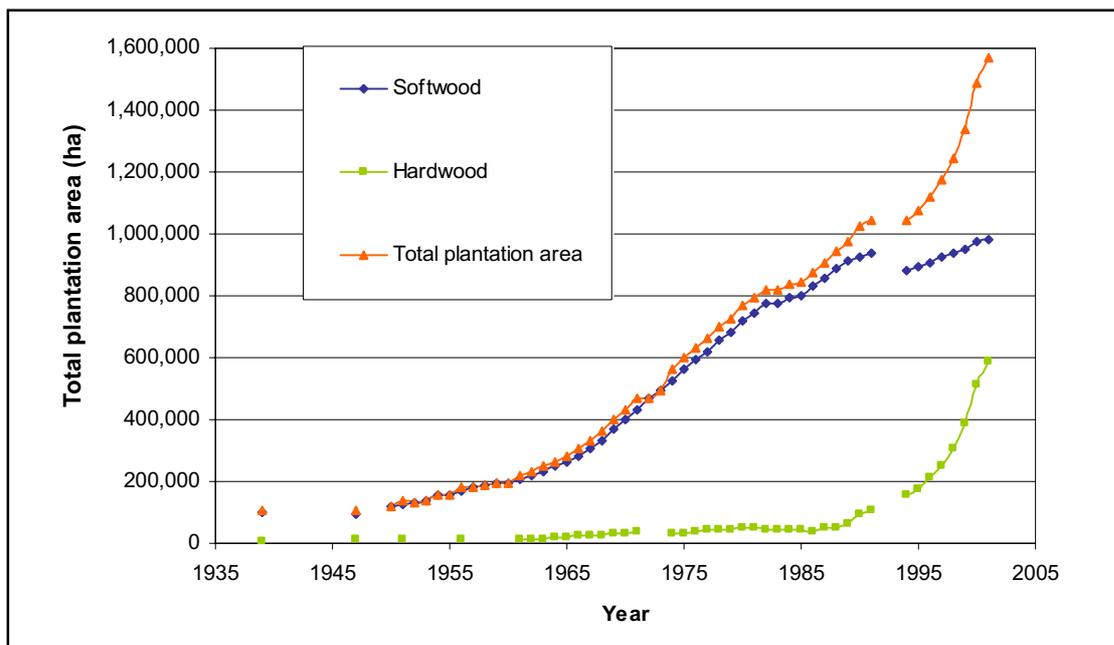


Figure 4: Australian forest plantation development

Data for the three figures were derived from the Commonwealth Forest and Timber Bureau (pre-1975), Australian Bureau of Agricultural and Resource Economics (ABARE) (1976 to 1991) and Bureau of Rural Sciences' National Plantation Inventory (since 1994). As the methodology for collection of information has changed over time, gaps are seen in certain years (for example, early 1990s in Figures 2 and 4). The data were averaged over five-year periods to minimize annual variability. Records before 1950 are incomplete except for 1939 and 1947. Therefore, early planting rates and trends cannot be quantified, but in general the planting rate was low and probably less than a few thousand hectares per year. Furthermore, ownership other than "public" is classified as "private" – this includes all joint ventures, annuities and unknown ownership. Large areas of plantation land were transferred from public to private in the late 1990s, through privatization/corporatization of state (public) plantations.

Key forest production and conservation policies

The principal national policy documents establishing priority actions for the sustainable management and use of Australian forests, relevant to plantations, are:

- National Forest Policy Statement (1992);
- Plantations for Australia: The 2020 Vision (1997); and
- Action Agenda for the Forest and Wood Products Industry (prepared in 2000).

In addition, a range of initiatives at state and national government levels further these policies, including programmes promoting farm forestry, revegetation and removal of government impediments to investment in growing and processing forest products. Numerous state acts cover conservation issues with implications for forestry, including Codes of Logging Practice, land-use planning, and flora and fauna protection. Other acts or legislation also cover the establishment and administration of National Parks, and regulate water rights and use.

National Forest Policy Statement

In 1992, the national and state governments developed a common policy position on forests, known as the National Forest Policy Statement (NFPS). As the primary means for integrating environmental sustainability and commercial production, it sets out objectives concerning conservation, wood production and timber industry development, private native forest use, plantation development, water supply and catchment area management, tourism development, employment, workforce education, public awareness and involvement, research and development (R&D), and the further development of intergovernmental arrangements and decision-making processes.³

Plantations for Australia: The 2020 Vision

In 1997, the industry and government developed a partnership called “Plantations for Australia: The 2020 Vision” to develop plantations and processing industries that are commercially oriented, internationally competitive and sustainable. The Vision aims to treble the plantation estate to 3 million ha by 2020. It also seeks to boost the availability of suitable land for plantations and improve the tree-growing skills of farmers through farm forestry. Achieving the target will require more than A\$3 billion additional investment (mainly private capital investment) and annual plantings of 80 000-90 000 ha.⁴

Forest and wood products action agenda

Action agendas generally encourage industries to achieve best practice and to work together to realize international markets. The Forest and Wood Products Action Agenda of 2000 provides a framework for industries to pursue competitive advantages. Its market-driven focus is a natural progression from previous initiatives, which mainly concentrated on fundamental “supply-side” issues. “Demand-side” initiatives, encompassing issues such as value adding, expanding non-traditional forest and wood uses, and market and investment development, are further developed to take advantage of opportunities emerging from earlier initiatives.⁵

³ A copy of the NFPS and further information is available at: <http://www.ffa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A03131>

⁴ Further information of the policy is available at: <http://www.plantations2020.com.au>

⁵ Further information of the Forest and Wood Products Action Agenda is available at: <http://www.ffa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A03643>

Research, extension and training

R&D will underpin the global competitiveness of Australia's forestry, wood and paper industries over the next 20 years. It will assist resource development and sustainable management, improve wood and fibre performance, increase efficiency and environmental performance of wood and paper processing and increase value adding in wood and paper products.

There are three main Commonwealth research bodies, namely:

- Forest and Wood Products Research and Development Corporation (FWPRD);⁶
- Commonwealth Scientific and Industrial Research Organisation (CSIRO);⁷ and
- Australian Centre for International Agricultural Research (ACIAR).⁸

State governments have similar organizations working on forestry research issues, alongside forestry and associated research departments within Australia's universities, in particular the Australian National University, Melbourne University and Southern Cross University. In addition, Cooperative Research Centres (CRCs)⁹ bring together researchers from universities, CSIRO and other government laboratories, private industry and public sector agencies in long-term collaborative arrangements to support R&D and education activities.

PLANTATION DEVELOPMENT AND INCENTIVES

Overview of plantation development

Efforts to establish plantations began with the state forest agencies in the early 1900s and are well described by Carron (1990) and Dargavel (1995). State governments established most of the initial plantations to offset Australia's limited endowment of native softwoods. The State of South Australia took the lead in the 1870s establishing integrated operations based on *Pinus radiata* plantations, state-owned sawmills and later private panel board and paper mills. Other states followed by establishing softwood plantations so that by 1940, more than 90 percent of the plantations were state-owned.

It was not until 1950 that private planting grew in importance when large industrial companies commenced planting to supply pine (*Pinus radiata*) and eucalypt pulpwood to complement state resources. These plantations gradually supplied increasing quantities of sawlogs and pulpwood. Between 1936 and 1941 three pulp and paper mills were built in Tasmania and Victoria to use eucalypts and one mill was established in South Australia to use wood from softwood plantations. The mills expanded rapidly, and the new ones, built during the 1950s and 1960s, were supplied with a combination of softwood from pine plantations and hardwood predominantly from native forests.

Various schemes to encourage smaller-scale or woodlot planting on farms and other private lands were undertaken from the 1920s. The rate of planting on farms increased in the 1990s, aided by incentives often associated with achieving broader environmental benefits.

The widening gap between forecasts of demand and domestic supply became clear after the Second World War. Native forests could not sustain high harvesting rates in the long term, let alone meet rising demands. Plantations were seen as the solution to increase timber supply and reduce imports. Commonwealth and state governments jointly advocated a significant proliferation of *Pinus radiata* plantations. The states aimed to raise their planting rate from 16 000 to 28 000 ha per year, so that Australia would be largely self-sufficient through its 1.2 million ha of

⁶ Further information of FWPRD is available at: <http://www.fwprdc.org.au>

⁷ Further information on the CSIRO is available at its Web site: <http://www.csiro.au>

⁸ Further information on ACIAR is available at: <http://www.aciar.gov.au>

⁹ Further information on CRCs is available at: <http://www.crc.gov.au>

plantations by 2000. In 1966, the Commonwealth provided generous, low-interest “Softwood Loans” to the states to increase their planting by 26 000 ha per year. In addition, private growers were encouraged to plant 4 000 ha annually. The scheme succeeded in increasing the rate of planting and was extended to 1982.

Pinus radiata dominated softwood plantings until the 1980s, occupying over two-thirds of the area. However, the plantation sector has shifted from softwood to hardwood, focusing mainly on *Eucalyptus globulus*. About 87 percent of the total standing hardwood plantations have been established since 1990.

The Australian plantation industry exhibits a diverse range of ownership arrangements, including joint venture and annuity schemes between public and private parties. Since the 1990s, private plantations have increased dramatically; 89 percent of newly planted areas were on private land in 2001 (Wood *et al.* 2002). About 54 percent of the country’s 1.57 million ha of standing plantations are now privately owned.

The development of Australia’s forest plantations can be traced over a four-phase period since 1900. Particularly noteworthy is the 1.26 million ha increase in plantations (513 percent) since 1965/1966 when planting began to flourish. This reflects the transition from the goal of self-sufficiency underpinned by commercial development with direct incentives, to ecological sustainable development supported by broader micro- and macroeconomic reforms. In line with this change, indirect incentives are replacing direct incentives, with the private sector progressively taking over plantation management and investments from the governments.

Phase 1: “Softwood import replacement” plantations – 1900 to 1960

A “softwood import replacement policy” served as the driving force for early plantation establishment in Australia. Even though the country had a surplus of native hardwood species, softwoods were perceived as more desirable for a wide range of uses including construction. Consequently, forest agencies sought to establish softwood plantations to meet demands and reduce softwood imports.

General investment climate

Dargavel (1995) notes that relief work during the Depression period had increased the plantation area to 90 000 ha by 1939; almost all of this land was planted with softwood, predominantly *Pinus radiata*, and over 40 percent occurred in South Australia. Since a number of these early schemes were experimental in nature, as suitability and species selection were being refined, poor growth or even failures resulted on some sandy land that was initially thought to be suitable.

During this phase, private sector involvement in plantations was limited. Practically all industrial wood was sourced from Australia’s extensive native eucalypt forests. Despite South Australia’s success in growing *Pinus radiata*, some sawmillers were reluctant to process the wood.¹⁰

Phase 2: “Self-sufficiency in timber” plantations – 1960 to 1980

Similar to Phase 1, this period focused on softwood plantings but reflected a national goal of achieving “self-sufficiency in timber,” recognizing that softwood plantations could replace softwood imports and much of the hardwood production from native forests. Considerable concerns about the native forests’ capacity to sustain large production increases, triggered by mechanization and rapid development in the postwar years, led to the conclusion that softwood plantations were the solution.

¹⁰ For information on areas planted for public and privately owned plantations, see Wilson (1969).

General investment climate

Although the plantations were mainly state establishments in the initial stages, 25 percent of the national total plantation area of 600 000 ha was privately owned by 1977. About 90 percent of this area was planted with conifers and ten percent with native species and poplars (Carron 1990). By the late 1970s, the private sector was planting over 10 000 ha per year mainly for industrial uses (predominantly for pulp and paper). Notable was the Australian Paper Manufacturers (APM), which established significant areas around their mill in Victoria. The Victoria Government set up an early system of leasing land to APM through a special Act of Parliament in the 1930s (Carron 1990). Both the New South Wales and Victoria governments provided low-interest loans for farm woodlots. Consumption of wood products during this phase was a factor of both population growth and rising living standards after the Second World War.¹¹

By the 1980s, Australia had developed a strong reputation in plantation forest research, focusing mainly on exotic softwoods, notably *Pinus radiata*. Research was able to create a highly successful and profitable wood-based industry from a “fairly ordinary” species. The strength and importance of Australia’s research capability was well demonstrated by the resolving of a problem that first appeared in the 1960s when the plantation industry was “profoundly shaken” by decreased productivity in the second and subsequent rotations of *Pinus radiata* in South Australia (Shepherd 1986; Keeves 1966). Shepherd notes the issue received substantial research effort in both Victoria and South Australia and that the two states’ research agencies came up with quite different solutions. Opting for a highly technical approach, South Australia developed a “maximum growth sequence” using machinery, chemical fertilizers and herbicides (Woods 1976). In contrast, Victoria focused on conserving nutrients through retention of slash and aiming at water conservation for the seedlings (Squire *et al.* 1979). Over time, with the publication of the research results and sharing of information, the two states combined their methodologies to ensure continued productivity.

By comparison, surprisingly little work was done on Australia’s native eucalypts until the late 1980s and 1990s. Researchers’ negative views of eucalypts’ potential at that time did little to instil public or private sector confidence in investing in eucalypts during this period.

Incentives in Phase 2

Types of direct incentives offered

The policy of attaining self-sufficiency in softwoods by 2000 was formalized under the Softwood Forestry Agreements Acts of 1967, 1972 and 1976. These committed the Commonwealth to provide favourable loans to the states for establishing and maintaining softwood plantations. The agreements, commencing in 1966, aimed to help the state governments increase their planting rate to 26 000 ha per year, with an additional 4 000 ha per year from private growers (Dargavel 1995). Under these Acts, loans made on an annual basis from 1967 to 1982 enabled purchases of land as well as the establishment and tending of (approximately) an additional 100 000 ha of new softwood plantations. The Commonwealth paid A\$78.1 million under these arrangements, which expired at the end of 1982 following a review of Commonwealth functions.

The loans were attractive to the states because of the ten-year interest free period. Financed from the Commonwealth’s Consolidated Revenue Fund, they were repayable over 20 years with payments commencing 15 years after the date of each advance. This “grace” period of 35 years matched the planned rotation, based on sawlog production patterns at the time. The agreements also provided for interest to be either capitalized over the deferment period, or paid when due at the prevailing long-term bond rates.

¹¹ For information on consumption of industrial wood and fuelwood, sources of supply from natural forests, public or private plantations, and imports, see Wilson (1969).

Under the agreements, the states carried out efficient planting and tending in accordance with sound forestry, financial and environmental practices. The Commonwealth also required the states to keep full accounts, books, vouchers, plans, documents and other records relating to planting and tending under the agreements. Programmes were monitored by the then Australian Forestry Council, which was made up of state ministers and chaired by the Commonwealth Minister responsible for forestry.

While large-scale incentive schemes for private investors were absent at this stage, this initiative was instrumental in enabling the state governments to dramatically increase plantations during the 1960s and 1970s. These plantations became the basis for Australia's extensive wood-processing industry. Victoria and Tasmania continue to progressively privatize their softwood plantations, parts of which were established under these loans. The establishment of small-scale forestry operations was insignificant during this phase. Companies were still largely Australian enterprises, as foreign investment in forestry had not yet begun to make its mark.

Impacts of incentives

The Softwood Loans were successful in establishing large-scale softwood plantations, especially of *Pinus radiata*, by state forest agencies across Australia. These agencies established the majority of plantations during this phase. Given their already overstretched budgets which serviced plantation expansion, their least expensive option was to use existing native forest land. New markets for woodchip exports also encouraged the clearance of native forest for planting in some areas. This enabled moderate-quality eucalypt forests to be clear-felled and sold for timber and woodchips to fund the *Pinus radiata* planting programme. However, this coincided with a rise in conservation and environmental awareness and the states were criticized and attacked by opponents (Dargavel 1995). This marked the start of a long campaign of protests against forest agencies.

Characteristics of established plantations

State agencies used the Softwood Loans mainly to plant trees for sawlog production, seen at the time to be the dominant timber need of the future. Species included *Pinus elliotii*, *Pinus pinaster*, *Pinus caribaea*, *Araucaria* spp., *Eucalyptus pilularis*, *Eucalyptus grandis* and *Eucalyptus regnans*. The species of choice was *Pinus radiata*, grown on rotations of 30 to 40 years depending on the silvicultural regime. These rotations were considered to be remarkably short compared to native forest rotations of 80 to 100 years or more.

Summary and lessons learned in Phase 2

The Softwood Loan Agreements were very successful, expanding the overall plantation estate from around 170 000 ha to nearly 900 000 ha. Without the agreements, the softwood plantation industry would not have reached its present scale. The plantations became the basis for a wide range of domestic wood-processing facilities that developed subsequently (for example, pulp mills). Over A\$78 million was loaned to the states during the 16 years the Softwood Loan Agreements operated. In 2001/2002 dollar rates, this equates to approximately A\$390 million.

Phase 3: “Transition from government softwood to private hardwood” plantations – 1980 to 1990

General investment climate

The 1980s represented a transition period for plantation development. Considerable changes occurred in the forest industry and government, business and Australian society. For plantations, Phase 3 marked a switch from the dominance of government to private ownership of softwood plantations and the expansion of eucalypt (hardwood) plantations for industrial purposes.

Other notable changes were increasing commercial and budgetary pressures on government and industry, influenced by high interest rates during the decade. Forestry was a relatively unattractive proposition for all but large processing industries with economies of scale and linkages to downstream processing of higher value products. The society was concerned about forestry activities and a number of high profile environmental battles were played out during the decade (notably the Franklin Dam dispute in Tasmania, which also raised community concerns about harvesting, especially of old-growth native forests). Such unease was significant enough for governments to try to address the problems – over 30 enquiries into forestry were held around this time. Every state agency facilitated an active R&D programme to help resolve many of the technical issues facing the emerging industry.

Large-scale private sector forestry investment occurred during the 1980s. Exporting woodchips became an important business in most states. This enabled some companies to convert significant areas – mostly non-native forests – to plantations. Tibbits (1986) notes the large increases of eucalypt plantations in Tasmania from 20 ha per year in the 1970s up to an average of 1 500 ha per year from 1982 to 1984.

Incentives in Phase 3

Types of direct and indirect incentives offered¹²

a. National Afforestation Programme and associated programmes

Dargavel (1995) notes that the National Afforestation Programme (NAP) funded the establishment of 6 000 ha of hardwood plantations between 1987 and 1992, and supported research on growth. A summary of the NAP and a useful overview of the major incentives and activities in relation to farm forestry programmes is provided by Donaldson (2001). Much of the information in this section is drawn from his analysis.

The Commonwealth established the NAP in 1987 to stimulate an expansion of commercial hardwood timber, assist in land rehabilitation and control degradation through afforestation. Nearly A\$15 million over three years was targeted for state and large private industrial growers. The programme was also the first production forestry initiative that directly sought to engage private landholders, but it was not really designed to address the needs of non-industrial forest managers. It lacked a supportive policy framework to deal with the underlying social, economic and institutional impediments to plantation development (Donaldson 2001).

In 1989, the NAP was expanded and replaced by the “One Billion Trees and Save the Bush” programmes, as promoted in the Prime Minister’s landmark statement on the environment “Our Country, Our Future”. These subsequent programmes had a clearer focus on biodiversity conservation and were later supplemented by initiatives such as the Corridors of Green Programme and the Wet Tropics Tree Planting Scheme in North Queensland. In 1997, these were all incorporated in the Bushcare Programme with the advent of the Natural Heritage Trust 1.

¹² Bhati *et al.* (1991) provide an excellent overview of the Australian plantation incentives during the 1980s. Apart from identifying economic research gaps and priorities, the authors include an annotated bibliography of relevant research and publications.

During this time, funding for programme delivery increased from about A\$3 million over the first five years to over A\$350 million between 1997 and 2002.

b. Joint venture arrangements

Joint venture arrangements first appeared in the mid- to late 1980s, often between state government forestry agencies and private landowners. With the Commonwealth Softwood Loan Scheme coming to a close, the states saw the arrangements as one option to continue the growth in commercial plantations and to promote small-scale farm forestry. Since then, joint venture arrangements have become an important tool in plantation development, especially as a mechanism to attract overseas investment.

Western Australia provides a good example of such an arrangement where foreign investors, mainly in the pulp and paper industry, sought to secure reliable high-quality supplies from eucalypt plantations. The first agreement in 1993 was made with the Japanese Oji Paper Company and Itochu, which expected to invest A\$60 million over ten years (Dargavel 1995). This was sufficient to plant 20 000 ha of *Eucalyptus globulus* in small farm woodlots and shelterbelts of ten to 20 ha each. The trees are to be harvested at ten years of age and the woodchips exported to Japan. The trees are to be coppiced for the second rotation crop. In addition to the direct benefits anticipated for wood processors, there are environmental advantages gained through the lowering of water tables and addressing dryland salinity problems. The Western Australian Government subsequently made a similar agreement with the Korean Hansol Forest Products Company to establish 15 000 ha of plantations over a ten-year period.

A number of other private plantation companies have followed, with private investment now leading the industry (see Box 1 for the Western Australian experience).

Justification for providing incentives and intended target groups

Rising awareness of a range of environmental problems during the 1980s led to a change in emphasis, stemming from historical land clearing for agricultural uses. A notable example is Western Australia where dryland salinity had become a major issue. Governments targeted farmers and small-scale landholders (i.e. of less than 1 000 ha) rather than large companies with incentives, although the effectiveness of these incentives in attracting smaller investors was limited.

Impacts of incentives

Figures 2, 3 and 4 also show the rise in plantation areas and change in tree species during the 1980s. Plantations were increasingly being established on former farmland. Although this was a relief to the predominantly urban conservationists, it was beginning to raise concerns among the farming community that their traditional livelihoods would be altered. Large-scale industries still dominated plantation development, and state governments still used subsidies in the form of infrastructure grants to attract industries to their regions.

Summary and lessons learned in Phase 3

Plantations and timber production started to generate significant employment and income in regional centres, creating an incentive to current and potential investors. Once a critical mass of plantation resources was achieved, processing industries developed, such as in the Green Triangle in southeast South Australia and southwest Victoria, and the Murray Valley in northeast Victoria and the southwest slopes of New South Wales. Enterprises included sawmills, paper mills, fibreboard and particleboard mills, pole and post production, and treatment plants.

Box 1: Forest plantations in Western Australia

Western Australia's Forest Products Commission (FPC) manages more than 112 000 ha of plantations and tree crops. By 2020, 800 000 ha of tree crops could be established on farms. Trials to find conifers suitable for local conditions began in 1896. The first softwood plantations, established in the 1920s were maritime pine (*Pinus pinaster*) grown on sandy areas north of Perth. Decades of tree breeding have produced trees that grow faster and straighter, producing more valuable timber. Significant areas of Monterey pine (*Pinus radiata*) were established south of Perth. The first hardwood plantations were mallet (*Eucalyptus astringens*), planted to support the tannin industry. Mallet plantations now support an industry making tool handles.

During the late 1980s, the focus changed from large plantations on Crown land to tree crops on agricultural land. The FPC developed the legal instruments and scientific foundations for integrating trees with traditional agricultural practices on farms.¹³ The greatest environmental threat is dryland salinity, which stems from the use of annual crops and pasture in agricultural areas. Deep-rooted perennial plants are critical to redress the water balance in these areas. Scientists estimate that 30 percent of the 18 million ha of cleared farmland in the southwest needs to be returned to perennial vegetation if salinity is to be controlled. This provides an opportunity for new industries in rural areas and greenhouse sinks on a massive scale.

Only commercial tree planting can attract investments at the required scale and provide continuous income to make it viable for farmers to work the land. In 1988 and 1989, the FPC planted about 4 000 ha of *Eucalyptus globulus* on farms along the western and southern coasts, demonstrating the potential of bluegum to landowners and investors. Together with other incentive schemes, major overseas companies were persuaded to invest in the venture. The FPC was contracted to manage three projects costing more than A\$150 million with a combined target of planting of at least 60 000 ha over ten years. Another A\$200 million would be paid to landowners over the life of the projects. At the end of the 1999 planting season, the FPC had planted 25 000 ha.

By the end of 1998, the state government and private investors had established more than 100 000 ha of bluegum. Altogether, about 125 million tree seedlings have been planted – one of the fastest planting rates in Australia.

In 1996, the FPC launched the Maritime Pine Project – a programme to extend tree crop cultivation on farms into areas with lower rainfall and selected catchments on the coastal plain – as a component of the state's Salinity Action Plan. The first 700 ha of maritime pine trees were planted in 1996.

Another 2 000 ha were planted in 1997 and nearly 2 500 ha in 1998. The FPC's target is to plant 150 000 ha of maritime pine in partnership with private landowners within a decade. Another 15 000 ha of mainly native trees will be planted under the Maritime Pine Project. Landowners can choose from more than 20 commercial and non-commercial species to plant in areas too rocky or saline for pines, or where landowners prefer native trees for landscaping reasons. Extending the area planted beyond sites suitable for pines increases the Landcare benefits. It will also increase biodiversity and help create corridors of native vegetation, which in turn will benefit native wildlife.

In January 1999, the FPC signed an agreement with British Petroleum marking the beginning of the first pilot study in Australia to examine the potential for planting tree crops as carbon sinks to offset greenhouse gas emissions. The crops will be planted in partnership with farmers.

(Source: Western Australia Forest Products Commission (2002).

¹³ See "Integrating tree crops and farming" at: <http://www.fpc.wa.gov.au>

The structural impediments to the development of commercial plantations included:

- Taxation provisions (for example, inadequate recognition of differences between agricultural and forestry rotational periods and timing of returns, lack of adjustment for inflation);
- Monopolies (lack of competitive neutrality between state agencies and private growers);
- Trade interventions and protection from imports of forest products;
- Land-use interventions through government policies (for example, assistance to other industries such as dairy farming or sugar-cane cultivation); and
- Problems of internalizing external benefits and costs of plantations, imperfect knowledge, weak bargaining power of small-scale growers in the log market, and fire risks.

Bhati *et al.* (1991) summarize the key findings of a number of reports during the 1980s. A case study on the eucalyptus woodlot scheme offered by APM forests in Victoria found that the scheme established only about half its target area. Farmers cited loss of productive land, initial cost of establishment and lack of information about forestry investments (uncertainty and risk) as reasons for their non-participation. In another review of the effectiveness of incentive schemes by Byron and Boutland (1987), farmers and other small-scale landowners did not accept the incentive schemes because they claimed that the schemes were designed with the interests and resources of the sponsors in mind, rather than the needs of the landholders. Reasons for lack of success of the schemes included:

- Cost of finance (investment loan interest rates of up to 20 percent);
- Many farms were too small to support viable woodlots in combination with agriculture;
- Decision-making was influenced by agricultural priorities;
- Varying levels of expertise from innovative and successful to very poor;
- Slow return on investment;
- Uncertainty of markets, exacerbated by a lack of political or marketing leverage; and
- Doubts about the future taxation liabilities.

The authors suggest future schemes, including joint ventures, may have more chance of succeeding, especially if others can gain from shared information and experiences. For example, Western Australia learnt valuable lessons from Tasmania's experience in setting up the Tasmanian Private Forestry Division (after the Everett and Gently Inquiry of 1976/1977).

Phase 4: "Private plantation boom" – 1990 to present

General investment climate

This phase is built on lessons learnt during the preceding 30 years, leading to what is presently the highest sustained growth in Australia's plantation development. A number of factors are driving this growth, largely underpinned by:

- Commonwealth and state recognition for, and agreement on, targeted strategies and programmes to promote Australian forest plantations (including farm forestry) nationally and internationally;
- Opening of the economy (free-market) and increased foreign investment, facilitated by amendments to the tax system arising from broader generic changes and adjustments specifically designed to improve the competitiveness and attractiveness of plantations;

- Market demand for pulpwood, especially in the Asia-Pacific region where supplies are anticipated to fall short of demand; and
- Sustained lower commercial interest rates combined with a stable economy and low inflation.

The broader farming and urban communities have also acknowledged the biodiversity and environmental benefits that plantations can provide when integrated into traditional agricultural areas or, in some instances, replacing them.

Incentives in Phase 4

Types of direct and indirect incentives offered

a. Tax policy

The Australian Taxation Office (ATO) is the Commonwealth government's main revenue collector. The ATO has offered a range of direct and indirect incentives to support primary production generally, including plantations.¹⁴ These incentives include tax equity, recognizing the unique challenges of plantation establishment as against other primary productions that are annual or have shorter rotations. This aims to directly assist plantations as a competitive alternative to other primary productions. Related tax incentives that can be applied to forest plantations are listed hereunder.

- ***Review of business taxation***

The Review of Business Taxation (commonly known as the Ralph Report) was released in July 1999. Its recommendations – shifting the *profits à prendre* into the income tax stream – are expected to benefit the timber industry where a “right to harvest” is sold separate to land. The change may stimulate the development of secondary markets for immature plantations and the cost-effective establishment of plantations, and increase joint venture arrangements with landowners growing trees on the basis of a guaranteed market for timber.¹⁵

- ***New tax system***

The New Tax System (NTS), launched on 1 July 2000, introduces a broad-based ten percent Goods and Services Tax (commonly referred to as the GST) and abolishes wholesale sales tax and some state taxes. Before the introduction of the GST, Australia had an indirect system with taxes levied at varying rates on specific groups of goods. The NTS, combined with changes to the marginal tax rates and tax brackets, will reduce indirect taxes, thereby lowering costs of operations and assisting businesses to be internationally competitive. Currently, the business taxation rate is 30 percent. The main benefits for forestry and associated industries, such as transport, will be through the removal of a number of state taxes, a reduction in the embedded taxes and less on-road transport costs for wood products. In effect, the GST affects all aspects of plantation investments, from establishment to processing and marketing.¹⁶

- ***Diesel and alternative fuels grants scheme***

This scheme is part of the NTS and assists Australian businesses through lower transport and production costs for on-road transport. It is separate from the Diesel Fuel Rebate Scheme for off-road fuel use. The grant is based on a flat rate per litre of fuel (except for gas, which is calculated per cubic litre). For diesel, the rate is presently 18.51 cents per litre.

¹⁴ Further information about the ATO is available at: <http://www.ato.gov.au>

¹⁵ Further information about the Review of Business Taxation is available at: <http://www.rbt.treasury.gov.au>

¹⁶ Further information about the NTS is available at: <http://www.taxreform.ato.gov.au/default.htm>

- *Prepayments*

Prepayments or “12-month rule” taxation amendments came into effect in 2002. These amendments on prepayment are specific to forestry activities and apply to expenditure incurred on or after 2 October 2001. The concession allows investors to claim an immediate deduction for certain prepaid expenditures invested under a plantation forestry agreement. The 12-month rule applies to “seasonally dependent agronomic activities” that occur during tree planting. The prepaid activities must be completed within 12 months of the commencement date and by the end of the following income year. The concession applies to activities such as land preparation and planting.

Managers of plantation forestry agreements need to include the prepayments in their assessable income in the year in which they can claim deductions, rather than when the work is done. Where deductions are first claimed by an investor in either the 2001/2002 or 2002/2003 financial years (whichever is the “first year of use”), the manager can spread the assessment of that income from the first year of use equally between that year and the following year.

The amendment addressed industry concerns. It is expected that the rule will boost investment by providing greater flexibility and helping to better plan land, contracting and seedling requirements.

- *Non-commercial losses*

The Non-Commercial Losses taxation amendment came into effect in 2002. The rule applies from the 2000/2001 financial year onwards. It prevents losses from a non-commercial business activity being offset against other income in the year in which they occur. In the plantation industry, thinnings may produce a one-off profit, making it ineligible to claim deductions from that year on. However, under the rule the Commissioner of Taxation can exercise discretion prospectively over a number of income years until the activity is expected to produce a profit or pass one of the tests on a sustained basis rather than on each income year. This discretion will also help to reduce compliance cost for industries. In essence, the tax will be realized only when income from the investment occurs.

- *Capital gains concessions*

Since September 1999, Capital Gains Tax (CGT) was effectively reduced and rules streamlined. The CGT discount enables trusts and individuals to reduce capital gains from assets owned for at least 12 months by 50 percent. Small-scale operators satisfying certain conditions may also qualify for one or more of the following CGT concessions:

- ⇒ The 15-year exemption provides a full exemption for capital gains from an asset continuously owned for at least 15 years.
- ⇒ The 50 percent active asset reduction offers a 50 percent reduction of capital gains from an active asset.
- ⇒ The retirement exemption grants an exemption for capital gains from active assets, up to a lifetime limit of A\$500 000, if proceeds are used for retirement.
- ⇒ The small business rollover defers capital gains if a replacement asset is acquired.

The CGT is relevant to forest plantations as most have long rotations. It also impacts commercial plantation-based annuity schemes that are promoted by several states and private companies. Many plantation-based annuity schemes promote the tax benefits, although the onus is on the investor to clarify and claim such benefits from the ATO.

- *Immediate deductibility of non-capital expenditure*

Non-capital expenditure on plantations such as plantings, establishment costs and management fees can be claimed as an immediate tax deduction. Expenditure on items of a capital nature (for example, roads and dams) is deductible over a period of time, as specified in the recent tax changes.

- *Farm Management Deposits Scheme*

This scheme is a tax-linked saving scheme. It allows primary producers to preserve some of their income from good years for use in those years where farm income is low or outlays are high.

- *Income tax averaging for primary producers*

In primary production, the application of marginal tax rates and income brackets for taxable income implies a relatively high average tax rate that is not compensated by a lower average tax rate in poor income years. To overcome this fluctuation, primary producers may use an arrangement that averages income for five years. This incentive is useful for plantation companies in reducing the average tax rate that may apply to the rather “high” income occurring during years of thinning or clear-felling. While introduced before 1985, it remains ongoing.

- *Spreading insurance recoveries for loss of timber or livestock*

Insurance recoveries from loss of timber or livestock and net income from forced disposal of livestock can be spread over five income years. This was introduced before 1985.

- *Landcare deduction and offset*

Introduced prior to 1985, Landcare deduction is ongoing. Primary producers and users of rural land can claim an immediate deduction for capital expenditure on soil conservation, prevention of land degradation and related measures. While not a direct incentive for plantation establishment, it boosts land rehabilitation that indirectly aids plantation establishment (especially in the case of farm forestry).

Landcare offset was introduced in 1998. Primary producers and users of rural land, with taxable income of up to A\$20 000 a year, can claim a 30 percent tax offset for capital expenditure on soil conservation, prevention of land degradation and related measures. This measure can be claimed as an alternative to the Landcare deduction and may provide an incentive for plantation establishment on degraded lands, which provide commercial and conservation benefits.

- *Thin capitalization*

With some exceptions, when an Australian company pays interest to a party offshore, tax is payable to the ATO. This tax is termed “withholding tax”. The thin capitalization rule may apply to such a withholding tax of Australian forestry companies with foreign partners. Under the rule, the Australian company may claim a tax deduction for such interest payments. However the rule does not apply if the foreign controller’s investment in the Australian company has a debt to equity ratio of more than 2:1.

- *De minimis exemption for thin capitalization*

The *de minimis* exemption was introduced in 2001. It allows taxpayers to claim debt deductions of up to A\$250 000 without being subject to the thin capitalization rule. An additional *de minimis* rule is included in the thin capitalization regime for outward investing entities, where the foreign assets of that entity and its associates represent up to ten percent of the total combined assets of that entity and its associates. Although the rule is not directly related to forests, it again benefits forestry companies with foreign assets.

- *Prepaid expenses – tax shelters*

Under the tax shelter rules, prepaid expenses that would otherwise be immediately deductible are required to be apportioned over their eligible service period (ESP). Broadly, the ESP is the period during which the activity under the agreement (for example, management services) is to be undertaken. Subject to some exceptions, the tax shelter rules apply to prepaid expenditure incurred under a tax shelter arrangement after November 1999. The tax shelter rules apply to all taxpayers and there are no transitional rules. The tax shelter rules do not apply to that part of a prepayment that represents “seasonally dependent agronomic expenditure”. (See earlier explanation in “Prepayments” of the “12-month rule”.)

- *Income tax exemption for funds expended on scientific research*

Income of funds expended for scientific research by, or in conjunction with, a public university or hospital is exempt from income tax. This exemption has been in effect since 1985.

- *R&D refundable tax offset for small companies*

This offset, announced in 2001, encourages smaller companies to undertake R&D. Eligible companies must have an annual turnover of less than A\$5 million and undertake R&D of up to A\$1 million. Companies meeting the criteria receive tax offset equivalent to the value of the R&D tax concession.

- *R&D tax concession*

The concession was introduced in 1985. Expenditure on R&D generally received an immediate 125 percent deduction. Until 29 January 2001, eligible expenditure on R&D was deductible at 125 percent over three years. Since then, expenditure is deductible over its effective life. Expenditure on “core technology” that relates to R&D is deductible at a rate of 100 percent over the period of the related R&D activities.

Another premium tax concession became available from 1 July 2001. Companies that increase their R&D expenditure receive a 175 percent concession. This concession covers all R&D expenditure excluding plant, pilot plant, contracted plant, plant leases, core technology, R&D related interest and items excluded from the 125 percent R&D tax concession.

The following forestry operations are considered to be primary production for accessing tax benefits specific to primary production:

- Planting or tending trees in a plantation or forest that is to be felled;
- Felling trees in a plantation or forest; and
- Transporting trees or parts of trees that have been felled in a plantation or forest to the place where they are first to be milled or processed, or from which they are to be transported to the place where they are first to be milled or processed.

b. The National Forest Policy Statement (NFPS)

The Commonwealth and state governments jointly released the NFPS in 1992 in response to three major reports on forest issues in Australia – those of the Ecologically Sustainable Development Working Group on Forest Use, the National Plantations Advisory Committee and the Resource Assessment Commission’s Forest and Timber Inquiry. The NFPS outlined objectives and policies for the future of Australia’s public and private forests, and contained specific commitments to improve the management of commercial plantations. Primarily, the policy stated that decisions to establish plantations for wood production should rest on their economic viability. Recognizing the protracted nature of plantation investments, governments saw the importance

of secure long-term policies including the need to enable trading of capital, the establishment of “pooled development funds” with concessional taxation rates and simplified planning procedures.

In many ways, the NFPS became (and remains) the basis for all subsequent forestry policies and programmes for the Commonwealth, and for the states to a lesser degree.

c. The National Landcare Programme

The National Landcare Programme, established in 1992, incorporated elements of the former Federal (Commonwealth) Water Resources Assistance Programme, but had a much broader focus on natural resource management, including whole farm or property management planning.

The National Landcare Programme coordinated government and community activities across whole catchments. It encouraged community involvement in mitigating rural land degradation and emphasized a self-help approach (SCARM 1995). In essence, the concept of Landcare provided a way to integrate several strands of natural resource management policy within the context of community development.

d. Collection and dissemination of quantitative plantation information

Quantitative information on the national plantation resource is an essential ingredient for decision-making and strategic planning, nationally and regionally, by all stakeholders. The provision of data by growers and their representatives ensures that governments and industry use correct information and that a realistic picture of the industry is portrayed nationally and internationally. The National Forest Inventory (NFI) therefore established the National Plantation Inventory (NPI) in 1993 to provide up-to-date quantitative reporting of Australia’s plantation resources and to monitor plantation expansion. This included regional plantation wood-flow estimates critical to business plans, attracting new investment and marketing. The NPI focused on collecting data from growers whose total estate was greater than 1 000 ha each. The National Farm Forest Inventory (NFFI), another NFI programme, was developed in 1998 to collect and collate information on plantations of less than 1 000 ha (generally those within the National Farm Forestry Programme [NFFP]). The first coordinated findings of these two inventories were published in the *Plantations of Australia 2001* report (Woods *et al.* 2001).

Collectively, the NPI and NFFI provided a reliable and transparent data series to assist regional and national resource planning, and guided investment in plantations and associated downstream industries.

e. Wood and Paper Industry Strategy (WAPIS)

In December 1995, the Commonwealth launched the four-year WAPIS, aimed at developing the wood and paper industries while protecting native forests for future generations. It focused on industrial development, value adding and new investment.

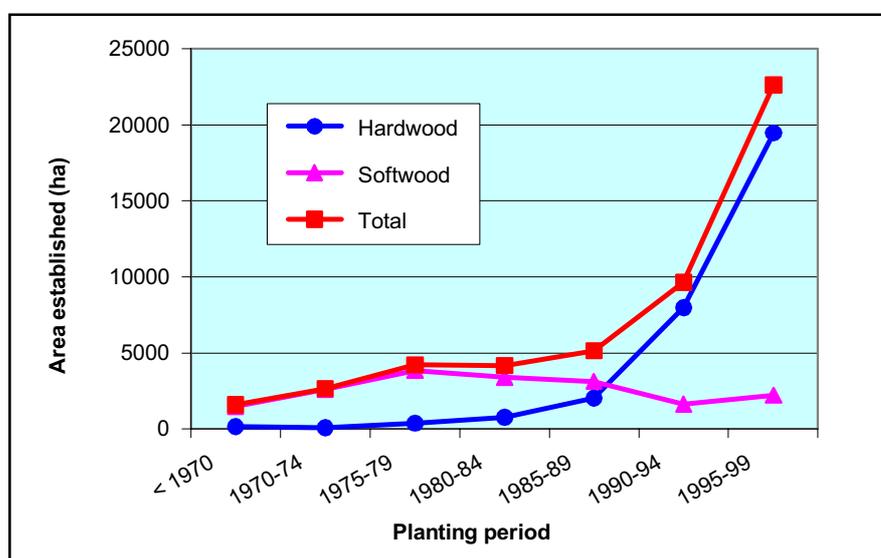
WAPIS activities promoted greater investment, research and downstream processing in Australian forest industries, expansion of farm forestry and the plantation sector, a skilled and flexible workforce and improved regional job opportunities. Improved information on plantation areas and wood flows was one of the key achievements of this strategy, significantly aided by the 1997 NPI.

f. National Farm Forestry Programme (NFFP)

The NFFP operated from 1996 to 2001, funded from the National Heritage Trust. Its aim was to encourage the integration of commercial tree growing and management into farming systems

for wood and non-wood production, increasing agricultural productivity and managing natural resources sustainably. This was aided at the regional level by establishing Regional Plantation Committees (RPCs) to promote information networks, increase the skill base, initiate demonstration projects and design regional strategies. The adoption of farm forestry was assisted by farmers wanting to diversify and enter new markets as a risk management strategy, investors establishing plantations on farmland through joint ventures or annuity schemes, agricultural gains (for example, increased agricultural yields) and provision of environmental services (for example, soil and water conservation). This mitigated, to some extent, the preliminary establishment costs and long lag-time for returns, future market uncertainty and initial lack of information and support networks.

More than one-third of the current total farm forest resources has been planted since 1995 (Figure 5). This period has seen a major shift from softwood to hardwood establishment. At the programme’s conclusion, farm forestry had contributed approximately five percent to the total plantation resource and 12 percent to the total privately owned resource. Approximately another 11 percent of industrial plantations came from leased or joint venture arrangements of farmland.¹⁷



Source: Wood *et al.* (2001).

Figure 5: Farm forestry plantation establishment rates

g. Regional Forest Agreements

The Regional Forest Agreements (RFAs), developed jointly by national and state governments, emerged from the NFPS and are a long-term plan for Australia’s native forests. Beginning with the first agreement in 1997, each RFA operates for 20 years to be reviewed every five years. The RFAs are designed to create jobs and protect forests through:

- A comprehensive, adequate and representative reserve system based on nationally agreed criteria;¹⁸
- Support for innovative, internationally competitive forest industries; and
- Sustainable forest management of the whole forest estate.

¹⁷ For more information, refer to: <http://www.affa.gov.au/content/output.cfm?ObjectID=F1B8B992-08B9-4EF9-959F6F06E8978BA4>

¹⁸ For details, check the Janis criteria at <http://www.rfa.gov.au/rfa/national/janis/index.html>

Important changes for the plantation industry followed the RFAs, for example allowing the Commonwealth government to remove the requirement for export woodchip licences because special values, such as rare species, now have agreed management frameworks through the RFA process. The Commonwealth's export controls on roundlogs from plantations have gradually been lifted over the last five years, removing what the industry considered a deterrent to plantation investment. This signals the Commonwealth government's endorsement of the plantation industry's full participation in global wood markets and gives potential growers access to a greater range of markets.¹⁹

h. Plantations for Australia: The 2020 Vision

Released in 1997, the "Plantations for Australia: The 2020 Vision" is the most important strategic policy setting the current direction of plantation development in Australia, with many of the present incentives being a direct result of this policy.

It is a framework designed to achieve an internationally competitive plantation-growing and processing industry that is commercially focused, market-driven and market-oriented. It aims to develop a significant, long-term and environmentally sustainable plantation resource through major private sector investment, which will enhance the growth of Australia's forest industries and the contribution made by plantations to the Australian economy, rural and regional communities and the environment.

The 2020 Vision details the main actions to encourage plantation establishment to meet the target of trebling the plantation area from 1.1 to 3.3 million ha by 2020. The Vision partners (the National Association of Forest Industries, Plantation Timber Association of Australia, Australian Forest Growers and the Commonwealth/state governments) are working jointly to implement these actions. Recent trends indicate that the current expansion in plantations is on track to meet this target. The focus is on boosting the availability of suitable land, getting incentives right, establishing a culture of commercial plantations and improving information flows. The government partners recognize their roles in:

- setting the overall attitude towards plantations;
- instilling market confidence;
- providing information;
- establishing rules and processes;
- providing education; and
- providing infrastructure for basic research.

In the initial phase, emphasis had been on increasing awareness of the Vision – particularly at the regional level, involving local government and seeking commitment from state governments to provide a regulatory environment that did not discriminate against plantation growing – and focused on overcoming obstacles to the development of plantation forestry.

A revised 2020 Vision stresses the need to remove some remaining impediments (such as the question of property rights) and to maximize the benefits from plantation expansion. It also highlights the potential for tree plantings to help maintain and improve the environment, while being productive at the same time, to stakeholders. It is expected that the social issues of water and land degradation, fire management and competing land uses will be increasingly addressed as a result.

¹⁹ For more information, see the RFA Web site: <http://www.rfa.gov.au>

Besides building an internationally competitive and environmentally sustainable plantation sector, other expected benefits of the 2020 Vision are reducing Australia's net greenhouse gas emissions, turning around the wood and wood product trade deficit, rural development (including creation of up to 40 000 jobs) and improved land management outcomes.

In line with the increasing production of softwood, the hardwood sawmillers have begun diversifying their mills to produce kiln-dried timber for furniture, flooring, mouldings and other value-added products. The increased domestic production will see a surplus of sawntimber in the next five years accompanied by a decline in imports. A similar trend is projected for wood panel products, including particleboard and plywood.

i. Action Agenda for Forest and Wood Products

Launched in 2000 by Commonwealth/state governments and industry, the Action Agenda's vision is maximizing sustainable and profitable activities for tree growing, value adding and marketing of Australian forest and wood products. In committing to this goal, industry and other stakeholders recognize:

- Australia's public and private forests (including plantations) generate a diversity of wood and non-wood products and services, the benefits of which are not always appreciated by the Australian community;
- Forestry operations in Australia must be, and clearly demonstrated to be, environmentally and economically sustainable;
- Future viability of the industry will depend on its ability to compete in both domestic and overseas markets; and
- An innovative and cooperative approach is necessary to optimize the potential of the industry in traditional and non-traditional areas.

The Action Agenda has been designed to provide an enabling environment, within which industry can seek sustainable competitive advantages. It identifies six broad themes considered vital in dealing with those impediments and in pursuing emerging opportunities:

- Credibility of forest products (for example, implement an Australian Forestry Standard);
- Intelligence development and diffusion (for example, establish a consolidated industry database);
- Product development and innovation;
- Market and investment promotion (for example, integrated approach to market investment development);
- Human capital; and
- Coordination and collaboration.

Impacts of incentives

Following the settlement of European immigrants in Australia, most forest land had been cleared for agriculture. Since the 1980s, however, the establishment of plantations on former agricultural land has reversed the trend. Most states now prohibit clearance of native forest for establishing plantations.

Increasing numbers of small-scale plantings were undertaken, notably in Western Australia. In other areas, in what became known as the "Green Triangle", the plantings were larger in size and often in contiguous blocks.

Investment companies, sometimes driven by tax advantages of various schemes, established many of the plantations during this period. Often they had no direct links to processors at the outset, but once sufficient critical mass was obtained, they negotiated sales agreements usually for woodchip exports to Japan or Korea. The largest plantation companies are closely tied to foreign companies, especially Japanese pulp and paper enterprises.

Summary and lessons learned in Phase 4

During the 1990s, Australia's economy opened up and moved to a freer market-based approach. This is reflected in the incentives now employed and has led to the highest sustained growth and total area in Australia's plantation development. At the state level, incentives are predominantly direct mechanisms and include those offered by large private companies targeting small-scale private landowners, while the Commonwealth has moved towards indirect mechanisms. Overall, governments have increasingly distanced themselves from hands-on participation and are focusing on removing impediments, supporting existing investors and attracting new ones.

Table 4 sets out a comparison of factors constraining the effective use of incentives in plantation forestry in the early 1990s and how these have been reduced or overcome by 2002.

Table 4: Comparison of effectiveness for forest plantation incentives between 1991 and 2002

1991 constraints	2002 situation
<p>Taxation provisions</p> <p>Long lead-time between establishment costs and revenues from harvesting made forestry unattractive, compared with agricultural crops.</p> <p>Lack of competitive neutrality between state forest agencies and private growers affecting (depressing) log pricing and log allocation.</p>	<p>Tax policy changes, including tax averaging, 12-month rule and farm management deposits scheme.</p> <p>By 2002, many of the largest state forest agencies corporatized during the preceding ten years (New South Wales state forests, Tasmanian and Victorian pine plantations, privatized agencies) now pay some taxes, putting them on a more level playing field than in the late 1980s/early 1990s.</p>
<p>Trade interventions</p> <p>Export approvals required for unprocessed wood and woodchips.</p> <p>Protection from imports of forest products.</p> <p>Land-use interventions through government policies (e.g. assistance to other land-using industries such as dairying or sugar cane).</p> <p>Much uncertainty in the supply of forest resources and hence in forest investment overall.</p>	<p>For RFA regions, export controls for woodchips have been removed, with no ceilings in place for private plantation wood.</p> <p>By 2002, tariffs had been reduced to between zero and five percent, to open up markets.</p> <p>By 2002, many of these subsidies had been reduced or eliminated.</p> <p>The RFA process was finalized in 2001, with ten agreements in effect. The agreements provide a 20-year certainty to forest industries as well as setting out extensive reserve systems for conservation purposes.</p>
<p>Marketing for logs from commercial plantations</p> <p>Other impediments are associated with problems of imperfect knowledge.</p> <p>The reliability and availability of information on the full nature and extent of Australia's forests and plantations were limited as it was compiled individually by the states and not reported consistently.</p> <p>Limited bargaining power of small growers in the log market.</p>	<p>By 2002, market intelligence reports are produced by several firms (e.g. the comprehensive but expensive <i>AUSNEWZ</i> by URS Forestry aimed at large industrial growers and processors, and the free Australian National University [ANU] Forestry Market Report which is primarily aimed at Australia's small forest growers [see Bhati 2002]).</p> <p>The Commonwealth government initiated the NFI programme in 1995. This grew to include statistics on plantations and culminated in the first comprehensive statistics on the plantation estate through the initial NPI reports of 1997 and the more comprehensive report of 2001 (Wood <i>et al.</i> 2001).</p> <p>This important resource information is vital for government policy-makers, industrial processors and investors to make better informed decisions. This reduction in uncertainty over the information and consequent reduction in risk is very important for investor confidence.</p> <p>By 2002, several cooperative schemes for private forest owners have developed (e.g. in Tasmania) and these are assisting small-scale growers to collectively market their wood with regular and increasing sales even into the international markets (e.g. Korea).</p>

Source for 1991 constraints outlined: Bhati *et al.* (1990). 2002 analysis is preliminary only.

Collectively the incentives have proven highly effective. Combined with an eager pulp market and the easing of the export and foreign investment restrictions, they have produced a steep increase in planting rates (see Figures 2, 3 and 4; Table 4). Since the 1980s, most plantations have been established on former agricultural land. Planning approval processes in many states now prohibit clearance of native forests for establishing plantations. Plantation growers actively compete for land with other sectors on a commercial basis.

CONCLUSIONS

Through international competitiveness and value adding, Australia’s native forest and wood product sector is targeting niche markets utilizing the unique characteristics of these timbers. Nevertheless, Australia has substantial plantation resources and is increasingly using them as a primary source of wood products, both for export and domestic use. Plantations cover just one percent of the total forest area but contribute 54 percent to all roundwood and 66 percent to all sawlog production.

Plantation incentives in Australia were initially offered to achieve self-sufficiency. Over time, this narrow focus broadened to encompass the strategic goal of creating an internationally competitive plantation-growing and processing industry by developing a long-term and environmentally sustainable plantation resource through major private sector investments. Although plantations are established for numerous reasons, wood production is now the most significant (Figure 6).

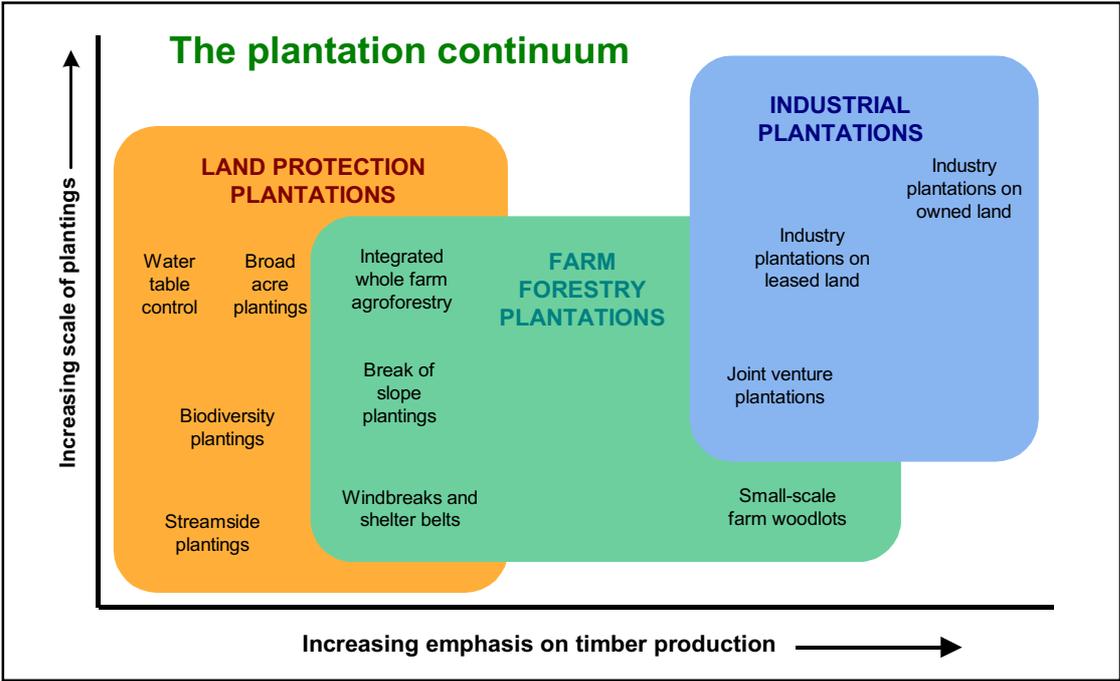


Figure 6: Australia’s forest plantation continuum: from environmental to industrial plantations

Incentives have been changed over time, reflecting the evolution of government, industry and community expectations of forestry. The Commonwealth government, most state governments and industry have provided a range of direct and indirect incentives with varying success. Specific plantation incentives now focus on creating an environment attractive to investors in commercial plantations and processing facilities. They include:

- A secure strategic policy framework;
- Removal of impediments through tax reforms;

- Resource security for industrial investments;
- Elimination of market distortions through the introduction of competitive neutrality principles, leading to progressive privatization/commercialization of state plantations;
- Progressive lifting of export controls on unprocessed wood from plantations;
- Development of internationally competitive wood-processing industries;
- Sustainable management of private forests;
- Integrated land-use planning, including farm forestry, to increase the availability of private land for plantations and environmental benefits; and
- Environmental benefits, for example, land and water conservation/carbon sequestration.

R&D and an associated strong extension programme to distribute research findings to stakeholders have contributed also to the successful provision of incentives.

Non-plantation specific incentives arising from broader national agendas and institutional changes over the last ten years have also benefited plantation development. These include:

- Relaxation of foreign investment restrictions;
- Expansion of rural development and employment opportunities;
- Provision of port and transport infrastructure; and
- Efforts to free market policies.

A summary of the more significant direct and indirect incentives is provided in Annex 1.

The result has been a sustained increase in total plantation area since the 1950s, particularly in the 1960s and early 1970s with the Softwood Loans, and more so since the early 1990s following national agreement of a secure strategic policy framework through the NFPS and 2020 Vision, and broader macro-economic reforms. In 2001, the total plantation area increased by six percent, the majority of plantations was privately owned (54 percent) and growing, with 89 percent of new areas being on private land (Wood *et al.* 2002). Ownership and partnership arrangements are diverse and reflect the success of recent initiatives to attract private investors. This includes a variety of joint venture and annuity agreements for tree ownership, where both public and private parties add some equity in the tree crop. Farm forestry is a growing area for such arrangements.

Based on Australia's experiences, conditions in which forest management and plantation investments may prosper include:

- Political and macro-economic stability;
- Trade liberalization and open foreign investment;
- Well-defined and stable property rights for land resources;
- Government with adequate institutional capacity to enforce laws and administer incentive schemes;
- Availability of appropriate technologies and basic infrastructure (for example, roads, electricity, ports) to support investment;
- Availability of commercial knowledge and expertise to establish, maintain, harvest, process and market plantation products; and
- Critical mass of the plantation resource to support internationally competitive, integrated processing facilities.

FUTURE DIRECTIONS

Creating a favourable climate for plantation establishment and growth

Australia's plantations largely began through the Commonwealth government's investment loans to the states. The success of the states' plantation developments in turn encouraged private investments. The increase in plantation area was sufficiently large to meet Australia's concerns for self-sufficiency in timber and the sustainability of its native forests, allowing the Commonwealth government to then gradually wind down the Softwood Loans. Despite this decline in direct support, plantings increased, facilitated by the removal of a range of tax inequities and general impediments, and by introducing supportive Commonwealth and state government policies and programmes. This pattern is not limited to Australia. Other countries that previously used substantial subsidies to encourage plantation establishment (for example, New Zealand, Chile, Brazil and Uruguay) have experienced similar increases in plantings, despite reduction or elimination of direct support.

According to Adams and Castano (2000), preconditions for establishing plantations are similar to those required to manage natural forests sustainably, namely: security of tenure, effective planning, yield control and environmentally sound harvesting (Poore *et al.* 1989). As such, simply possessing large areas of natural forest is not sufficient to maintain wood production. The initial relative advantage of countries with substantial natural forests will ultimately decline, if the underlying infrastructure and support mechanisms are not maintained and developed (Durst and Brown 2000). As such, countries with initially small areas of natural forests but having a well-developed forestry infrastructure, access to capital and the ability to shift their wood production to plantations and grow trees quickly, are well placed to capture existing markets and create new products and markets.

However, growth rates are only part of the equation for financial competitiveness. Overall rates of return are of critical importance. Besides growth rates, they also depend on other factors such as initial investment costs, interest rates, transport costs and the final product's price. Many developed temperate countries continue to have significant advantages in infrastructure, technology, labour and skills, and have lower interest rates compared with developing countries. Economic efficiencies arising from integrated processing are important. Likewise, having processing industries in close proximity is also important. The crucial point is that the ability to grow trees quickly is only one of a complex set of factors determining success in forestry.

Political will and policy stability

The Australian Government's policies, refined over time, remain remarkably consistent in supporting plantation establishment over the decades. This stability provides confidence to investors that the government is not likely to suddenly change the ground rules.

The Commonwealth and state governments have a range of policy instruments to promote natural resource management for the public good. These include regulation, education and provision of information, and the provision of economic incentives such as tax deductions, subsidies, grants and market-based instruments. Increasingly, Australia is moving away from direct subsidies and incentives to a market-based investment approach. The Commonwealth government achieves this through enabling incentives based on an appropriate policy and legislative framework to remove impediments (disincentives) and provide a conducive environment for private industry and capital to set up sustainable and profitable plantations. The 2020 Vision is a good example of industry-specific policy at the micro-level.

State government plantation ownership was a critical factor in advancing Australia's plantation industry. However, market distortion and a lack of competitive neutrality, caused by the continued dominance of some state-owned forest agencies as softwood suppliers, led to a monopoly in many regions. The Commonwealth government initiated the National Competition Policy (NCP)

to inculcate public agencies' competitive neutrality by separating their business and regulatory functions. As such, governments now apply full taxes or tax equivalent payments, debt guarantee fees and private sector equivalent regulations on public agencies. An essential element of the obligations is that government business activities, like their private sector counterparts, set prices to earn sufficient revenues to cover their costs. This ensures that public sector investments face the same costs and commercial pressures as their private sector competitors. Several state forest agencies have been corporatized with some states selling off most or all of their plantation estates. Most now pay taxes and adhere to price transparency, thereby creating a level playing field for timber sales.²⁰

Tariffs and trade barriers

In recent years, tariff barriers have declined in most of the main timber import markets and tariffs worldwide will continue to fall through bilateral, regional and global trade negotiations (Adams and Castano 2000). Non-tariff measures can also influence trade. These include a wide variety of rules and procedures ranging from health and technical standards to measures influencing price. Restrictions on log exports have traditionally been used to support the domestic processing industry in timber-producing countries.

Bhati (2001) highlights the issue of tariff barriers facing Australia's forest product exports. A further Commonwealth government economic study projects that Australia's net exports of logs and wood-based panels will rise significantly within ten years, and the country should change from a net importer to a net exporter of sawntimber. Paper imports will fall as a percentage of total paper consumption. The Australian forest product industry will soon transform from largely a domestic market-oriented to an export-oriented industry.

Australia nevertheless imposes tariffs on imports of forest products, generally between zero and five percent. However, due to the policy of preferential tariffs for the developing countries, forest products from such countries are duty free. Bhati (2001) argues that for this reason and the fact that Japan and Korea (developed countries) impose higher and escalating tariffs on some products than Australia, it is in Australia's interest to take the initiative to have tariffs on its exports in Asian markets removed (assuming it can retain and increase access to overseas markets).

Institutional changes supporting incentives

There is a clear and increasing trend in Australia to privatize many government-owned commercial ventures. This has ranged from telecommunications to banking and has occurred to some extent in two state-owned plantations. The State of Victoria has sold its pine plantation estate of several hundred thousand hectares to Hancocks Pty. Ltd., a subsidiary of the international firm Hancocks U.S.A. Likewise Tasmania has entered into a 50 percent joint venture of their pine plantations with the North American investment company GMO Renewable Resources.

Extension and dissemination of information

Commonwealth and state governments have extension and information dissemination systems actively providing information and advice to private industries and landholders. An example is the RPCs established by the Commonwealth government in 1996 in Australia's main plantation regions. Their aim is to promote wood production on cleared agricultural land and integrate

²⁰ Further information on the NCP is available at:
<http://www.ncc.gov.au/articleZone.asp?articleZoneID=72#Article-94>

commercial tree growing for wood and non-wood products with other agricultural land uses, with an emphasis on developing commercial uses of native species, through the coordination of stakeholder activities and the development of strategies for industry development. Since then, RPCs have worked with local and regional stakeholders, including landholders, state and local governments and industry to:

- address planning, infrastructure and coordination issues;
- undertake feasibility studies;
- develop regional plantation and farm forestry strategies to encourage commercial forest-based industries in the region;
- formulate related marketing, investment and wood-flow plans;
- facilitate communication among stakeholders;
- identify national R&D priorities for the plantation sector; and
- improve information flows on marketing and management of plantations and private native forests.

The RPCs have the potential to further contribute to improving linkages at the national and regional levels.

Other projects that prepare and provide information to support the plantation industry include the ANU Market Report project that contributes towards creating more informed forest product and input markets in Australia, primarily for small-scale forest growers.²¹

Possible future drivers

The Kyoto Protocol, greenhouse gas and carbon credits

The inclusion of “sinks” in the Kyoto Protocol has created expectations of increased investment in forest plantation development for carbon storage. Grant and Keenan (2000) note that because the total area that might be converted to plantations is limited, increased carbon sequestration in forest plantations is generally regarded as part of a transitional strategy to reduce atmospheric concentrations of greenhouse gases over the next 50 years or so. However, before carbon-oriented forestry can become a significant factor in global plantation development, the Kyoto Protocol has to be ratified and come into effect internationally.

Even so, this has not prevented initial investments. In New South Wales, the Tokyo Electric Power Company has signed a contract to establish a forest estate for carbon sequestration and timber products over a ten-year period. The target area is between 10 000 and 40 000 ha, with 1 000 ha to be planted initially. The estate is expected to comprise half hardwoods and softwoods. The investment opportunity is attractive because the underlying forestry asset achieves a positive return over time, even assuming no value for carbon. Hence, if the Kyoto Protocol is not ratified, or if ultimately the value of carbon sequestration from the carbon sink is not realized, a valuable asset will still have been created.

Other commercial and market-driven activities are resulting in plantation investment for carbon offsets. Commonwealth and state governments have developed specific policy initiatives to facilitate carbon-related investments, including:

- Bush for Greenhouse (1997) (Commonwealth);
- National Greenhouse Strategy (1998) (Commonwealth);

²¹ The project has produced 20 reports, available at: <http://sres.anu.edu.au/associated/marketreport/index.html>

- Carbon Rights Legislation Amendment Act (1998) (state);
- Renewable Energy (Electricity) Act (2000) (state); and
- Replanting Victoria (1999) (state).

Still, a number of issues require resolution before carbon offsets can play a significant role in plantation development, for example:

- risks from trade barriers;
- transaction costs;
- measurement of above- and below-ground biomass and verification; and
- social and community concerns.

Plantations as a financial investment

Plantation investments may provide portfolio diversification, long-term returns and improve risk management through reduced portfolio volatility. Experiences of large institutional investors in North America and Europe indicate that plantation returns are often counter-cyclical to the returns from financial assets such as stocks and bonds. As such, they may be worthwhile investments for superannuation funds because the long maturity periods match the fund's rising long-term obligations.

Annex 1: Summary of forest plantation incentives used in Australia

Date started/ ended	Brief description of incentive	Initiated by Commonwealth, state, timber industry, private sector	Target group (e.g. state, timber industry, private landowners, others)	Direct/ indirect funding ¹	Outcomes/impacts ¹
Ongoing	Infrastructure provision (e.g. roads and port facilities)	Commonwealth and state	Regional Australia and associated rural industries	Indirect	Attracts and facilitates investment, reduced cost of production, opens new areas to forestry
2002 - present	Tax equity package	Commonwealth	Timber industry	NA	A range of tax measures for current and future investors in plantations. Removed impediments will ensure forest plantations are treated equally with other rural industries, especially agriculture.
2002 - present	Natural Heritage Trust 2 (restructure of Natural Heritage Trust 1 with additional funding)	Joint Commonwealth and state	States, timber industry, private and communities	Direct	More strategic focus on environmental services and improved natural resources management. Mainly assists farm forestry
2001 - present	Investor attractiveness framework e.g. reduced interest rates, attractive exchange rate, incentives for large-scale processors	Commonwealth	Timber industry	NA	Attracts and facilitates investment, reduced cost of production, improved competitiveness of operations
2000 - present	Australian Forestry Standard	Joint Commonwealth, states and industry	Timber industry	NA	Provides credibility of Australia's sustainable forest management practices and improved sale of forest products to global markets
2000 - present	Action Agenda for Forest and Wood Products	Commonwealth	Timber industry	NA	Promotion of demand-side initiatives, encompassing such issues as value adding, expanding non-traditional forest and wood uses, and market and investment development
1998 - present	National Farm Forest Inventory	Joint Commonwealth, state and industry	Farm forestry	NA	Support the development of farm forestry and plantations generally by the collection, interpretation and dissemination of data, and assist to monitor the outcomes of the NFFP
1997 - present	Plantations 2020 Vision strategy	Joint Commonwealth, state and industry	Timber industry	NA	A trebling of Australia's forest plantation area by 2020 through removing impediments, encouraging value adding and regional development, and contributing to environmental services and a market-driven timber industry

Date started/ ended	Brief description of incentive	Initiated by Commonwealth, state, timber industry, private sector	Target group (e.g. state, timber industry, private landowners, others)	Direct/ indirect funding¹	Outcomes/impacts¹
1997 - 2001	Natural Heritage Trust 1	Joint Commonwealth and state	Commonwealth, states, timber industry, private and communities	Direct	Assists farm forestry programmes and contributes to broader environmental services by, in part, community involvement and stimulating additional investment in the natural environment sustainably
1996 - present	Removal of Export Controls on wood from plantations	Commonwealth	Timber industry	NA	Increased access to export markets, creating additional demand for forest products
1995 - present	Regional Forest Agreements	Commonwealth	State, timber industry and conservationists	Direct to state	Certainty of resource availability, comprehensive reserve system and sustainability
1995 - present	Establishment of networks to provide advice and streamline planning approvals (Regional Plantation Committees)	Commonwealth	Timber industry and private landowners	Indirect	Provide focal point in 17 regions to disseminate information and encourage plantation establishment and farm forestry
1995 - present	National Competition Policy	Joint Commonwealth and state	Timber industry	NA	Removal of unfair competitive advantage of state-owned forest corporations
1995 - 1999	WAPIS	Commonwealth	Timber industry and processors	NA	Greater research and downstream processing, expansion of farm forestry and the plantation sector, and improved information on plantation areas and wood flows
1993 - present	Joint Venture Agroforestry Programme	Commonwealth	Timber industry (including farm forestry)	Direct	Integrating sustainable and productive agroforestry within farming systems
1993 - present	National Plantation Inventory	Joint Commonwealth and state	Timber industry	NA	Support the 2020 Vision, through provision of reliable and transparent quantitative data series to aid regional and national resource planning and guide investment in plantations and associated downstream industries
1992 - present	National Forest Policy Statement	Joint Commonwealth and state	Timber industry	NA	Integrated environmental sustainability and commercial production for Australia's public and private forests, with specific commitments to improve the management of commercial plantations

Date started/ ended	Brief description of incentive	Initiated by Commonwealth, state, timber industry, private sector	Target group (e.g. state, timber industry, private landowners, others)	Direct/ indirect funding ¹	Outcomes/impacts ¹
Early mid 1990s	Numerous development incentives designed to attract and encourage new investors to forest plantation, maintain and improve quality and quantity of existing plantations, incentives for large-scale processors	State and private (normally larger timber and paper companies)	Private landholders	Direct	Numerous – often specific according to who funded the incentive, e.g. encourage reforestation within reasonable distance of paper mills, establish private softwood and hardwood plantations, increase pulpwood supply, re-establish plantations on suitable lands after harvesting, farmers to grow trees commercially
1990 - present	Relaxation of foreign investment rules	Commonwealth	International timber industry	NA	Increased foreign investments in plantations with improved attractiveness to potential new investors
1990s - present	Dissemination of information for investors and landholders	Commonwealth, states and industry	Timber industry	NA	Greater awareness of government programmes, superior decision-making, increased plantation rates and areas
1990	Grants to downstream processors	Commonwealth	States	Direct	Improved integrations and efficiency, value adding, greater market demand
1989 - present	Landcare: environmental issues an additional factor in planting trees	Joint Commonwealth and state	Timber industry and conservationists	Direct	Enhanced environmental gains arising from community participation and strategic targeting of national environmental issues, greater public awareness and acceptance of forest management practices
1987 - 1989	National Afforestation Programme	Commonwealth	State and private forests	Direct	Contributed to a 6 000 ha increase in hardwood plantations
1980 - present	Taxation deductibility arrangements for plantation establishment, Managed Investment schemes, reduction of company tax rates	Commonwealth	Timber industry	Direct	Improved attractiveness of plantations as investment vehicles and viable alternative options for diversification
1966 - 1982	Commonwealth Softwood Loan Agreement Act	Commonwealth	State forest agencies	Direct	Large increase in softwood planting

¹ A quantitative assessment of each incentive and its costs was not possible, as many incentives were generic to the whole timber industry – not just plantations. They operated in conjunction with other incentives and cannot be isolated. Impacts have changed over time and with the development of different aspects (e.g. farm forestry). Individual costs were unavailable as many incentives were/are part of broader natural resource management, general government policies and programmes.

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IMPACT OF INCENTIVES ON THE DEVELOPMENT OF FOREST PLANTATION RESOURCES IN CHINA

5

Jintao Xu¹, Nuyun Li² and Yiying Cao³

INTRODUCTION⁴

The People's Republic of China (PRC) is the world's most populous country with more than 1.3 billion people. The population growth rate is about 0.5 percent. About 64 percent of the people live in rural areas.

China's land area is about 9.33 million km² extending over a wide array of climatic zones including tropical, subtropical, warm-temperate, temperate and cool-temperate zones. Annual precipitation similarly ranges from 2 000 mm in the southeast to 100-200 mm in the northwest. These geographical and climatic variations give rise to China's tremendous biodiversity. To protect this diversity, 1 276 protected areas covering 123 million ha had been established by the end of 2000, accounting for about 12.4 percent of the total land area. Among these protected areas are 909 forest areas, which cover 103 million ha (SFA 2001a).

The country's land area is categorized as cropland (10.4 percent), permanent pasture (42.9 percent), forest and woodland (16.6 percent) and others (30.1 percent). About 95 million ha are cultivated, mainly in the Northeast Plain, North China Plain, Middle-Lower Yangtze Plain, Pearl River Delta Plain and Sichuan Basin.

The country is composed of 23 provinces, five autonomous regions (Inner Mongolia, Ningxia, Xinjiang, Guangxi and Tibet), two special administrative regions (Hong Kong and Macao) and four municipalities. Under each province and autonomous region, the next levels of administration are prefectures and cities. Further down in the administrative hierarchy are counties, townships and villages.

For over 20 years, China's economy has grown between seven and ten percent per year. The growth, market liberalization and economic reforms have lifted some 300 million people out of poverty (Ziegler 1997, cited in Lu *et al.* 2002). The reforms promote efficiency through the expansion of markets, improved allocation of resources and greater roles for the private sector. Today, private enterprises are estimated to account for 33 percent of the GDP, almost on par with the 37 percent state-corporation contribution (Kynge 2000, cited in Lu *et al.* 2002). Reforms have been greatest in rural areas where farmers have been allowed greater freedom to work for themselves on leased land, and are permitted to keep the rewards of their labour.

Forests and forestry in China

According to the fifth national forest resources inventory (1994-1998), China's forests cover an area of 153.63 million ha, which includes bamboo and economic forests (for example, fruit, rubber and oil seed trees).⁵ The stocking volume is estimated at 11.27 billion m³. About 263 million ha, or 27 percent of the total land area, are set aside for forestry. Against most

¹ Deputy Director, Center for Chinese Agricultural Policy, Chinese Academy of Sciences.

² Chief Engineer, Department of Silviculture, State Forestry Administration of China.

³ Senior Research Assistant, Center for Chinese Agricultural Policy, Chinese Academy of Sciences.

⁴ The *Introduction* and the section on *Remaining constraints* draw heavily from Lu *et al.* (2002). Some revisions have been made and data have been updated wherever possible.

⁵ Bamboo forests are forests with bamboo culms and bamboo shoots as primary products. Economic forests are forests that produce non-timber products (fruits, tea, spices and medicinal plants).

measures, China is forest-deficient and has only 0.1 ha of forest per capita, considerably less than the world average of 0.6 ha (FAO 1997).

China's forest product output has been falling short against increasing demands. China is one of the world's largest timber importers, and the only major net timber importer among developing countries (WWF 2002). In 2000, imports of timber and related products reached US\$14.25 billion, with US\$7.61 billion for timber products and US\$6.64 billion for pulp and paper. Forest products are now the largest imported commodity in China.

Regional variations

In terms of area and volume, forest resources are concentrated in state-owned forests in nine provinces or autonomous regions. These provinces account for just under half of the forest area and a significant 66 percent of the standing forest volume. Another 38 percent of the forest area and 18 percent of the volume are located in ten southern collective forest⁶ provinces and autonomous regions (Table 1).

Table 1: Regional distribution of forest resources (million m³ and million ha)

Forest regions	No. of provinces	All forests		Natural forests		Plantation forests ⁷	
		Area	Volume	Area	Volume	Area	Volume
South Collective Forest Region*	10	38.40	17.79	31.43	13.96	54.40	52.05
Tibet	1	2.66	12.42	3.81	13.82	0.002	0.0001
Other 10 provinces with little forest**	10	9.61	3.65	3.64	2.49	18.72	13.99
State Forest Region***	9	49.33	66.14	59.12	69.73	26.88	33.96
<i>Heilongjiang, Inner Mongolia, Jilin</i>	3	25.66	31.52	32.03	33.02	11.06	18.01
<i>Sichuan, Yunnan</i>	2	17.04	27.07	19.74	28.95	10.85	10.13
<i>Other provinces</i>	4	6.63	7.55	7.35	7.76	4.97	5.82

Source: SFA (2000a)

* Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi and Zhejiang.

** Beijing, Hebei, Henan, Jiangsu, Liaoning, Ningxia, Shandong, Shanghai, Shanxi and Tianjin.

*** Inner Mongolia, Jilin, Heilongjiang in Northeast China; Yunnan and Sichuan in Southwest; Sha'anxi, Gansu, Qinghai and Xinjiang in Northwest.

⁶ Collectives usually refer to villages. **Collective forests** are those found on forest lands that belong to the villages collectively, and **forest lands** are lands designated by the national zoning system for forest use. Since 1978, nearly 80 percent of the forest lands are managed by rural households as self-keeping and responsibility forest lands. Farmers living in the forests are allocated **self-keeping forest lands** for subsistence purposes, growing crops of their own choice and owning the products they harvest. On the other hand, farmers need to sign a contract with collectives to be allowed to operate on **responsibility forest lands** for a designated period of time. In the early 1980s, the contract period could be up to 15 years. In cases where input comes from the farmers only, the products grown on the land belong to the farmers alone, whereas if the collective has contributed to forest management, then farmers receive only partial income from timber sales.

⁷ **Plantation forests** are established through artificial regeneration, and they stabilize three to five years after planting, or five to seven years if they are seeded aurally and attain a canopy of 20 percent.

Economic contribution

In economic terms, forestry accounts for less than one percent of the GDP, but is an essential source of energy for 40 percent of the rural population and supplies virtually all the timber to the construction sector. In global terms, China's output of forest products is ranked amongst the top in many product categories. For instance, China is the third largest producer of sawnwood in the world, and accounts for over 30 percent of total bamboo-based production and for 40 percent of rosin, an important chemical raw material for industry (Zhang *et al.* 1998).

Since the 1980s, China's forest product industry, including the production of wood-based panels, forest chemical industry and paper, has experienced rapid expansion. In 1999 alone, the production of logs reached 48 million m³, that of wood-based panels exceeded 15 million m³ and the production of paper and paperboard reached 22 million tonnes (STB 2000).

Forest tenure system

Official forest land in China is either owned by the state or collectives. This system of forest land ownership is a result of China's late 1950s collectivization movement, which basically eliminated private forest lands⁸. Ownership was shifted from households to collectives, and later to communes. Today, after two decades of rural tenure reform, the legal status of the village collectives as owners of the forest land remains but most of the collective forests are managed and used by rural households through contractual arrangements. Initiated in 1978, the process of decollectivization turned the formerly uniform collective forest sector into a non-state forest sector with diverse components – forest farms still under village collective management; forests managed jointly by collectives, farmers and/or state forest entities; forest parcels managed by farmers; and forest parcels managed by private companies. In contrast, state-owned forests continue to be under the jurisdiction of the state forest enterprises and forest farms.

The state forests held 68 percent of the total standing volume, but collectives owned 58 percent of the forest land (Table 2). Collectives dominated the area and volume of plantation forests, while state forests are primarily composed of old-growth natural forests.

Table 2: Forest resources and ownership in 1998 (in million ha and million m³)

Tenure	Area of forested land	Volume of total forests	Area and volume of forest stand ⁹				Area of economic forests	Area of bamboo forests
			Natural forest		Plantation			
			Area	Volume	Area	Volume		
State	63.89	7 641	62.01	7 124	7.70	378	1.59	29.00
Share (%)	42	68	48	71	26	37	8	7
Collective	89.75	3 665	67.19	2 961	21.44	635	18.63	3.93
Share (%)	58	32	52	29	74	63	92	93
Total	153.63	11 306	129.20	10 085	29.14	1 013	20.22	4.21

Source: SFA (2000), cited in Lu *et al.* (2002), p. 21.

⁸ **Private forests** are established through investments on private land, with all rights to the forests accorded to the private owners. This type of ownership was common in the Min-Guo period, from the end of the feudal Qing Dynasty until the founding of the PRC, after which, private forests were gradually eliminated during collectivization (Chen 1983).

⁹ **Forest stands** are forests grown, both naturally and artificially, on forested land except what are classified as economic forests and bamboo forests. They are forests with timber as the main product including timber forests and **fuelwood forests**. **Forested lands** are lands with forest cover meeting certain criteria (e.g. canopy cover greater than 20 percent), and include areas of forest stands, economic forests and bamboo forests.

The relative importance of collective forests has been growing over time. Between 1950 and 1980, state forests were major suppliers of timber. Since the early 1980s, however, state forest output has declined significantly. Between 1984 and 1988, the Northeastern State Forest Region recorded an annual loss of 277 000 ha in forest areas (Zhang 1998). Deforestation is the direct result of overharvesting and a lack of investment in forest regeneration. The role of the collective sector in forest management increased mainly because of its success in developing plantation forests. Table 3 illustrates the change in forest area by ownership types between 1973 and 1998. Table 4 highlights the increase of plantations held by collectives between 1984 and 1998.

Table 3: Forest area change by ownership type, 1973-1998 (in million ha)

Years	Total	State	Collective	Collective share (%)
1973-1976	121.86	NA	NA	NA
1977-1981	115.28	NA	NA	NA
1984-1988	116.36	52.71	63.65	55
1989-1993	128.53	58.20	70.33	55
1994-1998	153.63	63.89	89.75	58

Source: SFA (2000b)

NA = not available

Table 4: Plantation development, 1984-1998 (in million ha and million m³)

Area (years)	Total	State	Collective	Collective share (%)
1984-1988	18.74	5.48	13.26	71
1989-1993	21.37	6.24	15.13	71
1994-1998	29.14	7.70	21.44	74
Volume (years)				
1984-1988	529.85	213.20	316.65	60
1989-1993	711.98	295.27	416.71	59
1994-1998	1 012.99	378.33	634.66	63

Source: SFA (2000b)

EFFORTS TO INCREASE FOREST RESOURCES AND PLANTATIONS

Since the foundation of the PRC, the government has placed great emphasis on forestry development and invested significant sums in forest resource expansion through afforestation and natural forest regeneration. As a result, China's forest area and volume has steadily expanded over time (Table 5).

Today, China has the largest plantation area in the world with 46.7 million ha, accounting for 30.4 percent of the total forested land (SFA 2000a). In terms of volume, plantations account for one billion m³, or nine percent of the total standing stock. Moreover, the government is seeking to raise the forest cover to 19.4 percent, 24.4 percent and 26 percent of the total land area by 2010, 2030 and 2050, respectively (SEPA 1999). More recently, the government's decision to implement a logging ban in large areas of natural forests has highlighted the urgency to shift to plantations. To achieve the pronounced targets, the government is increasingly looking towards the non-state sector as a major stakeholder in forestry.

Table 5: Forest resources expansion from 1973 to 1998 (in million ha and million m³)

Year	Area of forest land	Volume of standing stock	Area of forested land	Timber volume of forested land	Forest cover (in %)
1973-1976	257.60	9 530	121.86	8 660	12.7
1977-1981	267.13	10 260	115.28	9 030	12.0
1984-1988	267.43	10 570	124.65	9 140	13.0
1989-1993	262.89	11 790	133.70	10 140	13.9
1994-1998	263.29	11 306	153.63*	11 267	16.6

Source: SFA (2000b)

*The data for 1994 to 1998 were assessed by the new criterion that crown density (canopy) of forest is at least 20 percent. In previous years, forests were associated with crown density of at least 30 percent. Figures exclude forest resources in Taiwan Province of China.

As a result of government measures to promote private tree planting, by 1985 households were estimated to be responsible for over 50 percent of the increase in forest area (Li *et al.* 1988). The private sector is set to play a major role in plantation establishment for the government to meet its 2010 target.

ASSESSING THE DEVELOPMENT OF FOREST PLANTATION

Afforestation

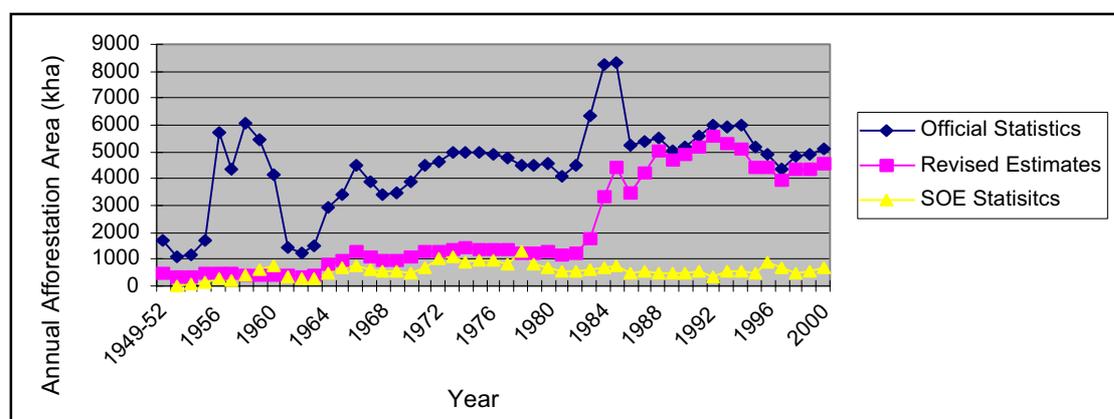
The Government of China attaches great importance to forest resource protection and development. While the protection of old-growth forests – mainly under state enterprises' jurisdiction – has not been satisfactory, plantation development has been more successful, in particular over the past two decades.

Clarifying forest plantation statistics

China has an afforestation performance reporting and verification system. Data on annual areas afforested are collected by local governments and forwarded through the various administrative levels to the central authority. The data comprise planting targets, allocated funds, and actual areas planted. The forest authority might verify achievements in the field based on indicators such as survival rate in the first year and preserving rate in the third year. The preserving rate is used to calculate the afforestation area for the national forestry statistics. Before 1985, the areas with a preserving rate of 40 percent and above were counted as plantations. Since 1985, the quality of afforestation has improved and the preserving rate indicator increased from 40 to 85 percent (SFA 2001a). Existing silviculture statistics illustrate that before 1976 the preserved plantation area was only 28 percent of the reported afforestation area (MoF 1980). In addition, based on the third forest inventory (conducted from 1984 to 1988), the preserved plantation area was below 30 percent for the 30 years before the inventory. Later inventories no longer provide this information, but the China Forestry Yearbook started providing statistics with regard to the preserving rate of afforestation projects, based on the re-investigation by the central forest authority. Available data indicate that preserved areas increased sharply in the 1980s to 91 percent in 1988, and further to 95 percent in 1990, ranging between 85 and 90 percent in the 1990s.

Therefore, the data reported in the official statistics have been adjusted accordingly (Figure 1). The top line in the figure shows the reported annual afforestation area from 1949 to 2000. The middle line represents the estimated real afforestation area. The bottom line indicates the share of state-owned enterprises in the official statistics. The (reported) afforestation by the state-owned sector has been smaller relative to the area (reported) by the collective sector. The average

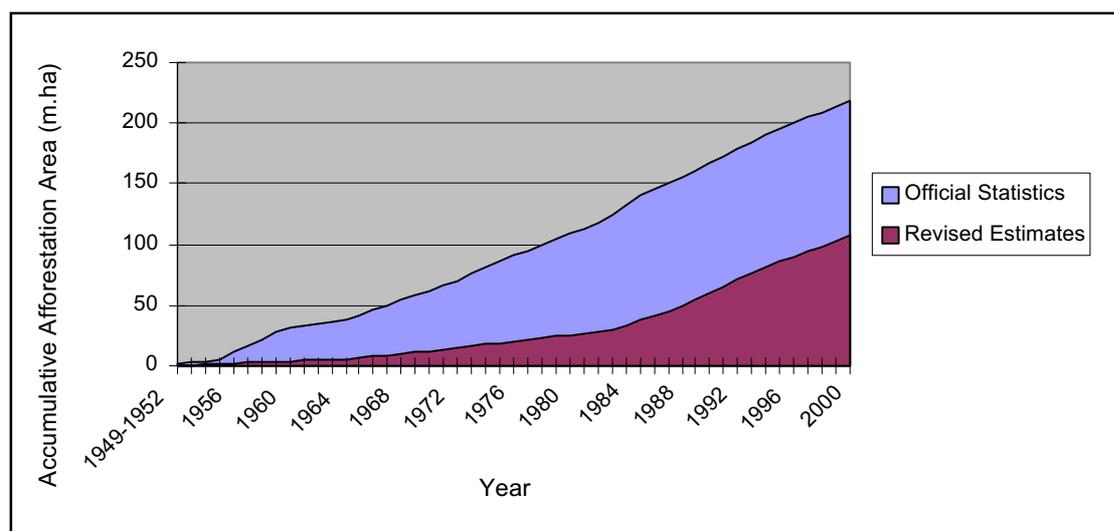
annual gross increase in plantation areas from 1949 to 1982 was about one million ha. The average annual gross increase after 1982 was over four million ha. Figure 2 presents the accumulative afforested area.



Source: SFA (2001b)

Note: The criterion for land area to be counted as plantation area was a preserving rate larger than 45 percent before 1985, and 85 percent after 1985. Under the 85 percent preserving rate, the afforestation area in the 1980s should demonstrate a smoother trend in the reported area.

Figure 1: Annual afforestation rate, 1949-2000



Sources: *China forestry statistics*, various issues; *China forestry yearbook*, various issues.

Note: In the official statistics, the criterion for land area to be counted as plantation area for the period before 1985 is a preserving rate greater than 40 percent; after 1985 it is 85 percent.

Figure 2: Accumulative afforestation area, 1949-2000

Net increase in plantation area

Since 1949, about 100 million ha of plantations have been established. According to the fifth national forest resource inventory, completed in 1998, China had 46.7 million ha of plantations. This means that approximately half of the area planted was lost to other land uses or replanted. The mean annual loss was around one million ha. Between the fourth and fifth inventories, 6.69 million ha were lost due to harvesting without replanting and various forms of forest conversion (legal and illegal) (Table 6). The annual loss during this period was about 1.34 million ha. This indicates that plantation forests have been increasingly converted and degraded, owing to economic growth and increased domestic demands.

On the other hand, afforestation efforts have obviously outpaced deforestation. There was a net increase of 8.82 million ha between the second to third inventories at an annual rate of 1.56 million ha, 3.24 million ha between the third and fourth inventories (0.65 million ha annually), and 12.42 million ha between the fourth and fifth inventories (2.48 million ha) annually. The annual rate of net increase in plantation area has accelerated in recent years (SFA 2000a).

Table 6: Change in the area of total plantation forests* (million ha)

	Area of closed plantation	Net Increase between inventory
1 st Inventory	23.69	NA
2 nd Inventory	22.19	-1.50
3 rd Inventory	31.01	8.82
4 th Inventory	34.25	3.24
5 th Inventory	46.67	12.42

Source: SFA (2000b)

* Total plantation forests include plantations, economic forests and bamboo forests.

Based on the fifth inventory, between the fourth and fifth inventories, an area of 1.75 million ha of plantation forests degraded to open forests, shrubs, or barren land, and 1.66 million ha were converted to other types of land use. The estimated total plantation area lost was 6.69 million ha, or 1.34 million ha per year.

Reforestation

Reforestation was unable to match the speed of deforestation and afforestation. Over the last 50 years, the average annual replanted area was around 0.4 million ha, far short of the average one million ha of plantations deforested, and considerably below total deforestation of natural forest and plantations. By the late 1990s, the reforestation rate reached only half of the total area of plantations lost each year (SFA 2000a).

EVOLVING ROLE OF NON-STATE SECTOR IN PLANTATION FORESTS

Historically, the state sector managed mostly the good quality, old-growth forests while the collectives were left with the poorer quality forests and extensive areas of barren land designated for forest use. The state forests were to supply timber to support the nation's industrialization, while the collective forests were more for conservation purposes. In the more recent past, collective forest management has increasingly responded to economic incentives, such as those created by higher government investment, tenure change and market liberalization. The investment was used to create employment for farmers who participated in government-initiated plantation projects, although the projects were on land managed by farm households. Tenure change (towards household-based forest management systems) ensured farmers a specified share of revenue from forest production, which used to be insignificant or even prohibited in the pre-reform era. When the demand for timber increased, farmers responded by planting trees (Yin 1994, 1998; Yin and Newman 1997). Under imperfect market conditions or when forest regulations are restrictive, collective forest farmers tend to shift from timber forests to economic forests and bamboo forests, but maintain the rate of forest area expansion.

In considering the impacts of incentives on the performance of afforestation efforts in China, plantation development can be divided into the period before rural reforms (1949-1978), the period after the launching of the reforms (1978-1987) and the period since 1987. This division reflects the transition of China's tightly controlled forestry sector under the planned economy (1949-1978), to a period of decentralization and market-oriented reform mainly in collective forestry (1978-1987), and finally to a period of initiating and implementing large-scale afforestation projects. The first two periods saw the sector undergo institutional changes, while maintaining the national goal of increasing timber supply. The third period started with a shift from timber production and timber self-sufficiency goals to an increased emphasis on the provision of environmental services.

1949-1978: Era of planned economy (insignificant private sector role)

(Milestones: 1950-1952: land reform; 1953-1961: collectivization and Great Leap Forward; 1966-1976: Cultural Revolution)

The first and most important reform introduced at the time of the founding of the PRC was the Land Reform Act of 1950, which permitted the government to nationalize all forestry enterprises and confiscate feudal forest lands in mountainous areas for distribution to farmers. Along with their new parcels of forests, farmers received ownership certificates. Effectively, two systems of forest ownership were established: state-owned forest land and individually owned mountain forest land. The transfer of forest land ownership and management rights to households resulted in significant productivity increases (Chen 1983; Liu 1998).

Only three years after the Land Reform Act, China proclaimed its policy of collectivization. In forest areas and mountainous regions, the era of cooperatives began in 1953 and "people's communes" were organized in 1958. This resulted in a dramatic shift in farmers' attitudes, when the household-based production system, under which farmers owned forests and were free to keep the fruits of their labour, gave way to collective ownership and the introduction of distribution systems according to labour provided and needs. Forest farms managed by communes, production brigades and teams¹⁰ began to emerge, and private forests were confiscated. Even though communes – or team-managed forest farms – experienced rapid development throughout the 1970s, numerous problems arose. A major stumbling block was the unclear land titles to mountain forest lands. Furthermore, the replacement of merit-based payments with salaried work in production teams seriously blunted farmers' enthusiasm for increasing production. The planned economic structure impeded advances in productivity, hampered efforts to increase investment in new forests, delayed economic diversification and generally resulted in poor economic performance (Lu *et al.* 2002).¹¹

The collectivization of forest land in rural areas, nevertheless, was not implemented without efficiency considerations by the government. Economics of scale were deemed very important. Resource allocation through central authorities was viewed to be more efficient and was expected to generate higher productivity than a market-based system. Small-scale, individually operated cropland and forest farms were also seen as obstacles to the efficient management of the central planning system. These expectations warranted the conversion of private cropland and forest farms into relatively large-scale and homogeneous production units. The efficiency gain was to materialize through:

¹⁰ A production team was formed to organize collective production in rural China, usually within the boundary of a natural village, before the early 1980s. It normally included ten to 30 rural households.

¹¹ Based on Lin's (1990) analysis, low productivity in collective production teams, before rural reform began in late the 1970s, was the result of high monitoring costs, asymmetry between contribution and reward and the inability of farmers to choose whether they wanted to participate in the system. This argument applies to the low success rates of China's plantation efforts before 1978.

- A centralized wood-distribution system that linked wood producers to wood processors and other designated users through the state-owned wood storage and shipping facilities located throughout the country; and
- A centralized pricing system that was to eliminate profits enjoyed by wood producers and provide inexpensive raw materials to the processing industry and urban users instead.

Fund allocations for the sustainable production of raw materials were inadequate. In the state-owned forests, due to emphasis on timber extraction from old-growth forests and a lack of regeneration, degradation became a problem. In the collective areas, funding for reforestation and afforestation was the responsibility of the government. Farmers were constantly requested to provide free labour for afforestation activities and infrastructure projects (for example, road construction and irrigation). By and large, the quality of afforestation was poor.

Due to the general failure of collectivization and the Great Leap Forward strategy, the government relaxed the control over forest resources. In 1961, around ten percent of the collectively owned forests were redistributed to farmers as self-keeping forest plots, mainly to provide subsistence resources. Farmers were allowed to use the land to grow trees and benefit from their work directly.

This modest decollectivization was short-lived. In 1966, the Cultural Revolution began and rights to the self-keeping forest and agricultural plots were withdrawn. The communal system again played the dominant role in organizing rural production.

1978-1987: Decentralization and establishment of household-based forestry

(Milestones: Household Production Responsibility System, Three Fix Policy in 1981, market opening in 1985 and marketing restrictions in 1987)

The 1978 to 1987 period saw dramatic changes in rural China. When the Household Production Responsibility System (HPRS) replaced the old collective production system, agricultural production accelerated. The reform had a profound impact on collective forestry, as the forestry sector started adopting the forest production responsibility system in the southern collective forest area in 1981. By 1986, about 70 percent of the collective forests were contracted to farmers for management (SFA 2001c). The market was opened and timber production rose in tandem with prices. Plantation development appeared to multiply during the decollectivization of forests. With lower standards (40 percent of preserving rate), the plantation area almost doubled from 1980 to 1984. From 1985 onwards (with the higher preserving rate), annual plantings averaged nearly five million ha.

The Three Fix Policy (1981)

In March 1981, the State Council issued its “Resolution on Issues Concerning Forest Protection and Development”, also known as its Three Fix Policy, marking the beginning of a long legislative and policy process aimed at encouraging private sector participation by providing increasingly secure resource rights (SFA 2001c). The Three Fix Policy sought to transfer responsibility of forest planting and management to households by:

- Clarifying rights to forests, with an emphasis on mountainous areas;
- Delimiting private plots; and
- Establishing a forestry production responsibility system.

This reform represented an extension of the HPRS used successfully in agriculture (Lu *et al.* 2002). The Three Fix Policy re-established a household-based forestry sector that occupied 70 percent of the former collective forests, to a certain degree. Since 1981, institutional changes occurred continuously in the collective forest area. From the household-based system emerged

various forms of non-state/non-collective forest entities (for example, rural forest cooperatives, shareholding groups, joint-venture forest firms and private forest farms).

Forestry Law (1984)

The key legal document guiding forest resource management is the Forestry Law, which was first issued in 1984 and amended in 1998. According to this law, forest resources were divided into state and collective forests. The former were owned by the state and managed by state forest enterprises (including state forest industry bureaus and forest farms), while the latter were owned and managed by rural collectives. While the state and collectives retained ownerships, the law re-enforced the earlier Three Fix Policy by allowing private use rights to trees (Lu *et al.* 2002).

Liberalizing timber markets – an iterative process

Prior to 1978, the state dominated the domestic forest product market. About one-quarter of all timber production was organized under a centrally planned system called the Unified Procurement System (UPS), administered by the Ministry of Forestry at that time, and the remainder was used locally. Under the UPS, state and collective farms sold forest products to state-processing enterprises at prices set centrally. Although prices were linked to costs of production, they did not take account of most forest management requirements and were consequently well below market prices (Lu *et al.* 2002).

Since 1978, the market was gradually liberalized and private producers were increasingly permitted to sell some or all of their outputs freely. In 1985, the UPS was officially abolished and the timber market was fully opened in the southern collective forest area. However, the government re-imposed controls in 1987 following rapid deforestation, including a monopsony of state-owned local timber companies over timber procurement, and new harvesting and shipping quotas.

Despite the control of timber procurement, restrictions on sales of timber end products were continuously being lifted. Until 1980, the central government was allocated 81 percent of the total wood production (Zhang *et al.* 1998; Waggener 1998). By 1993, it was responsible for only ten percent of timber purchases, much of which were designated for military use, disaster relief, coal industry and railway construction (Zhang *et al.* 1998; Waggener 1998). Nevertheless, regulations on logging and shipping remained restrictive.

The establishment of the household-based forest management system through the Three Fix Policy transformed plantation development significantly. Although afforestation remained a government initiative, farmers were no longer passive participants. Local forest authorities looking for land for planting trees often had to sign contracts with actual landholders, that is, farmers. The land rights empowered farmers to negotiate for compensation payments. Farmers' rights to benefit were better recognized, and incentives to support the afforestation initiatives also increased – major advancements relative to the years before the reform.

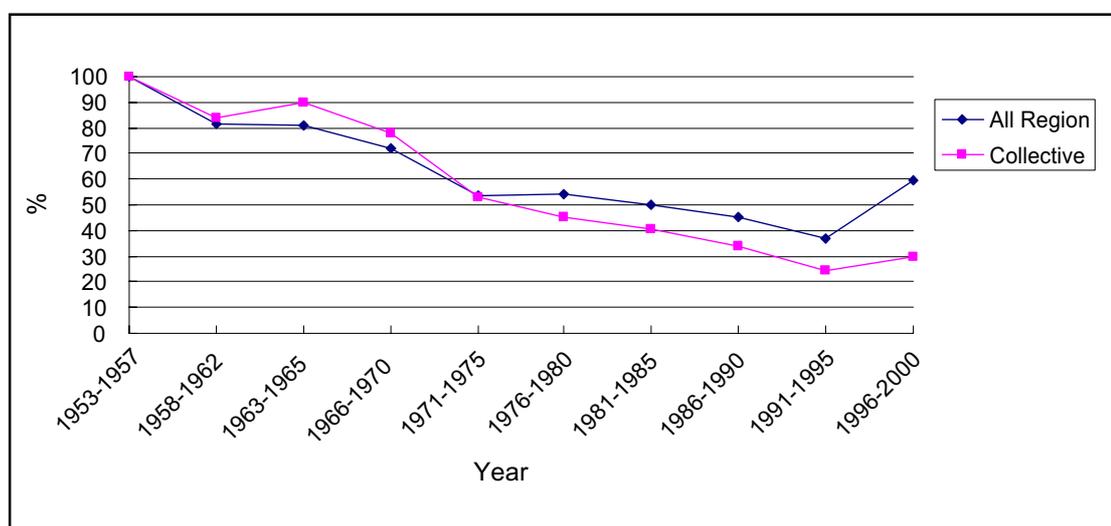
In summary, the 1978 to 1987 period was characterized by significant forest land tenure reform and policy changes. The extension of rural HPRS into forestry gave birth to household-based forestry in China's collective forest areas. Government control over collective forestry was transformed into a system that accepted farmers' rights to invest in and manage the forests, and benefit from their efforts. Marketing controls were also removed but soon re-imposed to counter massive deforestation. In the meantime, government initiatives, directed at increasing forest resources through the establishment of protection forests, began to take shape. Due to the transfer of forest tenure rights, farmers responded with better performance in tree planting. Investment remained mainly from government initiatives. The preserving rate reached new heights.

1988-2000: Major forestry projects and shift from production to environmental forest management objectives

(Milestones: Direct financial transfer to loan-based financing in 1988; National Afforestation Project, ten major afforestation projects, auctions of the “Four Wastelands”, amendment of Forest Law in 1998, National Forest Protection Programme and land conversion since 1998)

Change from direct financial transfer to loan-based financing (1988)

Private sector investment and local initiatives had been growing since the late 1970s, along with decentralization. This trend called for further reforms of fiscal policies to facilitate the development of local and private initiatives. The performance and efficiency of government-funded direct investment projects became an escalating concern. Consequently, in 1988, the fiscal policy was revised. A large portion of the government’s direct financing was shifted to loan-based financing. Direct transfers were gradually replaced by subsidized loans. As a result, the share of direct central government investment declined (Figure 3).



Source: SFA (2001b)

Figure 3: Share of central government investment in afforestation

The reform of the fiscal system was accompanied by several waves of downsizing of government bodies. The roles of government agencies transformed from direct project implementation to planning and monitoring. The power of the national forestry authority was significantly reduced. Funding previously controlled by the Ministry of Forestry (MoF) was allocated to the newly founded Forestry Investment Corporation (which later became the National Development Bank). The MoF retained only limited funds to support national-level projects (for example, the Three-North Shelterbelt Development Programme) and special-purpose activities (for example, fire management, pest and disease control). This reform dramatically shrank the central government’s share of direct afforestation investment. Most of the central government funding was shifted to provide interest subsidies and other forms of indirect investment. This decline of government financing was reversed in the late 1990s with the implementation of national programmes, such as the Natural Forest Protection Programme (NFPP) and the Conversion of Steep Cropland to Forests and Grassland Programme (Land Conversion Programme [LCP]) (Figure 3).

Auctions of the “Four Wastelands” (1993)

The government’s decision to permit the auctioning of barren forest lands (referred to as the “Four Wastelands”) to private operators for afforestation was a key prerequisite for its subsequent Forest Law Amendment of 1998. The Four Wastelands included uncultivated barren hills (sloping land), valleys, riverbanks and wilderness. Together, these areas covered about 5.6 percent of China’s total land area. Through the auctions, farmers were able to compete for long-term (70-100 years) utilization and management (though not ownership) rights over barren land, rather than to depend on administrative allocation. Moreover, the policy re-invigorated efforts to clarify use rights (Lu *et al.* 2002).

By 1996, 3.7 million ha of “wasteland” had been auctioned. Since the passing of the Forest Law Amendment, the practice of selling forest land through a public bidding process has been extended to lands with immature, middle-aged and mature forests (Lu *et al.* 2002).

The transferability of forest land use rights provided critical flexibility in resource allocation and boosted productivity by allowing less-able and labour-constrained farmers to sell their rights to others with the necessary skills and resources. This flexibility had been particularly important in regions experiencing significant outmigration since it permitted farmers to sell forest land to those with extra capacity. Transferability of forest land use rights also helped to mitigate the high risk and transaction costs from existing marketing constraints (for example, logging quotas, shipping permits and high taxes), and therefore improve farmers’ economic returns of forest investments. In some cases, rights were being sold back to collectives and state forest farms.

Liberalization of timber trade

In 1981, China’s timber imports started to increase to partially release pressure on the natural forest. In recent years, import tariffs have been reduced in line with commitments under the Asian-Pacific Economic Cooperation (APEC) Forum and the World Trade Organization (WTO). Timber imports have also been promoted to fill the shortfall in supply created by the NFPP. Prior to January 1999, tariffs on timber and other forest products ranged from one to 22 percent, and a total of 14 different rates were applied. Since then, tariffs have been eliminated for some roundwood, sawntimber and lumber products and where tariffs are still charged the average rate has fallen to 12.3 percent (Sun 2001).

Amendment of the Forestry Law in 1998

The amendments of the Forestry Law in 1998 stipulate that timber forests, economic forests, fuelwood forests and their use rights are transferable, although forest conversion is prohibited. Resource rights may last for up to 70 years, and are renewable. The revised law provides a range of government financial incentives for private investment in management (for example, inexpensive loans, tax breaks) and the Forest Environmental Benefit Compensation Funds to encourage forest protection (Lu *et al.* 2002)

Afforestation programmes throughout the 1980s and 1990s

Alongside various legislative initiatives, the government initiated a number of programmes (Table 7). Since 1978, China has invested in several programmes to expand its protection-oriented forest resources. The National Afforestation Project (NAP), financed by a World Bank Loan of US\$300 million and domestic funding equivalent to US\$200 million, provided new technologies and management schemes. The NAP contributed to China’s plantation efforts in many ways and assisted in adopting an engineering afforestation approach (Rozelle *et al.* 2000). By 1999, the programmes had established a total of 38.39 million ha of plantations.

Traditionally, programmes were implemented in a top-down manner. Recent programmes have attempted to generate greater private sector involvement. This shift is notable in the two large-scale forestry programmes: the NFPP and LCP. In the LCP, private resource tenure is encouraged and people planting trees on barren lands are awarded rights to these resources.

Table 7: Main afforestation programmes since 1978

Name of programme	Years	Coverage (area)	Targets	Achievements to date
National Greening Campaign: the National Compulsory Tree-Planting Campaign	1987-current			1987-1997, 27.9 billion trees planted
Three-North Shelterbelt Development Programme	1978-2050	551 counties in 13 provinces, 40.6 million ha (50 percent of northern China)	Afforestation of 35.08 million ha by 2050	25.67 million ha planted by 1999
Shelterbelt Development Programme along the upper and middle reaches of the Yangtze River	1989-2000	271 counties in 12 provinces	Afforestation of 67.05 million ha	1989-1999, 4.8 million ha planted
Coastal Shelterbelt Development Programme	1991-2000	195 counties in 11 provinces	Afforestation of 3.56 million ha	1991-1999, 1.08 million ha planted
Farmland Shelterbelt Development Programme in Plain Areas	1988-2000	918 counties in 26 provinces	Set standard	1988-1999, 850 counties reached standard
Taihang Mountain Afforestation Programme	1990-2010	110 counties in 4 provinces	Afforestation of 4 million ha	1990-1999, 3.28 million ha planted
National Programme on Combating Desertification	1991-2000	598 counties in 27 provinces	Control desertification in 7.186 million ha	1991-1999, desertification controlled in 8 million ha
World Bank Loan National Afforestation Project	1990-1997	306 counties in 16 provinces	High-yield fast-growth timber forests	1.39 million ha of plantations generated

Sources: Lu *et al.* (2002); SFA (2001a)

Natural Forest Protection Programme (adapted from Lu et al. 2002)

In the wake of widespread flooding of the Yangtze and Yellow rivers in 1998, the State Forestry Administration (SFA) proposed the NFPP to protect over 95 million ha of natural forest by 2010. The central aim of the programme is to protect valuable forest environmental services, most notably watershed protection. The programme has two major components: natural forest protection and afforestation.

Most funds are being channelled to the upper reaches of the Yangtze and Yellow rivers, where 61 million ha of natural forests will be conserved. In some areas, logging bans have been imposed, while in others harvesting is restricted. On average, annual timber production is being reduced by 12.39 million m³ between 2000 and 2010. This compares with total production of 64 million m³ in 1997. In addition, 8.67 million ha will be planted. The ultimate aim is to raise forest cover from its current 16.6 percent of the land area to 21.24 percent by 2010, well above the targeted forest cover of 19.4 percent set out prior to the NFPP.

In addition to its work in the upper catchments of the Yangtze and Yellow rivers, forest harvesting in the northeast and Inner Mongolia is also being restricted and 33 million ha of natural forest are to be conserved. In total, reforestation of 30.97 million ha in 17 provinces is to be achieved by 2010.

The State Council approved the programme in 2000 and has committed 96 billion yuan¹² over ten years. As timber production shifts from natural to planted forests, private entities will become a growing force in the sector. According to the NFPP, the government will “vigorously encourage private involvement in contracting for forest protection and management, and gradually set up a new model of Natural Forest Protection Programme implementation which is market-economy-oriented and participated with multidisciplinary stakeholders, including private sectors” (SFA 2001a).

It is hoped that the NFPP will have important positive environmental impacts. The social and economic costs will be substantial, however, including job losses and reduced local revenues in timber-dependent areas. Costs to rural communities are also extensive but largely overlooked. Collective forests in the NFPP area are affected by the logging bans and the owners have yet to be properly compensated. This has exacerbated the problem of tenure insecurity and will further discourage the private sector to invest in forestry.

Conversion of Steep Cropland into Forests and Grasslands

As an important element of China’s Western Development Strategy, the Conversion of Steep Cropland into Forests and Grasslands (also known as the “Grain for Green” Programme because of its components that subsidize land conversion with food) is a major initiative to integrate water and soil conservation with agricultural restructuring, poverty reduction and sustainable development. It focuses on the upper reaches of the Yangtze River, and the upper and middle reaches of the Yellow River.

With the approval of the State Council in 2000, pilot projects of the Grain for Green Programme were launched in 174 counties in 13 provinces. Funds allocated for the programme up until 2001 totalled 3.65 billion yuan. The implementation of the LCP was supported by the following measures (Xu and Cao 2002):

- Free grain for farmers converting their croplands: at present, the standard grain subsidy is 150 kg of unprocessed grains per *mu*¹³ per year in the upper reaches of the Yangtze River, and 100 kg in the upper reaches of the Yellow River.
- Cash payments for farmers converting their croplands: 20 yuan/*mu*/year.
- Free seedlings for farmers converting their croplands: the standard quantity is 50 yuan/*mu*.
- “Converting one to two or three or even more”: farmers are responsible for growing trees and grass not only on their former agricultural land, but also on one *mu* or more of barren hills and wastelands that are suitable for afforestation.
- Implementing and monitoring an accountable compensation system.
- Free grain and seedlings for five years if economic plots are established and for eight years if timber trees are planted. The support period may be lengthened if necessary.

According to official statistics, the entire area of cropland with a slope of more than 25° in the country is about six million ha, of which more than 70 percent is located in the western region. Recent assessments during the pilot projects, however, indicate that the actual area of reclaimed and cultivated sloping land is far larger than that originally reported. The total area of converted croplands and afforested barren lands reached 17.4 million *mu* and 15 million *mu* respectively in three years (Xu and Cao 2002). Goals were met; and in some cases, they were exceeded.

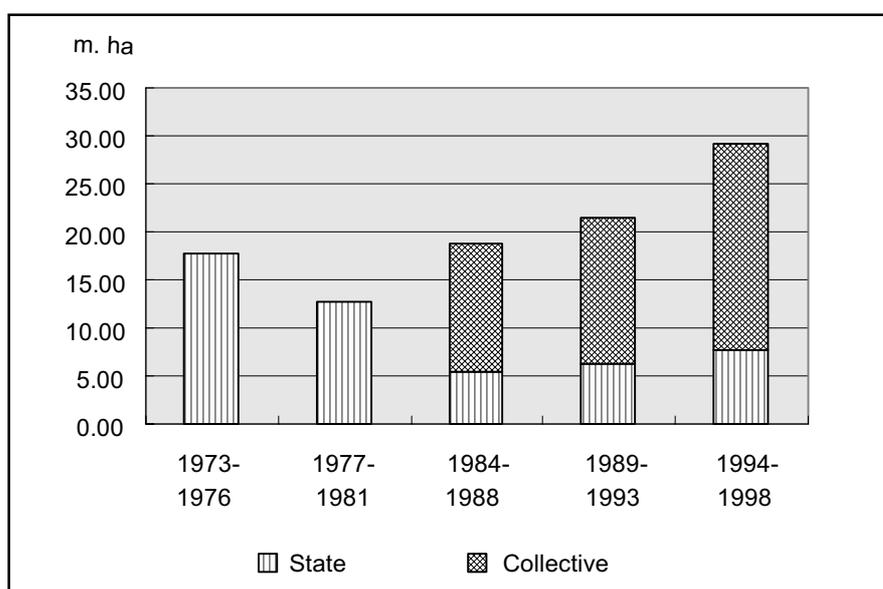
¹² US\$1 = 8.28 yuan

¹³ 1 *mu* = 1/15 ha

In general, farmers welcomed the programme support, as the value of compensation was more than agricultural yields in most cases. Encouraged, the central government decided to extend the programme across the whole country. The total target for land conversion by 2010 was doubled to 220 million mu as was the programme budget. With the exception of Shanghai, Hong Kong and Macao, all provinces participated in the programme.

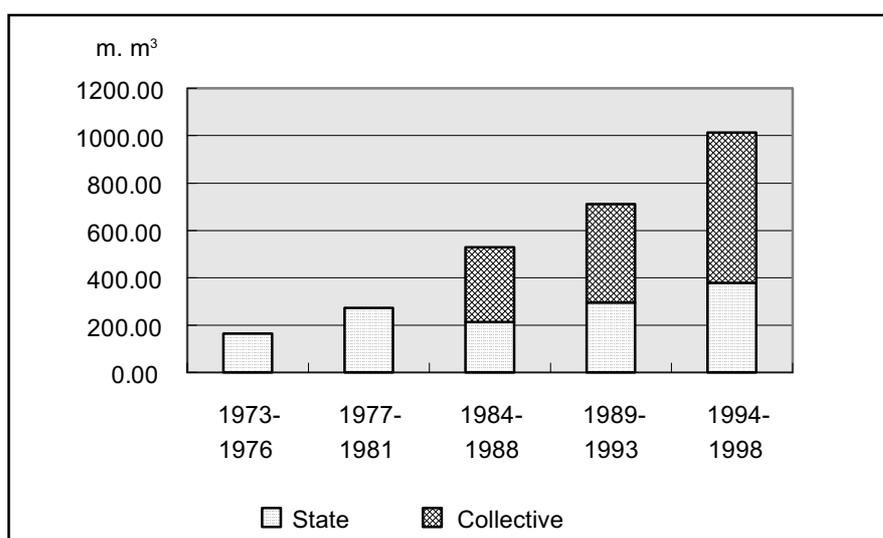
Contribution of the non-state sector to forest resources

Due to its dominance in plantation development, the collective forest sector (recently divided into collectives, cooperatives, households) contributed considerably to the recovery of China's forest resources. Between the first (1973-1976) to the fifth (1994-1998) inventories, the plantation area increased from over 17 million ha to over 29 ha (Figure 4) and the stock volume of plantation forests increased from 160 million to 1 010 million m³ (Figure 5).



Source: SFA (2000b)

Figure 4: Area of plantations, 1973-1998 (million ha)



Source: SFA (2000b)

Figure 5: Volume of plantations 1973-1998 (million m³)

SUMMARY OF INCENTIVES

A variety of incentives have contributed to the development of plantation forests in China, especially in the non-state forest sector (for example, collective forests, newly developed joint ventures, rural forest cooperatives, private forests). They include financial support, services, and incentives created by institutional changes (Table 8).

Direct investment includes afforestation grants from the central government, subsidies in the form of reduced interest rates, food, seeds and seedlings, and loans. Historically, afforestation activities were directly funded through government grants and rural labour was provided as a free input. Since the late 1970s, levying free labour became increasingly difficult, and adversely affected afforestation efforts, most prominently in the Three North Shelterbelt Forest Programme. Nevertheless, strong government commitment, coupled with an increase in investments, remains the most important contributing factor for the growth of plantation forests in China.

Table 8: Categories of incentives affecting plantation development in China

Incentive	Characteristics	Source/period	Target group	Impact
Financial incentives				
Investment	Cost-sharing	Government 1949-	SOE*, collectives, farmers	Large
Subsidy	Cost-sharing	Government 1949-	Collectives, farmers	Large
Low-interest loan	Cost-sharing	Government, International Aid 1988-	SOE, collectives, farmers	Large
Services				
Technical assistance	Increasing productivity	Government 1949-	Collectives, farmers	Small
Seed and seedling supply	Cost-sharing, quality control	Government 1949-	Collectives, farmers	Large
Pest and disease control	Increasing productivity and reducing risk	Government 1949-	SOE, collectives, farmers	Unclear
Fire control	Increasing productivity and reducing risk	Government 1949-	SOE, collectives, farmers	Unclear
Institutional change				
Forest tenure reform	Providing incentives for forest investment and management	Government, local community 1981-	Collectives, farmers	Large
Market reform	Providing incentive for forest investment and management	Government 1985-1987	SOE, final products	Small

*SOE = State-owned enterprises

Institutional changes such as tenure reforms are also very important. However, due to the existing restrictions on harvesting and marketing, the reforms could easily lead to deforestation and forest conversion, as past experiences have illustrated. The restrictions also reduced the incentives for plantation development by inhibiting the private sector from investing in forest plantations using loan funds borrowed at commercial interest rates. Even if private sector incentives were in place, a functioning local financial market was not: the national banks were seriously affected by bad loans and have become more profit oriented through the reforms. Government subsidies were provided to reduce the loans of forest farmers and local enterprises. More funds became

available for afforestation as a result of the shift in the government's fiscal policy. The increase in government investment in the late 1990s was due to the implementation of the NFPP and LCP (see Table 9).

Table 9: Investment in afforestation (in million yuan)

Year	TSI ¹	DAI ²	Nursery	I/P ³	Education	R&D ⁴	FC ⁵	PDC ⁶
1980	573	204	12	7	22	16	25	4
1985	572	175	10	7	42	22	12	3
1990	975	308	24	11	44	29	112	13
1995	2 017	616	44	14	67	85	106	34
2000	15 016	5 594	1 175	32	234	67	231	175

Source: SFA (2001b)

¹ Total silviculture investment

² Direct afforestation investment

³ Investigation and planning

⁴ Research and development

⁵ Fire control

⁶ Pest and disease control

IMPACT OF EXTRA-SECTORAL POLICIES

China's forest sector has been influenced by a number of important extra-sectoral policies, such as rural reforms and decollectivization, food policies, urban reforms and market liberalization policies.

Rural reforms and decollectivization in China started in the late 1970s. The reforms established rural household-based agricultural production systems, which triggered substantial production increases in agriculture. The benefits gained through decollectivization encouraged similar changes in tenurial arrangements in forestry.

To achieve food self-sufficiency, the government protected prices for agricultural goods. In combination with various incentives, this policy instrument kept grain production attractive for many years in the rural areas. Liberalizing markets for other agricultural products (for example, fruits, fish, livestock and vegetables) helped these sectors to grow in an unprecedented way, which in turn increased competition for land.

Urban industrial reforms started in 1984. The reforms opened markets for industrial products, and stimulated economic activities that required labour. Employment opportunities in the industrialized areas triggered rural outmigration and drew nearly 100 million people to the cities. The increase in off-farm employment opportunities partially relieved pressure on forest lands and forest resources.

Market liberalization had the most significant effect on final forest products. Government control over commercial forest products declined from 80 percent in the early 1980s to ten percent in the mid-1990s. Forest product imports were also liberalized gradually and filled gaps in the domestic supply. Combined with the impact of reduced marketing constraints in key forest regions, the forest industry in coastal areas and the non-traditional forestry areas (i.e. northern plain) are growing faster and reshaping the forest landscape.

REMAINING CONSTRAINTS

Restrictive harvesting quota scheme

The government imposes very restrictive harvesting regulations across all forest ownerships. The basic principle is that production should not exceed growth. The central authority determines separate annual harvesting quotas for each province, based on forest conditions and expected annual growth. According to the quotas, forestry workstations at the township level issue logging permits to villages and farmers. Permits are also required for cross-county and interprovincial transportation of logs and other forest products

The current harvesting quota system diminishes the attractiveness of forest-use rights since farmers can only partially reap the benefits from adopting more productive management practices and adjusting to market demands. Even if they can raise productivity and shorten rotations, they may not be allowed to harvest trees (Hu 1995).

Tenure insecurity

Tenure reform has advanced considerably in the forestry sector, but insecurity remains a major threat to forest management. Land-use conflicts are common. Even when land titles are clear, use rights are subject to frequent adjustments to accommodate population change and land zoning. Another contentious issue is customary rights of local communities over forests and mountain land. Furthermore, frequent policy changes have been the main cause for insecurity, as witnessed when logging was banned in collective forests under the NFPP without any proper compensation (Lu *et al.* 2002).

High taxes and fees

Forest taxation is a major impediment to private sector investment in forest management (Lu *et al.* 2002). Taxes, charges and fees can be as high as 70 percent of timber selling prices. Forest authorities endorse such high rates because they view forestry as a source of government revenue to pay the salaries of staff who are needed to implement various government programmes (Sun 2002). The negative impacts of the forestry taxation system include reduced income, a decline in the value of the leased forest land and stands, constraints on forest industrialization, increased illegal harvesting and corruption, and increased rural-urban inequalities. The low financial returns expected from afforestation, also severely undermine the motivation of private investors. In some counties, private investments in tree planting have completely ceased (Lu *et al.* 2002).

Rationalizing tax and fee structures has to be accompanied by significant administrative reforms, and the devolution of forest administration to local organizations and the private sector, to reduce the high cost of government staffing.

IMPACTS OF INSTITUTIONAL CHANGE AND VARIOUS INCENTIVES

Increasing forest resources has been a top priority on the Chinese government agenda, especially since the 1990s. The government has augmented resource allocations to support the forestry sector's efforts in afforestation and reforestation. Numerous institutional innovations have been tested with apparent mixed results, although rigorous empirical research on the impacts of government policies, initiatives and reforms remains sparse. A few exceptions are the recent reviews by Rozelle *et al.* (2000), Yin (1994; 1998), Yin and Newman (1997) and Zhang *et al.* (2000).

Rozelle *et al.* (2000) found that over the last 20 years, the structure of the forest in Yunnan Province changed significantly. There was a decline in old-growth forests, from 28 to 25 percent. The area of plantations and monoculture forests rose sharply, from 39 to 43 percent of the total

forest area. Most notably, forests producing non-timber products expanded from less than one percent in the 1970s to 5.2 percent in 1996, with most of the growth occurring since the early 1990s.

Zhang *et al.* (2000) found that higher timber prices promoted investment in managed forests and led to a decrease in rain forest area in Hainan. This indicates that increased hardwood prices had, in the past, caused an increase in the “mining” of rain forests. Higher prices for tropical agricultural crops complemented rain forest conservation but reduced investments in plantation development – implying competition between plantations and tropical food crops. On the other hand, Zhang *et al.* (2000) found that the area of managed forest in Hainan had actually increased with growing population pressure. Managed forests increased alongside improvements in economic welfare, indicating that a combination of demand-side effects, infrastructure development and stricter law enforcement had promoted plantation development. Finally, decollectivization stimulated investments in plantations and promoted the loss of natural forest before the 1980s (although this trend may have been reversed subsequently).

Yin (1994; 1998) and Yin and Newman (1997) found significant regional differences in the development of plantation forests between traditional collective forest regions and the agricultural regions (mostly in the northern plain). In the 1980s, while both regions were experiencing similar decollectivization, the northern agricultural area was subject to much less forestry regulation, such as for logging, marketing and taxation. Consequently, the north had much better achievements in increasing forest cover.

SUMMARY

There is no systematic documentation and analysis of the impacts of government policies on plantation forests. Primary data and a limited number of empirical studies indicate that the improved performance of plantation forests in the last two decades in the non-state sector could largely be attributed to strong government commitment and associated resources made available to support the initiatives. Decentralization in China’s collective forest and plain areas increased private investments. Government subsidies and improved services (for example, fire management, pest and disease control and technical assistance) facilitated the implementation of afforestation and reduced costs, offsetting to a certain extent underlying constraints to private sector involvement in plantation development. As a result, private investments in afforestation multiplied, and the proportion of plantations in collective forest areas increased. This underlined the shift of China’s forest resource distribution in favour of the southern collective forest areas. Nevertheless, major constraints (for example, high taxes, logging quotas and tenure insecurity) remain. It is still uncertain whether current incentives will lead to a sustainable increase in afforested areas. In the near term, plantation development will probably continue to depend on direct government initiatives in tree planting.

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