



Planted forests

in sustainable forest management

A statement of principles



Key messages

1. Planted forests come in many appearances from strictly protected conservation forests to highly productive, short-rotation plantations. In this continuum the boundary between planted and naturally regenerating forests is often indistinct.
2. Planted forests are a legitimate land use to provide wood, fibre, fuel and non-wood forest products, addressing industrial roundwood demand and sustainable livelihoods, ensuring food security and contributing to poverty alleviation.
3. Globally, planted forests cover ca. 264 million hectares. They account for 7 percent of the global forest area, but have the potential to provide two thirds of the global industrial roundwood demand. In many countries planted forests have become a substantial component of the productive forest resources. During 2005-2010, the area of planted forests expanded each year by around 5 million hectares on average. Given this trend, a further rise of the planted forest area up to 300 million hectares can be anticipated in the near future.
4. Planted forests can support rural livelihoods, help communities raise their standard of living, and contribute to sustainable development. Poor design and management of planted forests can affect landscapes that people value, alienate people from their traditional lands and undermine relationships, which keep communities and societies together.
5. FAO coordinated a two-year multi-stakeholder consultative process to develop a framework of social, ecological and economic guiding principles for the responsible management of planted forests, which resulted in the adoption of Voluntary Guidelines.
6. In view of its critical significance for the supply of wood and wood products and its high potential to contribute to environmental and social benefits and landscape diversity, FAO will continue to support developing countries in their efforts towards sustainable management of planted forests as documented in the Voluntary Guidelines for Responsible Management of Planted Forests.
7. FAO further adopts an important role in facilitating an informed public debate about the controversy of planted forests and in supporting major stakeholder groups, including the public, to better understand the role of planted forests in integrated ecosystem management and sustainable development.

Planted forests

Planted forests are established by planting or seeding of native or introduced species either through afforestation on land which has not carried forest within living memory or by reforestation of previously forested land. Most countries have varying economic, social, cultural and environmental contexts that influence policy objectives and management practices for planted forests resulting in a continuum of appearances from strictly protected conservation forests, to highly productive, short-rotation plantations. In this continuum the boundary between planted and naturally regenerating forests is often indistinct.

The establishment of planted forests is not new in concept and practice. The first planted woody species was probably the olive tree (*Olea europea*), which has been cultivated in Greece since the Minoan civilization around 3000 BC. Ancient historical records on the establishment of planted forests exist in Egypt (myrrh trees, *Commiphora myrrha*, 1500 BC), southern Arabia (frankincense, *Boswellia* spp., 400 BC), and in China (fruit trees, pines, Chinese fir), the Republic of Korea and Sri Lanka (Evans, 2009). In central Europe the first historically documented method for the large-scale reforestation of degraded forest land by seeding coniferous trees had been developed in Germany in 1368 by the town-councillor of Nuremberg, Peter Stromer.

In 2010, the global planted forest area was estimated at 264 million hectares, of which three quarters were grown for productive purposes (production of wood, fibre, fuel or non-wood forest products) and one quarter for protective purposes (mainly rehabilitation of degraded lands, combating desertification or protection of soil and water) (FAO, 2006a, 2010). The planted forests area continues to grow in all regions of the world. During 2005–2010, the planted forest area has increased by almost 5 million hectares



every year on average (FAO, 2010). Given this trend, a further rise of the planted forest area up to 300 million hectares can be anticipated in the near future.

The context

Indigenous forests continue to be converted to other land uses at large scale. Since 2000 global deforestation was estimated at a rate of 13 million hectares a year, a land area the size of Bangladesh or Greece. Forest planting, landscape restoration and the natural expansion of forests at a rate of 7.8 million hectares could not make up for this loss, resulting in a net loss of forest area of 5.2 million hectares per year on average in the period 2000 to 2010 (FAO, 2010). The area and quality of indigenous forests continue to decline due to unsustainable agricultural and forestry practices, infrastructural and

residential development and other biotic and abiotic stressors, exacerbated by climate change. Additionally, indigenous forests are increasingly being designated for protection of soils and water, conservation of biological diversity or other forms of reserve that preclude or limit production of wood, fibre, fuel and non-wood forest products at a time when demand for these resources increases substantially.

In view of a decline in harvesting from indigenous forests, planted forests will emerge as an alternative of wood and wood products in future. In 2010 planted forests accounted for only 7 percent of the global forest area (about 2 percent of land use), but had the potential to produce two thirds of the 1.8 billion cubic metres of the global industrial roundwood demand, with an anticipated increase to 80 percent by 2030 (Carle and Holmgren, 2008).



Drivers of global wood demand

The long-term global demand for wood products will be driven by the following factors (FAO, 2009):



Demographic changes. The world population has risen from 2.9 billion in 1960 to 6.7 billion in 2008, an increase by 130 percent within almost 50 years. The forest area per capita has declined from an estimated 1.20 ha in 1960 (FAO, 1966) to 0.62 hectares in 2005 (FAO, 2006b). The global industrial roundwood consumption is projected at 2.436 billion cubic metres by 2030, while the production of biomass for energy is estimated to increase from about 530 million tonnes oil equivalent in 1970 to about 1075 million tonnes oil equivalent in 2030.



Continued economic growth. Global GDP increased from about USD 16 trillion in 1970 to USD 47 trillion in 2005 and is projected to grow to almost USD 100 trillion by 2030.

Regional shifts. Developed economies accounted for most of the GDP in the period 1970 to 2005. The rapid growth of developing economies, especially in Asia, will swing the balance significantly in the next 25 years.



Energy policies. The use of renewable energy resources, and foremost, the use of wood and woody biomass is increasingly promoted by industrialized countries. The global consumption of biomass for energy increased by 51% between 2006 and 2009. The global pulp industry in 2009 used an estimated 75 million tons of biomass for energy generation to reduce dependence on fossil fuels (Wood Resources International, 2010).



“Wood is Good” campaigns. Worldwide promotion campaigns strive to advance the value of wood as an environmentally friendly material with a favourable energy balance, as a renewable source of energy and as a long-term carbon store that helps mitigate climate change.

Nature of planted forests

Planted forests do not purport to provide the social, environmental and economic functions of indigenous forests. They can take over many, though not all functions that indigenous forests provide. On logged-over and degraded forest lands, unprofitable or marginal agricultural lands, shifting cultivation areas or other abandoned and idle lands, planted forests constitute a legitimate land-use option in a similar manner as intensively managed livestock and cash crops in agriculture, horticulture and aquaculture are common methods of addressing sustainable livelihoods, ensuring food security and contributing to poverty alleviation.

Planted forests yield a diverse range of wood, fibre, fuel and non-wood forest products for corporate and smallholder investors pursuing commercial or subsistence purposes. They can also provide a number of social and environmental services, ranging from rehabilitation of degraded lands, combating desertification, soil and water protection, sequestering and storing carbon, recreation

and landscape amenity. Planted forests conserve genetic resources, provide shelter, shade and fodder for livestock. They deliver valuable services to urban populations, particularly in arid zones, by mitigating sandstorms, preventing sand-drift and absorbing sewage water. Responsible management of planted forests can reduce pressures on indigenous forests for forest products and allow them to be designated for other protective and conservation purposes. They can also complement and supplement the REDD and REDD-plus initiatives to reduce greenhouse gas emissions from deforestation and forest degradation in developing countries. As such, planted forests have multiple values, many of which cannot be provided by other types of land use.

Planted forests are long-term investments that require awareness and diligence in policy and planning, but particularly in management practices in order to avoid negative impacts. This relates to the selection of germplasm, nursery production, site preparation, establishment, tending, weeding, silviculture, protection and harvesting interventions. Unfortunately, planted forests have not always lived up to their potential.





The causes for failures of planted forests in the past include inappropriate governance frameworks and insufficient application of established knowledge, technology and techniques. The lack of capacity and capability in providing enabling policies, laws, regulations, plans and technical support systems have lead to controversy and poor management of planted forests. Some planted forest investments have produced land-use, social, cultural and environmental conflicts, as well as unsustainable management practices. In some instances indigenous forests and unique ecosystems were being cut to establish new planted forests while local forest dependant communities, indigenous peoples and minority groups were not being engaged in management decisions that

impacted their lives and livelihoods.

Asia has 50 percent of the world's planted forests, Europe 30 percent, North and Central America 10 percent, South America 4 percent, Africa 4 percent and Oceania 2 percent (FAO, 2006a). Overall, planted forests are owned by government, 58 percent, smallholders, 26 percent and the corporate private sector, 16 percent. The species planted vary in different regions; overall, conifers account for 52 percent, broadleaves, 37 percent, and unspecified, 11 percent. In order of importance the main coniferous genera by area extent are *Pinus*, *Cunninghamia*, *Picea*, *Larix* and *Cryptomeria* while the main broadleaf genera are *Eucalyptus*, *Acacia*, *Tectona* and *Populus*.



Planted forests and the international policy framework

The United Nations Conference on Environment and Development (UNCED), Earth Summit held in Rio de Janeiro in 1992, recognized the significance of planted forests in supporting sustainable forest management as reflected in the Forest Principles, referenced to Chapter 11 of Agenda 21 that states:

"The role of planted forests and permanent agricultural crops as sustainable and environmentally sound sources of renewable energy and industrial raw material should be recognized, enhanced and promoted. Their contribution to the maintenance of ecological processes, to off-setting pressure on primary/old growth forests, and to providing regional employment and development with the adequate involvement of local inhabitants should be recognized and enhanced" (UNCED, 1992).

Subsequently both the Intergovernmental Panel of Forests (IPF) and the Intergovernmental Forum on Forests (IFF) developed and promoted a diverse range of proposals for sustainable forest management, including those related to planted forests. An International Expert Consultation on the Role of Planted Forests in Sustainable Forest Management was hosted by Chile (and four partner countries) in 1999 to prepare recommendations for action to the IFF on enhancing the role of planted forests in sustainable forest management.

The United Nations Forum on Forests (UNFF) was established in 2000 to promote the management, conservation and sustainable development of all types of forests and to strengthen long term political commitment. Planted forests were recognized in the recommendations for action within the UNFF mandate. A UNFF Intersessional Experts Meeting was hosted by New Zealand (with 9 partner countries and 4 international organizations) on the Role of Planted Forests in Sustainable Forest Management in 2003. The purpose of the meeting was to maximize the contribution of planted forests to sustainable forest management, support country actions, build consensus and informed dialogue and support the UNFF in implementing its work programme.

The XIII World Forestry Congress (WFC), Buenos Aires, 2009 highlighted that in view of the growing global population and demand for forest resources, planted forests will become an increasingly important part of the landscape along with cities and towns, agricultural lands, and indigenous forests. In its final communiqué the WFC stressed that planted forests provide the opportunity to produce more goods and services from less land and that they effectively contribute to climate change mitigation, degraded land restoration and other environmental benefits. Development and management of these forests need to be done within a sustainability framework that allows consideration of potential risks, such as pressure on other land uses and effects on water, and biodiversity, along with the expected benefits. Finding the appropriate balance among all land uses requires a more integrated consideration of the services and values that each provides from the environmental, social, and economic standpoint. Highlighted actions included recognition of the importance of planted forests in meeting economic, social and environmental needs; focus on degraded landscapes, especially restoration of degraded forest lands; and development and implementation of technologies to maintain and enhance the productivity of planted forests and their contributions at local and landscape levels (World Forestry Congress, 2009).



Principles for responsible management of planted forests

FAO is committed to strengthening primarily developing country capacity in formulating enabling policies and technical standards for responsible management of planted forests. The goal is to increase the provision of goods and services from planted forests towards achievement of sustainable livelihoods and land uses in the landscape and in particular to mitigate the effects of climate change and provide a sustainable source of wood, fibre, fuel and non-wood forest products. In so doing, planted forests can play an important role in relieving the pressures for these goods and services from indigenous forests (Evans, 2009).

Recognizing the economic, social, cultural and environmental importance of planted forests, FAO upon request of its member countries coordinated a two-year multi-stakeholder consultative process to develop a framework of guiding principles for responsible management of planted forests to enhance their contribution towards achieving sustainable forest management. The guidelines (FAO, 2006c) translated the international conventions and processes of relevance for sustainable forest management into key principles and considerations for planted forest decision-makers (policy, legal, planning, practices), whether government, private sector, non-government organizations or civil society.

Principle 1: Good governance

The strategic framework for planted forest management is determined by legislation and policies which govern land use, land tenure, forestry, forest industries, and timber markets, and which control stakeholder concerns about the time frame and risks in establishing and managing planted forests.

FAO encourages governments to facilitate an environment of stable economic, legal and institutional conditions to enable long-term investment, sustainable land-use practices and socio-economic stability. This comprises in particular the clarification and provision of long-term land tenure arrangements for investors and traditional owners, binding regulations on the use of best management practices and sustainable forest management plans, and the application of effective forest monitoring systems. Good governance also relates to the creation of enabling conditions for an equitable distribution of benefits to relevant stakeholders in planted forest management and the recognition of internationally accepted workers' rights to organize and to negotiate salaries and working conditions to meet their needs.

Principle 2: Integrated decision-making and multi-stakeholder approaches

Planted forest management is marked by complex interactions with local communities, agriculture, animal husbandry, indigenous forests and agroforestry land uses. Ensuring engagement with stakeholders in ways that are transparent, just and sound is at the heart of responsible management of planted forests.

FAO encourages policy-makers to support intersectoral and multidisciplinary decision-making processes by stakeholders in planning, managing, monitoring and utilizing planted forests. Such approaches aim to support the understanding of the varying needs, aspirations, priorities and accountabilities of stakeholder groups, including women's and marginal groups, and helps to exert appropriate levels of influence in decision-making. If conflicts arise among stakeholder groups they must be resolved promptly through mutually agreed conflict resolution mechanisms involving



the concerned stakeholders. Conflicts on land use must be avoided by the strict adherence to international and national laws to ensure that local communities and indigenous peoples retain rights over their lands, unless they delegate control with free, prior and informed consent.

Principle 3: Effective organizational and personal capacity

Governmental, private-sector and other organizations must strengthen their organizational and personal capacities and capabilities to deliver knowledge, technology, techniques and other support services for sound planted forest management, at all levels.

FAO strongly supports the process of enabling people, organizations and societies to develop and expand their ability for planted forest management with the aim to effectively combine governance framework, stakeholder

interests, knowledge, and financial resources to manage planted forest development. An indispensable prerequisite for achieving effective organizational and personal capacities are appropriate and continuing funding of the organizations responsible for research, development and management of planted forests. Further, strengthening continuous professional education and training, extension support services and national research capabilities are considered essential building



blocks to improve planning, management and technical decision-making and to enable organizations to understand and respond to the priority needs and aspirations of important stakeholders. In this context FAO advocates the process of decentralization and devolution of responsibility to local levels, which is currently being undertaken by many countries. In this process governments are moving away from a centralized system of governance to facilitate and accelerate decision-making and to establish a balance of competences and responsibilities in forest sector development.

Principle 4: Recognizing value of goods and services

Planted forests make an obvious economic contribution to human well-being and constitute a resource that is exceedingly expensive to replace. Their products and services are essential for local subsistence and commercial enterprises. Whether productive or protective, planted forests should be recognized for their provision of both market and non-market benefits, including wood, non-wood forest products and social, cultural and environmental services.

FAO recognizes that there are limited financial and economic incentives to drive responsible

management of planted forests due to the prevailing non- or under-valuation of forests' services and generally low prices for wood and non-wood products. FAO is committed to improve economic and market valuation of planted forests to accomplish a higher recognition of the full range of goods and environmental services they provide, and to help justify investments by governments and private-sector entities (both corporate and smallholder). FAO is convinced that higher recognition of these services will facilitate and contribute to the balancing of trade-offs between return on investment to the investor and the costs and benefits to society in terms of sustainable livelihoods, land use, and forest management.

Principle 5: Enabling environment for investment

The continued annual loss of forest area gives evidence that the conversion of forest land into other land uses or the unsustainable exploitation of forests for short-term profits often outweigh the current benefits of sustainable long-term management. Investments into planted forests are restricted by the long gestation period, the high risks of poor governance and the low timber prices that are not commensurate with the costs of production, in particular under sustainable forest management schemes. Even though planted forests are in general productive and profitable, national and private investments into planted forest projects are still scarce and limited to a few countries that have created supportive financial incentive packages.

FAO encourages governments to create

stable investment environments, comprising transparent land-use and land management policies, laws and procedures in order to give corporate, medium and small-scale investors the confidence to make long-term investments in planted forests and to yield a favourable return on investment. An important instrument to promote such long-term investments is the provision of direct or indirect incentive-packages that are justified as long as the economic benefits to society are in balance with financial gains. By the same token, economic disincentives must be avoided that have adverse trade, social or environmental impacts and distort the value of planted forests or limit the opportunities for investors.

Principle 6: Recognition of the role of the market

Timber markets link industrialized consumer countries closely with developing producer countries. As the world economy grows and the globalization of international markets proceeds, timber and other forest products are also traded internationally at an increasing scale, in particular primary and secondary wood products.

FAO argues, that unless established for environmental, protective or civic reasons, the establishment and management of planted forests should be driven by the market under strict adherence to the limits of the prevailing site conditions. Investors in planted forests, particularly those having productive functions, should design their planning and management to respond to signals from international and national markets with the aim to improve the probability of achieving acceptable





returns on investment for the benefit of investors, workers and local economies. FAO acknowledges that the role of the market can only be understood if there is access to intelligence on current markets and future trends, changes in the use of forest products and consumer behaviour. Market transparency must be supported by conducive regulatory policies, legislative regimes, guidelines and practices that provide for fair competition and acceptable rates of return and that do not discriminate among appropriate resource uses.

Principle 7: Recognition and maintenance of social and cultural values

Smallholders and farmers own an increasing proportion of the planted forest area worldwide. Planted forest programmes can contribute to socio-economic development, through paid employment, smallholder investment opportunities and through extension and training. In many developing countries rural populations depend on planted forests for their livelihoods, if they are established on land that has either been abandoned or has previously been



of marginal use. Then, a large number of people may gain employment and income from planted forests, particularly in remote, undeveloped areas where forestry is the only economically viable land-use option. The multiplier effect on employment at secondary (wood processing) and tertiary (service sector) levels can be considerable, especially when a significant portion of the wealth of such value-added activity remains in the local economy and among the forest-dependent workforce. Under these conditions, planted forests directly contribute to poverty alleviation and food security, which are among the prime goals of FAO.

Sustainable management of planted forests by definition emphasizes the social responsibility of forestry organizations as many social and cultural issues are contentious and easy solutions do not exist. FAO recognizes, that in case social issues are not addressed properly, combinations of conflicting interests, unfulfilled demands and inadequate responses, have too often led to social conflict. Forest managers should seek to find the best balance possible between conflicting demands through the application of consultative and participatory decision-making processes, social impact assessments, the recognition of social and cultural values and the maintenance of social and cultural services. Conflicting social and cultural values must be taken into consideration in planning, managing and using planted forests. This includes the observance of local community values, customary rights, traditional knowledge, religious values and land tenure of indigenous peoples and ethnic minorities in areas targeted for planted forest investments. This also includes the various multiple-use contributions of smallholders (including outgrowers) in planted forests and trees and their unique needs for support in terms of tenurial rights, training, extension, research, access to markets and benefit-sharing.

FAO supports the implementation of socio-economic baseline surveys and long-term social impact assessments prior to establishment of planted forests. Thereafter, monitoring and conflict-resolution mechanisms help to address stakeholder disagreements over tenurial rights, access to land, social service provision, and employment issues that might arise among investors or organizations involved in planted forest investment and management. Preventing displacement or



resettlement of communities without free, prior and informed consent, providing a safe and healthy working environment in compliance with national or international standards, respecting community ancestral rights and hunting grounds, protecting sites and landscapes of archaeological, cultural, traditional, spiritual, scientific, aesthetic or other sociocultural significance help to avoid the emergence of such conflicts. In this context FAO considers the implementation of voluntary certification programmes an acceptable mechanism for addressing social issues in planted forest management

Principle 8: Maintenance of environmental sustainability and forest health

Planted forests will impact on the provision of environmental functions. Thus, planning, management, utilization and monitoring mechanisms must be designed and implemented in a way as to promote positive impacts and minimize negative ones. FAO recognizes that the application of policy and legal frameworks, environmental impact assessments and good management practices in the establishment, management, harvesting and utilization of planted forests, including appropriate contractor arrangements, contribute to maintain environmental functions and improve forest health. The application of sound biosecurity measures and the adoption of integrated pest management approaches can help reduce the risk of wildfires, control the outbreak of pests and diseases and reduce the incidence and impact of invasive species. The use of

herbicides, pesticides, fungicides and other chemicals and the disposing of chemical materials, containers and waste materials are only acceptable in accordance with legal requirements and best practice standards. The application of fertilizers should be based on periodic soil, mycoflora and/or foliar analyses and tailored to specific nutrient requirements during the rotation of planted forests.

FAO places a high priority on the conservation, use and sustainable management of watershed resources through integrated and participatory approaches within planted forests landscapes in order to meet the water demands of the growing world population. To this end, FAO supports the protection of soil from erosion through afforestation of bare and denuded land using appropriate technology and equipment, particularly in steep topography. Planting forests in areas that did not have trees before may cause potentially damaging side effects. They can reduce the local availability of water particularly in catchment areas that are fed by small rivers. Under certain conditions nutrient export may threaten sustainability, but usually more important for maintaining site quality are care with harvesting operations, conservation of organic matter, and management of the weed environment. Planted forests are sustainable under responsible management, but not where wasteful and damaging practices are permitted. The monitoring and control of yields in successive rotations suggest that there is no significant or widespread evidence that planted forests are unsustainable. In fact, evidence in several countries suggest that current growth rates, including those in planted forests, exceed those of previous

rotations at the same site (Evans, 1999).

Soil degradation has become an increasingly serious problem, especially in the tropics and subtropics, where many soils are inherently poor in nutrients and at high risk of erosion. The main causes of soil degradation are poor agricultural practices, deforestation and overgrazing. Good management practices will help to minimise soil compaction by heavy equipment, soil loss and declines in fertility, regardless of whether the land is devoted to planted forests or agricultural crops. However, in certain circumstances planted forests or agroforestry systems can help reduce erosion and maintain agricultural land productivity.

The application of biotechnologies in planted forests has been seen as a unique opportunity for obtaining new information on the extent, patterns and functioning of tree genetic diversity; and for providing new tree varieties and reproductive materials adapted to changing environmental, social and economic environments (Fenning and Gershenzon, 2002). In planted forests the majority of biotechnology work has focused on only six genera (*Pinus*, *Populus*, *Eucalyptus*, *Picea*, *Quercus* and *Acacia*), whereby *Populus* remains the most commonly studied tree genus (Haines, 1994).

While there is little controversy about many aspects of biotechnology and its application, genetically modified organisms (GMOs) have become the target of a very intensive and, at times, emotionally charged debate. FAO recognizes that genetic engineering has the potential to help increase production

and productivity of planted forests and can generate planting material that is more resilient against pests and diseases, water scarcity or the impacts of climate change. However, FAO is also aware of the concern about the potential environmental risks posed by certain aspects of biotechnology. They include the possibility of upsetting the ecosystem balance through the development of more aggressive, invasive species or wild relatives with increased resistance to diseases or environmental stresses or the loss of biodiversity as a result of the displacement of traditional cultivars by a small number of genetically modified cultivars.

FAO perceives modern biotechnology as a tool or means to be used as adjuncts or complements to conventional technologies in solving problems and meeting the needs of human beings. In this context biotechnology is considered much more than a technical issue; sociocultural values and the multiple uses of planted forests need to be taken into account and public acceptance is necessary if genetically modified forest trees are to be deployed. FAO promotes reliable, tested and agreed protocols for evaluating risks associated with genetically modified forest trees, and calls for a cautious case-by-case approach to address legitimate concerns for the biosafety of each product or process prior to its release. FAO intends to continue monitoring genetic modification technology and products in forestry at the global level and ensure availability of objective and reliable information (FAO, 2000; El Lakany, 2004).





Principle 9: Conservation of biological diversity

FAO recognizes the conservation of biological diversity and genetic resources as one of the fundamental issues in planted forest management. The impact of planted forests on the conservation of biodiversity depends to a large extent on the resource conditions found prior to the land being planted. FAO disapproves of the substitution of indigenous forests, in particular primary forests, ecologically significant ecosystems (e.g. wetlands, peatlands) or fertile agricultural land with planted forests as this would cause unwanted damage to valuable ecosystems or threaten livelihoods. These areas must be integrated and sustained within planted forest programmes on a landscape level in order to promote connectivity among existing indigenous ecosystems. FAO also advocates the strict control of hunting, foraging and the removal of rare and endangered animals from planted or indigenous forest areas. In some cases indigenous forests have been degraded or destroyed by over-exploitation, fire, pests and diseases, or natural calamities, e.g. hurricanes, droughts, landslides or avalanches. If the residual growing stock is unable to naturally regenerate within a reasonable time frame, then reforestation with suitable site-adapted species may be considered.

Planted forest management should aim to develop or enhance the diversity of plants and animals by the establishment of mixed-species plantations rather than mono-species plantations. FAO encourages the establishment of planted forests with indigenous species over exotic species, as they produce a wider range of products and benefits, among them

a lower environmental risk and an increase in biodiversity. Introduced species should be selected only in relation to specific management objectives, market conditions and ecological site conditions. The decision to plant introduced species should carefully evaluate the risk that these species may become invasive and have adverse effects on the local biodiversity.

Principle 10: Management of landscapes

Planted forests interact with and impact on local land uses, livelihoods and the environment. Integrated planning and management approaches should be adopted within a landscape or watershed to ensure that upstream and downstream impacts are mitigated by effective mitigation measures within acceptable social, economic and environmental standards. In managing landscapes it is of utmost importance to maintain a landscape mosaic of indigenous and planted forest areas and to provide corridors, where practicable, between naturally regenerating forest areas with high environmental conservation value. In water catchment areas naturally regenerating riparian reserves or buffers of varying widths on permanent and non-permanent water courses should be maintained depending upon their size and their conservation importance. Monitoring programmes should be in place to monitor upstream and downstream water quality and quantity and take action if there is a substantial negative impact on water supply.

FAO advocates that such measures are accompanied by integrated and intersectoral, learning sites, education programmes for the local communities and the general public through outreach programmes, so that they better understand the interrelationships in the



management of planted forests, naturally regenerating forests, land destined for conservation, grasslands, croplands and other land uses. FAO is active in support to landscape approaches and landscape restoration, particularly through the Global Partnership for Forest Landscape Restoration and the International Model Forests Network.

Summary

Planted forests are set to become a more significant form of forestry development over the coming decades. During 2005–2010, the area of planted forests in the world expanded each year by around 5 million hectares on average. Given this trend, a further rise of the planted forest area up to 300 million hectares can be anticipated in the near future. For many countries they have become a substantial component of their productive forest resources. Given the rapidly rising demand for wood, fibre, fuelwood and other wood products, this trend is very likely to persist for some time unless there is a dramatic change in worldwide consumer behaviour and consumption patterns. Furthermore, the increasing importance of afforestation and reforestation in adaptation to, and mitigation of climate change is being widely acknowledged in the mechanisms of the UN Framework Convention on Climate Change (Clean Development Mechanism, REDD-plus).

Planted forests are not inherently good or bad. At its best, planted forests can help communities raise their standard of living and contribute to sustainable development. At its worst, poor design and management of planted forests can affect landscapes that people value,

alienate people from their traditional lands and undermine relationships, which keep communities and societies together.

The failure of planted forests to satisfy many of the demands made on forest resources can be attributed to a variety of factors, particular in each single case. Technical limitations have contributed. However, foresters and scientists have generally been successful in developing the knowledge, tools and techniques necessary to establish, maintain and harvest planted forests sustainably and to improve and maintain their productivity over successive rotations. The more fundamental causes of failures have been inappropriate governance frameworks, failure to appreciate the political economy of land and forest use, lack of stakeholder consultation and insufficient application of established knowledge, technology and techniques or a too narrow definition of management objectives focussing on the production of wood for industrial use.

In view of its critical significance for the supply of wood and wood products and its high potential to contribute to environmental and social benefits and landscape diversity, FAO will continue to support developing countries in their efforts towards responsible management of planted forests as documented in the Voluntary Guidelines for the Responsible Management of Planted Forests. FAO further adopts an important role in facilitating an informed public debate about the controversy of planted forests and in supporting major stakeholder groups, including the public, to better understand the role of planted forests in integrated ecosystem management and sustainable development.

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