

Planted forests are a vital resource for future green economies



Summary Report of the 3rd International Congress on Planted Forests

based on

three scientific workshops held in Bordeaux (France), Dublin (Ireland) and Porto (Portugal), and one plenary meeting held in Estoril (Portugal) from May 15th to 21st, 2013

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A) Executive Summary

- a) **Organization and sponsors.** The 3rd International Congress on Planted Forests was organized by the Atlantic Regional Office of the European Forest Institute (EFIATLANTIC), the Food and Agriculture Organization of the United Nations (FAO) and the Union of Foresters of Southern Europe (USSE). The congress comprised three scientific workshops held in Bordeaux, Dublin and Porto from 15th to 18th May 2013, and one plenary meeting held in Estoril from May 20th to 21st. The congress was sponsored by national and regional governments, and a number of public, private and international institutions (see section B, item 1). This summary report was prepared by a committee of international experts on planted forests and does not necessarily represent the position of the congress organizing institutions.
- b) **Planted forest area and wood production.** The global area of planted forests corresponds to 7% of total forest area. It has considerably increased since 1990 to comprise 264 million ha in 2010. The expansion was mainly achieved in countries in Asia. Statistically surveyed data on wood production from planted forests are incomplete; the available data sets are based on a number of different definitions, assumptions and calculation models, and yield different results. The summary report provides an account of regional perspectives on planted forest development in Africa, Asia, Europe, Oceania, Latin America and North America (see section C, item 7).
- c) **Planted forests and natural forests.** Planted forests range from highly protected conservation forests to productive short rotation plantations. The congress emphasised that, as a matter of principle, planted forests should not replace natural forests, nor should they adversely affect the livelihoods of forest dependent or indigenous peoples. The roles of planted forests should rather complement those of natural and semi-natural forests and competitive effects should be minimized.
- d) **Contribution to poverty alleviation and food security.** In many developing countries smallholders and farmers own planted forests and depend on them for their livelihoods. A large number of people, particularly women, gain employment and income from nursery operations, land preparation, plantation establishment and maintenance and in wood-based industries. A number of studies around the world have presented strong evidence of the significance of planted forests and trees outside forests as supporters of sustainable livelihoods, food security and poverty alleviation however the congress called for enhanced efforts to strengthen evidence-based research on this topic.
- e) **Renewable energy.** Wood fuels are the most important energy source and the most important forest product for many developing countries. In industrialized countries the use of wood and woody biomass as a renewable energy resource is increasingly promoted and demand is likely to increase further due to high prices of fossil fuel alternatives. The congress stressed however that meeting this increasing demand is problematic because there is insufficient area of land suitable for planted forests. Further, the total supply of wood fuel is not available for bioenergy production, as in many countries this resource is indispensable for heating and cooking. In this context, the congress noted that the competition between the material and energy use of wood is intensifying and needs to be adequately managed
- f) **Management interventions to cope with climate change.** The significance of afforestation and reforestation in adaptation to, and mitigation of climate change is widely acknowledged in the mechanisms of the UN Framework Convention on Climate Change (UNFCCC). In this context the congress highlighted that the provision of goods and ecosystem services from planted forests will be altered by climate change phenomena posing new challenges to forest planners and managers. Possible interventions in planted forest management to tackle this situation are listed in section D, item 10.

- g) **Biological diversity.** The congress recognized that the conservation of biological diversity and genetic resources are fundamental issues in planted forest management. It reaffirmed that the positive or negative impact of planted forests on biological diversity depends to a large extent on the condition and previous use of the land being planted and on the intensity of management applied at a landscape level. The use of large-scale single species plantations with strong environmental impacts should be replaced by more ecological and integrated approaches, including mixed species plantations, silvicultural systems based on close-to-nature principles, conservation management of natural forest remnants and the planting of native as well as introduced species. The congress noted further that the potential of native species is often neglected in planted forests; some of which may achieve growth rates comparable to those of introduced species given proper silvicultural management and careful genetic selection.
- h) **Good governance of rural areas** is a crucial economic, legal and institutional precondition for planted forest development. It 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. The congress emphasized the need to replace the term ‘good forest governance’ by ‘good governance of rural areas’, as good governance is expected to be comprehensive and inclusive integrating the demands and priorities of all types of land-users on a landscape level.
- i) **Standards for sustainable forest management and certification.** The congress called for enhanced efforts to clarify whether the costs of forest owners incurred for engaging in forest certification schemes are sufficiently rewarded by the price premium paid in markets for products from sustainably managed forests. The congress further noted that standards and guidelines tend to reflect the capacity and capability inherent in large-scale forest plantation projects, while their stipulations are too demanding to be implemented by small-scale forestry or too rigid to be adapted to the local natural and socio-economic conditions.
- j) **Incentive schemes to support private investment.** The congress stressed the importance of taking advantage of the current trends of responsible investment in the finance sector and in the prevailing strategies of investors to diversify their portfolio away from more risky stock market products towards sustainable, environmentally sound, tangible asset classes. In this context the congress called for supportive financial incentive packages commensurate with capital expenditure requirements for the establishment and long-term management of planted forests. It was noted however, that precise information about the incurred cash flows and impacts related to such investments remain limited and should be made more readily available through country-led processes.
- k) **Communication and knowledge transfer** with a wide range of stakeholders including policy makers, private and corporate investors and environmental groups needs to be enhanced to better articulate the multiple economic, social and environmental benefits that planted forests can provide. These stakeholders must be made aware that professional sustainable planted forest management requires multidisciplinary expertise including ecology, planning and management of natural resources, field operations and socio-economics.
- l) **Biotic and abiotic hazards.** The congress noted that planted forests are exposed to many biotic and abiotic hazards and extreme weather events that are likely to increase as a consequence of climate change. Thus higher temperatures and prolonged droughts can provide favourable conditions for pest and disease outbreaks and forest fires. The perceived higher intensity, quantity and frequency of biotic and abiotic hazards coupled with the potentially increased vulnerability of planted forests can result in serious impacts on forest productivity, the provision of ecosystem services, and rural infrastructure. Another major risk is the accidental transmission of invasive pests or pathogens to other countries

through international trade. The congress noted with concern that some hazards have reached a level that is threatening regular forest management.

- m) **Socio-economic risks.** Planted forests are exposed to socio-economic pressures that can lead to encroachment onto planted forest estates, illegal harvesting of wood and non-wood forest products and the use of fire as a precursor to the establishment of new settlements. Such risks are particularly high in the context of high population pressure or a high incidence of poverty and hunger.
- n) **Risk prevention and adaptive risk management.** Forest owners, particularly corporate forestry organizations and financial investment companies that own forests, are becoming more risk aware and are seeking tools and techniques that enable them to assess, manage and mitigate risk. Risk assessment should be based on long-term, large-scale monitoring networks able to detect trends in the occurrence of hazards. Risk management should focus on prevention, through the application of management practices that can be flexibly adapted to changing environmental situations. Risk mitigation in the first place should embark on a targeted strategy for improving the resilience of planted forests by preventive operational practices and silvicultural methods to maintain stand vitality and viability.
- o) **Ecosystem services.** The congress highlighted that planted forests provide a wide range of provisioning, regulating and cultural services, many of which cannot be provided by other types of land use. Despite consistently being recognized in forest policy and legislation, in practice they can be sidelined because they are complex, intangible, and difficult to measure, to value or to incentivize. The congress stressed that it was essential to produce more evidence-based and consistent messages on the benefits of ecosystem services from planted forests as compared to other land uses and to communicate them in a simple, comprehensible language.
- p) **Rural landscape restoration.** Efforts to restore rural landscapes can use planted trees and forests to support the development of functional ecosystems, to reduce communities' environmental and economic risks and to enhance the contribution of natural resources to food security and poverty alleviation. The congress noted that guidelines need to be developed on the role of planted forests in rural landscape restoration (rehabilitation/reforestation), which should assign productive and protective functions to existing and new forest areas, and reconcile local needs and objectives with broader development goals and national and international forest policies.
- q) **Biotechnology.** The application of biotechnologies in planted forests has been recognized as an opportunity for providing new tree varieties and reproductive materials adapted to changing environmental, social and economic environments. However, there are also serious concerns about the potential environmental risks posed by certain aspects of biotechnology. The congress stressed that modern biotechnology was a complement to conventional technologies in solving problems in planted forests and meeting the needs of society. In this context biotechnology is considered much more than a technical issue; its application needs to be governed by accepted environmental and societal standards in order to find acceptance with policy makers and society.
- r) **Research needs.** The congress called for increased efforts to strengthen the commitment to research and development and saw such efforts as being critical to the sustainable management of planted forests. Research needs are listed in the last section I of this report.

B) Introduction

1. **Acknowledgement of sponsors.** The governments of France, Ireland, and the United Kingdom (Forestry Commission and Department for International Development), and the regional governments of Aquitaine, the Basque Region and the county of Bizkaia, together with a number of international organizations (FAO, IUFRO, IEF, GPFLR), research institutions and universities (INRA France, the Catholic University of Portugal in Porto), projects (FORRISK, LabEx COTE) and companies of the public and private sector (Grupo Portucel Soporcel, Altriflorestal, Arthur Cox, Investissements d'avenir, iFor ut, Green Belt, Coillte, Neiker tecnalia and the New Zealand Journal of Forestry Science) sponsored the 3rd International Congress on Planted Forests entitled "Planted Forests on the Globe – Renewable Resources for the Future".
2. **Previous conferences in Chile and New Zealand.** Previously, two international conferences on the role of planted forests in sustainable forest management had been held in Chile (1999) and in New Zealand (2003). Both of them highlighted the need to promote the multiple dimensions of planted forests in view of the social and environmental challenges of the 21st century. Since then, new research, global resource assessments and outlook studies for wood from planted forests, best practice guidelines and many interesting country case studies have documented and emphasized the global significance of planted forests. In parallel, international processes and financing mechanisms have increasingly recognized the major role of planted forests in supplying wood and providing a range of other ecosystem services. In contrast to these positive developments, there has been continuing concern in international debates or policy processes about the role of planted forests. Social and environmental advocacy groups have argued that man-made forests are not desirable as they can induce negative social and environmental impacts if they are not properly managed.
3. **Organization and opening.** The 3rd International Congress on Planted Forests was organized by the Atlantic Regional Office of the European Forest Institute (EFIATLANTIC), the Food and Agriculture Organization of the United Nations (FAO) and the Union of Foresters of Southern Europe (USSE). The congress comprised three scientific workshops held in Bordeaux (France), Dublin (Ireland) and Porto (Portugal) from May 15th to 18th, 2013, and one plenary meeting held in Estoril (Portugal) from May 20th to 21st. The plenary meeting in Estoril was opened by Ms. Assunção Cristas, Portuguese Minister of Agriculture, Sea, Environment and Spatial Planning, Mr. François Moreau from the French Ministry of Agriculture and Forestry, Mr. Eduardo Mansur, director of the Forest Assessment, Management and Conservation Division, FAO, and Mr. Niels Elers Koch, the president of IUFRO. More than one hundred and eighty participants from 38 countries attended the workshops and the plenary meeting representing national and regional governments, the private sector, universities, research institutes, international and non-governmental organizations. The participants in these meetings raised a wide range of important points about planted forests, many of which are summarized below.
4. **Process of formulating the summary report.** More than 60 invited papers from more than 20 countries and 3 high-level panel discussions, which addressed a set of questions related to the conference theme, formed the basis of deliberations that led to the formulation of this summary report. The report was prepared by a drafting committee of international experts on planted forests¹. This document does not necessarily represent the position of the congress organizing institutions. It is however the only shared reference document that summarises the congress deliberations. It provides

¹ Américo Mendes, Bill Mason, Christophe Orazio, Gert-Jan Nabuurs, Hervé Jactel, Inazio Martinez, Jean-Michel Carnus, Margarida Tomé, Peter Freer-Smith, and Walter Kollert (in alphabetic order).

guidance and recommendations for the development of planted forests and serves to integrate the congress outcomes into the broader policy dialogue on the future of planted forests at the global, regional and national levels. It also identifies future research needs for the development of planted forests.

C) Global context and regional perspectives ²

(from Estoril plenary meeting and Dublin workshop)

5. **Planted forests increasing in importance worldwide.** The global area of planted forests has considerably increased from 178 million ha in 1990 to 264 million ha in 2010, which corresponds to 7% of total forest area. During 2005 to 2010 the area of planted forests expanded each year by around 5 million ha on average. This expansion has been mainly achieved in countries in Asia. In some countries in Europe, Latin America, Oceania and the United States the establishment of new planted forests or the replanting of existing ones has decreased due to high land prices, a lack of financial incentives, and environmental restrictions. The contribution of planted forests to addressing the major socio-economic and environmental challenges of our time - poverty alleviation, food security, renewable energy, climate change and biodiversity conservation- is widely acknowledged. In many developing and developed countries planted forests have become a substantial component of the productive and protective forest resources. Various estimates indicate that planted forests provide between one third to two thirds of the global industrial roundwood demand and sequester 1.5 gigatons carbon (1.5×10^9 tons) per year. The congress noted in this context that statistics on wood production from planted forests including small woodlots and trees outside forests are incomplete and tend to overlook local markets for fuelwood, poles and other minor wood products. Globally, extensive areas are estimated to be available for forest restoration, rehabilitation or reforestation. The congress stressed that such endeavours must be based on an integrated land-use plan including all types of land uses, which will require new mechanisms for people to cooperate across different sectors. However the congress also underscored that land is not the only limiting factor in planted forest creation, but capital, labour and the security of the investment are equally important.
6. **Planted forests to complement natural forests.** The distinction between natural and planted forests can be difficult, for example in temperate and boreal countries when natural species are grown on long rotations and comprise mixed-species and mixed-age plantings. The distinction is clearer where planted forests are based on single species stands, even age classes, short rotations and intensive management, as often found in tropical and sub-tropical regions. In this context the congress acknowledged that planted forests form part of the forest continuum, from highly protected conservation forests to productive short rotation plantations, a concept that was developed at the first experts' meeting on planted forests held in Santiago de Chile in 1999. Intensively managed plantations will have to play a significant role to meet the increasing demand for wood products and avoid further reduction of natural forests. As a matter of principle planted forests should not replace natural forests, nor should they adversely affect the livelihoods of forest dependent or indigenous peoples. The roles of planted forests should rather complement those of natural forests and competitive effects should be minimized. Strong efforts need to be made by industry, governments and other stakeholder groups to avoid any negative impacts that may be associated with the establishment of planted forests. In this context the congress highlighted that forestry stakeholders should produce more evidence-based and consistent messages on the benefits of planted forests as compared to other land uses (e.g. intensive agriculture).

² figures in this chapter are taken from FAO's Global Forest Resources Assessment 2010. FAO Forestry Paper 163.

7. Regional perspectives on planted forest development

Africa accounts for 5.8 % (15.4 million ha) of the global planted forest area. Most of Africa's wood is still produced from natural forests; investments in planted forests have occurred mainly in countries with relatively low forest cover (e.g. in Algeria, Morocco, Nigeria, South Africa and the Sudan). Most forest planting programs were created in an effort to secure industrial wood and wood fuel sources while some were established to combat desertification. The majority of planted forests consist of exotic species (*Eucalyptus*, *Pinus*, *Hevea*, *Acacia*, *Tectona*) chosen for their ability to rapidly produce wood or other economic products (e.g. gum arabic, rubber). The congress noted that those African countries where planted forests rely on a few tree species are encouraged to focus more on species diversification as a safeguard against pests, diseases and climatic hazards, which may also result in increased market security through product diversification.

The quality of management and productivity of planted forests largely depends on the type of ownership. Most planted forests are established and managed by public forestry agencies with the exception of South Africa. Publicly owned forests were generally reported to be in a poor state due to inadequate governance frameworks, weak forestry departments, inadequate silvicultural management, budgetary constraints, and lack of research. Exceptions to this situation are Côte d'Ivoire and Zimbabwe, where publicly owned forest plantations are found to be well managed. Privately owned forest plantations are common in South Africa, Swaziland and Zimbabwe. They are generally well managed, display high productivity and aim at profit maximization often integrating plantations with wood processing plants.

The growing demand for wood has encouraged farm planting on individual woodlots owned by private households. Farm woodlots, including trees outside forests, are now wide-spread in Ghana, Kenya and Uganda, though information on their extent is unreliable. They have become a major source of wood and non-wood forest products thus playing a significant role for the livelihoods of rural communities and national economies. This trend is expected to intensify in the future though woodlot development is hampered by a number of obstacles related to the absence of well defined property rights, a lack of governance frameworks conducive to attract investments, the low capacity of forestry extension services, the lack of silvicultural knowledge and the use of seed sources of low genetic quality.

Asia has 123 million ha of planted forests, nearly half of the global total. The planted forest area increased substantially during the last 10 years through large-scale afforestation programs, mainly in China, India and Vietnam, which aimed to expand forest resources, protect watersheds, control soil erosion and desertification, and maintain biodiversity. China's national forestry strategy sets a goal of expanding the planted forest area by a further 40 million hectares by 2020. As more of the natural forests are excluded from production, planted forests are becoming the mainstay of wood production in the region. Future wood supply will depend on improving the productivity of existing planted forests (e.g. through biotechnology), on expansion into urban and peri-urban spaces and on encouraging farm forestry as an important source of wood. Farm forestry is expected to continue to expand as a result of improving security of land tenure, declining profitability of agriculture and increasing demand and prices for wood products. On the other hand, the scope for expansion of commercial plantations is limited. In a changing environment the value of ecosystem services provided by planted forests are increasingly appreciated by policy makers and the general public. China's forest policies on forest ecosystem services have evolved from an emphasis on timber production and utilization to ecological improvements. The National Development Strategy of China (2013) emphasizes the establishment of an *Ecological Civilization*. Planted forests are increasingly assigned to protective and multiple-use functions with the objective to optimize land use at a landscape level. Future forestry research will focus on the conduct of long-term monitoring of forest resources, the development of cross-sectoral multi-purpose guidelines, the development of climate change adaptation strategies, and integrated landscape management policies and practices, so that planted forests along with other land uses can ensure sustainable landscape management.

Europe has about 69 million ha of planted forests (including the Russian Federation) or 26% of the global planted forest area. Most European forests are actively managed and show an enormous diversity in terms of forest types, species and management objectives. The distinction between natural and planted forests is less clear than for other regions as much of the original forest cover was removed hundreds of years ago. The observed increase in forest area in Europe (on average 400,000 ha per year from 2000 to 2010) results both from the establishment of planted forests using mainly native species and from natural colonisation of former agricultural land. Current trends in European forest management could result in an over-supply of wood from broadleaved species, as well as a shortfall of coniferous timber from European forests, in particular as an increase in harvest is difficult to achieve due to restrictive environmental policies and the fact that many small forest owners prefer to leave a legacy to their children rather than to harvest the timber on their plots.

Many European countries have introduced policies to increase the share of renewable energy in total energy consumption in order to combat climate change and address concerns about rising fossil fuel prices and energy security. These policies have stimulated an increasing demand for wood as an energy source and have led to substantial public and private investments in biofuel production from forest plantations often in the form of fast-growing, short-rotation coppice plantations (e.g. from poplars). It is anticipated that further oil price increases will significantly increase the demand for wood as a source of energy.

The future management of planted forests has to meet a number of challenges, among them the coping with the high fragmentation of private forest ownership (16 million forest owners in the EU), the sluggish demand under the current economic crisis, the creation of innovative products and, with it, the optimization of the value-added chain, and the increasing role of the forestry sector in the bio-economy.

Oceania, with the two major countries New Zealand and Australia, accounts for 1.6 % (4.1 million ha) of the global planted forest area. It has a long history of planted forest management due to historic wood supply deficits and offers excellent growing conditions for a number of fast growing species, among them *Eucalyptus* spp. and *Pinus radiata*. The driver for the establishment of plantations was the desire to achieve a sustainable production of timber outside the native forests. For most of Oceania the outcome is a timber supply well in excess of domestic market needs and an economically important export industry, which mainly serves the Chinese market. The supply of timber is expected to increase up to 2020 due to productivity gains in existing plantations however the establishment of new plantations has stalled. The existing fiscal regime (grants, loans, tax incentives) and available infrastructure were originally conducive to forest production, however these incentives had only a short-term impact. There still is considerable potential for further investments in planted forests, but governance, tenure and property rights issues currently do not support such investments. The ecosystem services including carbon sequestration provided by planted forests are increasingly recognized by the government and the general public, but there is little tangible return to investors for the provision of these services.

Latin America has about 15 million ha of planted forests. Although this area is relatively small representing less than 6% of the global planted forest area, it has expanded at a rate of 3.2% per year over the last decade and projections suggest a further increase. In Brazil the forest plantation area is anticipated to double by 2020. The region is emerging as a leader in the use of renewable fuels and in the development of high-productivity forest plantations driven by the private sector and supported by favourable government policies and financial incentive schemes. These factors have made Latin America a preferred destination for investments by both regional and global pulp and paper producers and North American investors including timber investment management organizations (TIMOs). Key features of forest plantation development in particular countries such as Argentina, Brazil, Chile, Costa Rica and Uruguay include:

- increasing investments in productivity-enhancing technology, especially clonal propagation, achieving in some cases growth rates of more than 50m³/ha/yr,
- use of intensively managed short-rotation species such as *Eucalyptus spp.*, *Pinus radiata*, *P. taeda*, *P. elliottii* and *Tectona grandis*,
- integration of plantation management with wood processing facilities, especially pulp and paper and panel production,
- advanced biotechnology and environmental legislation on land use have contributed to reduce the negative environmental impacts of fast growing forest plantations.

Sustainable intensification based on science and good operational practices has been largely demonstrated in Chile's forestry sector. Forest plantations focusing on wood production form the basis of a vibrant forest industry that has grown to become the 3rd largest exporter in Chile contributing considerably to employment and GDP. International certification schemes recognise that planted forests contribute to the reduction of soil erosion and maintain and increase water quality. In addition many plantation companies have established successful community support programs.

Recent government regulations in several Latin American countries have discouraged forest investment in agricultural land, as food, fibre and fuel production increasingly compete for limited land resources. Private and corporate companies appear to making excellent returns based on cheap land costs paid decades ago; new investments in many cases will have smaller rates of return due to higher land costs, but still compare favourably with other asset classes.

North America accounts for about 14% (37.5 million ha) of the global planted forest area. In Canada, planted forests represent 3% of the total forest area, in Mexico 5%, and in the USA 8%. The area of planted forest shows a slightly increasing trend in the three countries. However climate change phenomena may intensify threats to forest health. The intensity and frequency of forest fires and pest infestations (e.g. by the mountain pine beetle) have increased in both Canada and the USA, exacerbated by prolonged drought attributed to climate change. In the US large changes in ownership patterns have occurred over time favouring in particular large landowners, e.g. TIMOs, and resulting in a highly intensive management of planted forests. Thus, substantial gains in productivity have been achieved in Douglas fir and southern pine forests resulting in shorter rotation ages. Increased investment in planted forests followed the pulp and paper boom in the southern US, the Pacific Northwest lumber boom, and the development of the plywood industry and OSB markets. Locally, the contribution of the forestry sector to the overall economy is considerable while the development of markets for ecosystem goods and services still needs to be intensified.

D) Crosscutting themes: poverty alleviation, food security, renewable energy, climate change, biodiversity conservation

(from Estoril plenary meeting and Dublin workshop)

8. **Poverty alleviation and food security** are overriding themes of sustainable development, as reflected in Agenda 21 (1992), the Copenhagen Declaration on Social Development (1995), the Millennium Development Goals (2000), the Johannesburg World Summit on Sustainable Development (2002) and in the outcome document 'The Future We Want' of the Rio+20 Conference (2012). In many developing countries smallholders and farmers own planted forests and depend on them for their livelihoods, in particular if the forests were established on land that has either been abandoned or has previously been of marginal use. A large (but not quantified) number of people, particularly women, gain employment and income from nursery operations, land preparation, plantation establishment and maintenance and in wood-based industries, 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. A number of studies around the world have presented strong evidence of the significance of planted forests and trees outside forests as contributors to sustainable livelihoods, food security and poverty alleviation. However, definitive quantitative data on the contribution of planted forests to poverty alleviation and food security in different geographical regions are still lacking. In this context the congress called for enhanced efforts to strengthen evidence-based research on this topic.

9. **Planted forests a preferred source of renewable energy.** Wood fuels comprising firewood and charcoal are the most important energy source and the most important forest product for many developing countries. Globally, about half of the annual wood removals (about 1.7 billion m³) are used for fuel. Fast-growing planted forests can be an efficient way to produce wood fuel. Currently, they supply an estimated 15 to 20% of the world's wood fuels, whether in the form of by-products or residues from industrial forest plantations or as whole trees from dedicated bioenergy plantations (*Populus*, *Salix*, *Eucalyptus*, *Acacia*), which in most cases do not compete with food production as they grow on land that is unsuitable for intensive agriculture. However, the assessment of the impacts of bioenergy plantations is complex and there are a number of potential risks for food security, land use change and the conversion of valuable eco-systems. The use of renewable energy resources including the use of wood and woody biomass is increasingly promoted by industrialized countries and demand is likely to increase further due to high prices of fossil fuel alternatives. The congress stressed however that meeting this increasing demand is problematic because there is insufficient area of land suitable for planted forests. Further, the total supply of wood fuel is not available for bioenergy production, as in many countries this resource is indispensable for heating and cooking. In this context, the congress noted that the competition between the material and energy use of wood is intensifying and needs to be adequately managed.

10. **Management interventions to cope with climate change.** The significance of afforestation and reforestation in adaptation to, and mitigation of climate change is widely acknowledged in the mechanisms of the UN Framework Convention on Climate Change (Clean Development Mechanism, REDD). In this context the congress highlighted that the provision of forest goods and ecosystem services from planted forests will be altered by climate change phenomena posing new challenges to forest planners and managers. Specific interventions in planted forest management to cope with this situation comprise:

- identify, survey and measure existing forest resources and their best possible uses in order to diversify management, and to reduce the risk of damaging climate change impacts;
- monitor natural conditions to obtain early indications that changes are occurring, and to facilitate effective responses to such changes;
- plant tree species that are resilient to projected climate change impacts on harvested, burnt or degraded forest land and abandoned agricultural land; vice versa, prevent deforestation of forest land;
- establish short-rotation woody biomass plantations on suitable sites to substitute bioenergy for fossil fuels;
- diversify structures and species in planted forests to increase their adaptive capacity to climatic hazards; establish mixed species plantations, do not substitute natural forests for planted forests, reduce the scale of harvesting operations and enhance the connectivity between natural and planted forest areas;
- maintain health and vitality of planted forests by implementing fire, pest and disease prevention measures and by applying appropriate silvicultural treatments;

- reduce emissions from deforestation and forest degradation through integrated fire and pest management, the adoption of low impact harvesting methods and extend rotation periods to reduce damages to soil fertility and standing trees;
- manage and preserve the natural hydrological cycle on a landscape level to maintain or adjust the availability of water for tree and plant growth.

The congress agreed that there was a need to support countries in planning and implementing these interventions and to assist them in understanding the role that planted forests can play in adaptation to and mitigation of climate change.

11. Impacts of planted forests on biological diversity. The congress recognized that the conservation of biological diversity and genetic resources is one of the fundamental issues in forest management. The positive or negative impact of planted forests on biological diversity depends to a large extent on the condition and previous use of the land being planted and on the intensity of management applied at a landscape level. The design of planted forests needs to embrace principles of complexity, adaptability and self-regulation for biodiversity conservation. Large-scale single species plantations with strong environmental impacts should be replaced by more ecological and integrated approaches at stand and landscape levels, including mixed species plantations, greater use of silvicultural systems based on close-to-nature principles, conservation management of natural forest remnants and the planting of native species as well as introduced species. The congress noted further that the potential of native species is often neglected in planted forests since some of the former may achieve growth rates comparable to those of introduced species given proper silvicultural management and careful genetic selection. Introduced species should be selected only in relation to specific management objectives, market conditions and ecological site conditions and the risk that these species may become invasive and have adverse effects on the local biodiversity should be evaluated.

E) Governance, economics, trade and markets

(from Estoril plenary meeting and Porto workshop)

12. Good governance of rural areas depends on an environment of stable economic, legal and institutional conditions to enable long-term investments, 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 of rural areas also involves the:

- attenuation of top-down, state-led, command and control instruments;
- strengthening of economic incentives, participatory mechanisms, capacity development of forest owners' organizations, and the empowerment of local communities as equal partners;
- balancing informative and regulative instruments;
- acknowledgement of trade-offs and opportunity costs of alternative land uses;
- application of mediation and other conflict resolution mechanisms;
- creation of enabling conditions for an equitable distribution of benefits to relevant stakeholders in planted forest management.

The congress emphasized the need to replace the term '*good forest governance*' by '*good governance of rural areas*', as good governance is expected to be comprehensive and inclusive integrating the demands and priorities of all types of land-users on a landscape level.

13. Standards for sustainable forest management and certification. The area of planted forests with forest management certification and wood processing plants with chain of custody verification has increased considerably in the last decades. The congress called for enhanced efforts to clarify whether

the costs of forest owners incurred for engaging in forest certification schemes are sufficiently rewarded by the price premium paid in markets for products from sustainably managed forests. The congress further noted that many standards and guidelines for sustainable forest management do not adequately acknowledge planted forests or use inconsistent terminology. Further, such standards and guidelines tend to reflect the capacity and capability inherent in large-scale forest plantation projects, while their stipulations are too demanding to be implemented by small-scale forestry or too rigid to be adapted to the natural and socio-economic local conditions. Therefore the congress emphasized the need for harmonization, simplification and greater flexibility of standards and guidelines to make them more adjustable to and inclusive of small-scale forestry, specific regional characteristics and local community needs.

14. Promotion and adaptation of financial incentive schemes to support private investment. The congress stressed the importance of taking advantage of the current trends of responsible investment in the finance sector and in the prevailing strategies of investors to diversify their portfolio away from more risky stock market products towards sustainable, environmentally sound, tangible asset classes. Even though planted forests are in general productive and profitable, private investments into planted forest projects are mainly limited to countries that have created supportive financial incentive packages commensurate with capital expenditure requirements for the establishment and long-term management of planted forests. Other countries may wish to emulate such incentive packages to attract private and corporate capital. However, precise information about the incurred cash flows and impacts related to such investments remains limited and should be made more available through country-led processes. These would combine analytical research with studies on the socio-economic and environmental impacts of such investments, the needs for institutional reform and capacity development, and the required changes in governance and policy. Such studies should be supported by dialogue between the forestry and finance sectors, knowledge sharing events and the preparation of educational materials that investors can easily understand. By the same token, economic disincentives should be avoided that have adverse trade, social or environmental impacts and distort the value of planted forests or limit the opportunities for investors.

15. Communication, knowledge transfer, capacity building, research and development. Communication with a wide range of stakeholders including policy makers, private and corporate investors and environmental groups needs to be enhanced to better articulate the multiple economic, social and environmental benefits that planted forests can provide. These stakeholders must be made aware that sustainable management of planted forests requires multidisciplinary expertise including ecology, participatory processes of planning and management of natural resources, site and species matching, soil fertility and nutrient management, tree planting, forest protection, silvicultural and harvesting operations, economics, business management and social sciences, forest products marketing and commerce. The availability of these skills depends upon various factors such as: continuous professional education and training, extension support services, data collection services, research and development capabilities, and networking at the national and international levels. Consequently, the forest sector including governmental, private-sector and other organizations are advised to strengthen their organizational capacities, personal capabilities and communication skills to transfer and share knowledge, technology, and techniques for sound planted forest management, at all levels.

F) Vulnerability and risk management

(from Bordeaux workshop)

16. **Biotic and abiotic hazards are putting planted forests in jeopardy.** Planted forests are exposed to many biotic and abiotic hazards that are likely to increase in response to climate change. Higher temperatures and prolonged droughts can provide favorable conditions for pest and disease outbreaks and forest fires. Interactions between hazards have to be taken into consideration, such as bark beetle outbreaks following windstorms. Some hazards have reached a level that is threatening regular forest management. Another major risk of forest health of planted forests worldwide is the accidental transmission of invasive pests or pathogens to other countries through international trade of export products (plants, timber, chips, packaging). This is of particular concern for forest plantations of widely-used introduced species, e.g. *Eucalyptus spp.* For reference see also the *Montesclaros Declaration* (Spain 2011)³.
17. The **vulnerability of planted forests** to biotic and abiotic hazards is closely related to their areal expansion, species composition, stand structure, and forest management. The increasing global area of planted forests is inevitably more exposed to occurring disturbances. Single-species plantations of fast-growing, even-aged stands that lack adequate management interventions (e.g. thinnings, removal of logging debris) are potentially more vulnerable to biotic and abiotic hazards. The perceived higher intensity, quantity and frequency of biotic and abiotic hazards coupled with the increased vulnerability of planted forests can result in serious impacts on forest productivity, the provision of ecosystem services, and rural infrastructure.
18. **Governance failures entail socio-economic risks.** Planted forests are exposed to socio-economic risks due to governance failures. These risks comprise a weak or inadequate forest policy framework including insecure investment conditions, inadequate regulations on land tenure, and poor conflict resolution mechanisms. These can lead to encroachment onto planted forest estates, illegal harvesting of wood and non-wood forest products and the use of fire as a precursor to the establishment of new settlements. Such risks are particularly high in the context of high population pressure or a high incidence of poverty and hunger. Ensuring participatory engagement with concerned stakeholders and local communities in ways that are transparent, just and sound may contribute to the understanding of the varying needs and priorities of stakeholder groups and help to resolve them through mutually agreed conflict resolution mechanisms.
19. **Risk prevention and adaptive risk management help prevent biotic and abiotic damage.** Risk management has not always been fully embedded as part of forest management planning. Forest owners, particularly corporate forestry organizations and financial investment companies that own forests, are becoming more risk aware and are seeking tools and techniques that enable them to assess, manage and mitigate risks, which are often insufficiently covered by risk insurance policies. Risk assessment should be based on long-term, large-scale monitoring networks able to detect trends in the occurrence of hazards. Risk management should focus on prevention, through the application of management practices that can be flexibly adapted to changing environmental situations. Risk prevention should involve on a targeted strategy for improving the resilience of planted forests by preventive operational practices and silvicultural methods to maintain stand vitality and viability. These include species diversification at the landscape scale, mixed planting patterns at the stand scale for increased resistance against a broad class of threats, as well as on sanitation methods to eliminate infested trees and logging debris. Phytosanitary measures have also to be taken to reduce pathways for

³ see: <http://www.iufro.org/science/divisions/division-7/70000/publications/montesclaros-declaration/>

exotic pests and disease invasions. Risk prevention is to be complemented by adaptive management that will improve the decisions of a forest manager by anticipating future risk events and by monitoring the effects of past actions so that appropriate measures may be taken to mitigate future damage. The congress noted in this context that more monitoring data and predictive modelling work, notably for multiple risks, are needed that combine quantitative data on the potential impact of climate change on the occurrence of hazards and on the susceptibility of planted forests to these hazards.

G) Ecosystem services and landscape restoration

(from Dublin workshop)

20. Ecosystem services by planted forests. The congress highlighted that planted forests provide a wide range of provisioning, regulating and cultural services, many of which cannot be provided by other types of land use. Besides timber they also provide a wide range of non-wood forest products and play an important role in the rehabilitation of fragile ecosystems. They contribute substantially to combating desertification, protecting soil and water, restoring forest landscapes, and are often integrated with agriculture and other land uses. In addition, since planted forests generally involve fast growing species, they are very effective at sequestering carbon and mitigating climate change. They can also deliver valuable services to urban populations ranging from fuel wood to recreation and environmental services such as mitigating sand-storms, preventing sand-drift and absorbing sewage water. The congress noted that the provision of many ecosystem services is not an inevitable consequence of planting trees but depend upon the type and intensity of management employed.

21. The value of ecosystem services. Many of the environmental services that forests provide are often taken for granted without their socio-economic and environmental value being realised. Despite consistently being recognized in forest policy and legislation, in practice they can be sidelined because they are complex, intangible, and difficult to measure, to value or to incentivize. In this context the congress highlighted that the provision of desired ecosystem services to society may not only increase the value of planted forests, but also strengthen the license of the forestry sector to embark on projects relating to planted forests. The congress stressed that it was essential to communicate quantified evidence of the benefits of ecosystem services in a simple and comprehensible language. This would involve establishing targeted partnerships with other stakeholders to increase understanding of the potentials of ecosystem services and to obtain more public support and funding for planted forests, in particular in difficult financial times. In recent years payment schemes have been developed in pilot case studies (payment for environmental services, PES) that offer incentives to forest owners and farmers as a compensation for managing their forests to provide ecological and environmental services. They have been acknowledged as an innovative, promising conservation approach, but their success depends on a set of basic institutional conditions, including a strong legal framework and political stability, a sustainable source of financing, trust and confidence among buyers and sellers, and transparency in the management of funds. If carefully designed, these schemes may benefit forest owners and farmers and improve the natural resource base, but it is unlikely that they will completely replace other conservation instruments.

22. Role of planted forests in rural landscape restoration. Efforts to restore rural landscapes can use planted forests to support the development of functional ecosystems, to reduce communities' environmental and economic risks and to enhance the contribution of natural resources to food security and poverty alleviation. The congress noted that guidelines need to be developed on the role of planted forests in rural landscape restoration (rehabilitation/reforestation), which should assign productive and protective functions to existing and new forest areas, and reconcile local needs and objectives with broader development goals and national and international forest policies. The congress further stressed that such guidelines should adopt a coordinated, transparent and participatory land-use

planning process linking agriculture, forestry and urban areas within a landscape or watershed to ensure that upstream and downstream impacts are met by effective mitigation measures within acceptable social, economic and environmental standards.

H) Biotechnology

(from Estoril plenary meeting)

23. The **application of biotechnologies** in planted forests has been seen as an opportunity for providing new tree varieties and reproductive materials adapted to changing environmental, social and economic environments. In planted forests the majority of biotechnology work has focused on a few genera, whereby *Populus* remains the most commonly studied tree genus. While there is little controversy about many aspects of biotechnology and its application, genetically modified organisms (GMOs) have become the subject of an intense debate. It is widely recognized 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, there are also serious concerns about the potential environmental risks posed by certain aspects of biotechnology. They include the possibility of the development of more aggressive, invasive species or the loss of biodiversity as a result of the displacement of traditional cultivars by a small number of genetically modified cultivars. The congress stressed that modern biotechnology was a complement to conventional technologies in solving problems in planted forests and meeting the needs of society. In this context biotechnology is to be considered much more than a technical issue; its application needs to be governed by accepted environmental and societal standards in order to find acceptance with policy makers and society. An important pre-condition for such development is that forest stakeholders engage in an open and transparent dialogue with society and convey clear messages on the potentials and risks of biotechnologies.

I) Research needs

24. **Research and development.** The congress called for increased efforts to strengthen the commitment to research and development as being critical to the sustainable management of planted forests. The congress specifically identified research needs in the following fields:

Crosscutting themes

Poverty alleviation and rural development. Conduct evidence-based case studies in rural areas of different geographical regions to quantify and qualify the contribution of different land uses (among them planted forests) on poverty alleviation, food security, the provision of employment and the generation of income for the local population.

Climate change. Conduct analytical research to quantify and qualify the climate change impact on vitality, growth performance, and value of planted forests; support science-based projects to secure and manage genetically diverse forest resources including seeds that will be needed for the continued existence of planted forests under altered climatic conditions.

Monitoring greenhouse gas emissions. Conduct research studies to monitor, measure and model green house gas fluxes between forests and the atmosphere in order to support REDD and other climate change mitigation strategies.

Governance, economics, trade and markets

Governance frameworks and institutional support. Conduct analytical research studies to develop and strengthen governance frameworks and institutional support structures for the forestry sector and the associated ecosystem services in developing countries.

Statistics on wood production from planted forests. Conduct global resource assessments to improve the available data and information on supply of wood and non-wood forest products from planted forests and trees outside forests.

Forest management guidelines for small landowners. Develop a better understanding of the capacity and needs of small landowners in planted forest management and develop simple and flexible forest management standards and normative guidelines that take into account small-scale forestry, specific regional characteristics and local community needs.

Forest management certification. Investigate whether the costs incurred by forest owners, including small farmers, for engaging in forest certification schemes are sufficiently rewarded by the price premium paid for products from sustainably managed forests.

Investments into planted forests. Conduct comprehensive analytical research on the institutional, socio-economic and environmental impacts of investments into planted forests, including the disclosure of ensuing costs and revenues, and the required changes in governance and policy.

Communication campaign on planted forests. Conduct professional communication campaigns with a wide range of stakeholders, including in particular policy makers, private and corporate investors and environmental groups, to better articulate the multiple economic, social and environmental benefits that planted forests can provide in order to overcome false perceptions of planted forests.

Exemplary planted forest management. Develop an internet supported database of exemplary case studies of successful planted forests in order to facilitate communication, knowledge transfer and capacity building and promote inter-disciplinary and international collaboration.

Vulnerability and risk management

Risk assessment. Conduct analytical studies based on long-term, large-scale monitoring networks in order to detect trends in the occurrence of hazards and to provide evidence of the perceived higher risk of biotic and abiotic hazards in planted forests including the interactions among them and with observed climate change phenomena.

Monitoring of forest health status. Establish research networks to collect time-series data on forest health and develop innovative methods, including remote sensing technology and the development of integrated forest health indicators, to monitor the health status of planted forests and their susceptibility to biotic and abiotic hazards.

Socio-economic and environmental impact of biotic and abiotic hazards. Conduct research studies to quantify and qualify the impact of biotic and abiotic hazards on wood production, the local forest industry and the related value-chain, as well as the whole range of ecosystem services.

Risk modeling. Develop coherent and comprehensible predictive models to improve risk assessment and to assess the effect of global environmental change. Seek to use this information to develop innovative forest management methods on risks related to forest management.

Mechanisms for risk governance. Improve communication between scientists and forest stakeholders to facilitate a better consideration of research results in forest management planning. This includes an analytical study of the chain of decisions made during previous environmental crisis situations.

Ecosystem services and landscape restoration

Environmental impact of planted forests. Investigate the impacts of the establishment and management of different types of planted forests at different sites on the environment including the consumption of water as compared to other land uses.

Resilient close-to-nature planted forest types. Conduct applied field research to design and develop resilient mixed species and/or complex structured planted forest types that meet societal and environmental demands. This includes an investigation into the potential of using native and lesser known species to produce high-value and high-productivity planted forests and/or agroforestry systems

Valuation of ecosystem services. Develop better definitions and concepts for the valuation of and payment for ecosystem services to provide quantified evidence of the range of ecosystem services and to facilitate cross-disciplinary discussion and the link to policy development.

Demand for ecosystem services. The demand for certain ecosystem services has been largely under-researched; most research has focused on the supply side. Investigate in greater depth the expectations of buyers, users or local communities from ecosystem services.

Integrated and participatory land-use planning. Develop methods for integrated and participatory land use planning at a landscape level and apply them in pilot demonstration projects.

New products from planted forests. Develop new and innovative products from planted forests (e.g. biorefineries, nanotechnology).