INTERNATIONAL POPLAR COMMISSION

22nd Session
Santiago, Chile, 29 November – 9 December 2004

THE CONTRIBUTION OF POPLARS AND WILLOWS TO SUSTAINABLE FORESTRY AND RURAL DEVELOPMENT

Synthesis of Country Progress Reports

Activities Related to Poplar and Willow Cultivation and Utilization, 2000 through 2003

November 2004

Forest Resources Development Service
Forest Resources Division
Forestry Department

Working Paper IPC/3
FAO, Rome, Italy

Disclaimer

Twenty one member countries of the IPC, and the Russian Federation, a non-member country, have provided national progress reports to the 22nd Session of the International Poplar Commission. A synthesis has been made by the Food and Agriculture Organization of the United Nations and summarizes issues, highlights status and identifies trends affecting cultivation, management and utilization of Poplars and Willows in temperate and boreal regions of the world.

Comments and feedback are welcome.

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For quotation:

FAO, November 2004. Synthesis of Country Progress Reports received prepared for the 22nd Session of the International Poplar Commission, jointly hosted by FAO and the National Poplar Commissions of Chile and Argentina; Santiago, Chile, 29 November – 2 December, 2004. International Poplar Commission Working Paper IPC/3. Forest Resources Division, FAO, Rome (unpublished).

Web references:

For details relating to the International Poplar Commission as a Technical Statutory Body of FAO including National Poplar Commissions, working parties and initiatives can be viewed on http://www.fao.org/forestry/ipc and highlights of the 22nd Session of the International Poplar Commission, 2004 can be viewed on http://www.fao.org/forestry/ipc2004.

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ACKNOWLEDGEMENTS

This Synthesis of Country Progress Reports is the product of National Poplar Commission personnel, FAO consultants and staff. The major scope and diversity of information available on natural and planted forests and trees of Poplars and Willows is reflected by the range of authors, from 21 International Poplar Commission member countries and the Russian Federation.

It is with appreciation that the efforts of the National Poplar Commission personnel is recognized for submitting Country Progress Reports in compliance with the general textual and statistical guidelines, which facilitated preparation of the global synthesis. Jim B. Ball, Alberto Del Lungo, and Michèle Millanès, FAO consultants, provided professional services in authorship, statistical compilation and editing services respectively. The communications with National Poplar Commissions were efficiently coordinated by the IPC administrative assistant, Graciela Andrade (FAO). Ms Marion Lespine and Mr Fernando Barrientos provided quality translation services in French and Spanish languages, respectively, at very short notice.

To all persons who contributed to this publication, the International Poplar Commission and its members, we express our grateful thanks.

FOREWORD

Globally there are about 70 million hectares of natural associations of Poplars and Willows and about 7 million hectares of planted forests and trees outside forests (including agroforestry). Poplars and Willows are among the fastest-growing trees in temperate regions and are easy to cultivate and form an important component of forestry and agricultural systems, often for small-scale farmers. They provide a wide range of wood products (industrial roundwood and poles, pulp and paper, reconstituted boards, plywood, veneer, sawn timber, packing crates, pallets, furniture etc); non-wood products (fodder, fuelwood/bio-energy, etc); and services (shelter, shade, conservation and protection of soil, water, crops, livestock and dwellings). Poplars and Willows play an important role in phyto-remediation of severely degraded sites, rehabilitation of fragile ecosystems (including combating desertification), forest landscape restoration, often integrated with agriculture, horticulture, viticulture and apiculture and as fast growing species are effective at sequestering carbon. They create employment, boost exports and contribute to social and economic development and sustainable livelihoods in rural areas.

Country Progress Reports were submitted by IPC member countries, Argentina, Belgium, Bulgaria, Canada, Chile, China, Croatia, Egypt, Finland, France, Germany, India, Italy, the Republic of Korea, New Zealand, Serbia & Montenegro, Spain, Sweden, Turkey, United Kingdom and the United States of America as well as the Russian Federation as a non-IPC member. These reports reflect topical issues and statistics in Poplar and Willow culture and use.

The main aim of this *Synthesis of Country Progress Reports: Activities Related to Poplar and Willow Cultivation and Utilization, 2000 through 2003* is to summarize issues, highlight status and identify trends affecting cultivation, management and utilization of Poplars and Willows in temperate and boreal regions of the world. A secondary purpose is to draw the attention of IPC members and individuals to the rich diversity of expertise and experience documented in the Country Progress Reports.

This *Synthesis of Country Progress Reports: Activities Related to Poplar and Willow Cultivation and Utilization, 2000 through 2003* (Working Paper IPC/3) should be read in association with *Publications Listed in Country Progress Reports* (Working Paper IPC/4), a comprehensive listing of reference documents released during 2000-2003. These reports will facilitate transfer of new knowledge and technology to strengthen capacity and capability for less developed countries to define new roles and take actions to make greater contributions of Poplars and Willows to sustainable forestry and rural development.

Working Papers IPC/3 and IPC/4 are available on the FAO website:
http://www.fao.org/forestry/ipc.

Jim Carle
Secretary
International Poplar Commission

INTRODUCTION

The main aim of this synthesis is to attempt to identify trends and issues affecting poplar and willow culture and use concerning member, and one non-member, countries of the International Poplar Commission (IPC). A secondary purpose is to draw the attention of IPC members and individuals to the rich diversity of experience documented in the national reports, which will be available in hard copy at the Session and also on the IPC website http://www.fao.org/forestry/site/ipc.

Twenty one member countries of the IPC reported (24 in 2000), and the Russian Federation, a non-member country.

In developing the synthesis of these reports, only activities actually carried out during the period since the last Session (Portland, USA, September 2000) have been included; reported plans for the future have, on the whole, not been included. A note has been included where trends have been confirmed by the numbers of voluntary papers submitted for this Session of the IPC to a particular Working Party.

The synthesis follows the format of the National Report Guidelines, except that the list of publications in each national report has been extracted and has been published separately as Working Paper IPC/4. The synthesis will be presented to the IPC 22nd Session in plenary on 2nd December 2004, and will also be posted on the IPC website.

I. POLICY AND LEGAL FRAMEWORK

Most of the IPC member countries which are also members of the European Union (EU) have reported major changes in European Council regulations which affect poplar plantations:

- The previous decree #2080 of 1992 for support for the afforestation of agricultural land came to an end in 2000;
- A new regulation #1257 of 1999 concerning support for rural development came into effect, valid from 2000 to 2006. Certain forestry (including poplar) activities are eligible for support. **Belgium, France** and **Spain** reported the adjustment of national policies and the passing of national laws to implement the new regulation;
- A new regulation, #105 of 1999, on the marketing of forest reproductive material, affecting poplars and poplar hybrids but not willows, was implemented by European countries. The three countries above, as well as **Finland, Germany** and **Italy**, have reported on this, as did **Turkey** in the context of national regulation of clonal quality control.

Of the ten countries which have recently joined the EU, only **Hungary** is a member of the IPC. The adjustments that the ten countries will have to make on accession to the EU were discussed at the First International Conference on the Future of Poplar Culture, held in Rome in 2003 (see Section IV.3). **Bulgaria** reported changes in national policies and laws affecting poplar growing and use to prepare for accession to European standards.

Canada reported that the Provinces had jurisdiction for regulations governing forest management on the one hand, and agriculture on the other. There were, however, some provisions which may restrict poplar cultivation. In British Columbia, for example, poplars intensively cultivated in plantations are considered primary agricultural production, with favourable tax treatment, but only up to 12 years of age – which is before the culmination of mean annual increment especially when grown for saw logs or peelers. Other Provinces do not have policies or fiscal measures to promote poplar planting, but some, such as Ontario, have more favourable treatment for managed forestland which is not necessarily favourable to the

growing of poplars. Québec Province was reported to restrict the planting of tree crops on prime agricultural land. The **United Kingdom** reported that Government support focused on social, environmental and amenity benefits and that there is no current grant system to support agroforestry.

In relation to the removal of land from agriculture under "set-aside" programmes, the **Republic of Korea** noted that the prohibition of agricultural protection under the Doha Round of the World Trade Organization (WTO) could lead to more land becoming available for poplar plantations.

All willow plantations in **Sweden** are subsidized by the Government, but it was reported that the rules are changing almost every year, which makes it difficult for long-term planning by farmers proving an obstacle for the further development of energy forestry. Without subsidies, the Swedish report states that there would be no energy forestry. The **United Kingdom** reported that policies to encourage greater uptake of renewable energy by the electricity generating and supply industry were creating an improved market for woodchips from short rotation coppice, currently dominated by willow.

Environmental restrictions on the cultivation of poplars have been noted in previous Syntheses. **Belgium** reported uncertainties for forest owners arising from such actions, following the delineation of the Flemish Ecological Network where nature conservation has absolute priority. Forty-three percent of the Flemish poplar plantations are located within the network and it is unclear whether in the long term poplar plantations have to be transformed into forests composed of native species, or even into non wooded areas, such as flower-rich grasslands. **France** has translated international engagements into national regulations, notably those concerning sustainable management and the multi-functional character of forests arising from the Ministerial Conference on the Protection of Forests in Europe (MCPFE). The national report noted that this could lead to an important impact on the area of poplar plantations in France, notably where there is conflict for land use between the maize and poplar growers and associations for the protection of the environment.

China reported plans to expand wood pulp production significantly, with associated plantations which will include poplar species. Six other tree planting projects for wood production and shelter, which will include poplars and willows, began in 2002; these plantations will accelerate the move of wood supply from natural forests to plantations.

Argentina noted that the national economy started to recover from 2003, with positive impact on forestry projects. A World Bank project had recently started, which included technical assistance. The effects of the terrorist attacks in New York in September 2001 had a major impact even on the growing of poplars and willows in the **United States of America**. The weaker economy led to major federal and state cuts for research and development, and reductions in support from forest industry. On the other hand, lower interest rates led to a surge in house-building with increased demand for poplar-based composite board. There has been too an increase in funding for environmental purposes, reported in Section III, including agroforestry, a forest-based climate–change study and phyto-remediation.

The **United States of America** was the only country to report that most companies growing poplar in block plantations were participating in the Forest Stewardship Council (FSC) certification programme in order to "remain competitive and to be more environmentally conscious".

II. SUMMARY STATISTICS

Statistics related to poplar and willow cultivation and management are detailed in the Annex. These tables include some information drawn from reports to the First International Conference on the Future of Poplar Culture, 2003, held in Rome, Italy.

1. Natural forests and other wooded land

Table 1 shows the natural poplar and willow areas by purpose, as reported to the IPC in 2004.

The total reported area of natural poplars is over 70 million ha, 97 percent of which occur in **Canada** (28.3 million ha at 2001 base year), the **Russian Federation** (21.9 million ha) and the **United States of America** (17.7 million ha at 2003 base year). These three countries report that the main purpose of these natural forests is wood production. **China**, which has the fourth largest area of naturally occurring poplars (2.1 million ha), reports that the main purpose of management of these forests is environmental, as do the next five countries in terms of naturally occurring poplars: **Germany** (100 000 ha), **Finland** (67 000 ha), **France** (39 800 ha), **India** (10 000 ha) and **Italy** (7 200 ha).

It was, however, noted that these reported area figures have greatly increased in two countries since they reported to the 21st Session of the IPC due to new survey figures. **Canada**, for example, then reported 17.8 million ha, based on 1991 figures, while the **United States of America** reported 8.75 million ha – plus large areas growing outside the surveyed forest area. **China** reported about 3 million ha in 2000.

In 2000 only two countries reported areas of naturally occurring willows – **Romania** (18 500 ha) and **Croatia** (6 600 ha). The number of reports has greatly improved in 2004. Most of the area of naturally occurring willow was reported from the **Russian Federation** (2.85 million ha), followed by **France** (66 600 ha), **China** (60 000 ha), **Italy** (35 100 ha) and **Croatia** (6 700 ha). Several other countries reported that natural willow occurred, usually in mixture, but was not included in national inventories e.g. **Canada**, **Chile**. In the last-mentioned, it is an important resource for domestic and artisanal use in rural areas.

Table 2 details species composition of natural poplar and willow stands without an indication of relative importance of each species.

2. Planted forests and trees outside forests, including agroforestry

Tables 3 and 4 show the areas of poplar and willow plantations respectively as reported to the IPC in 2004 for wood production or environmental purposes, and in block plantations or agroforestry systems.

The global reported area of planted poplar was 6.7 million ha, of which 3.8 million ha (56%) were planted primarily for wood production and 2.9 million ha for environmental purposes. Thirty percent of the total reported area of plantation was established in agroforestry systems, and 40 percent of the global wood production area was from agroforestry systems.

China reported most planted poplar overall (4.9 million ha, or 73 percent of the global total) and in both categories – plantations for wood production comprised 53 percent of the global wood production total and nearly all of the environmental, while making up 49 percent of the plantations established in agroforestry systems. **India** reported also 49 percent of the total of agroforestry plantations, and with 1 million ha contributed the second largest area of poplar plantations. In 2000, **India** reported approximately 40 000 ha, and 26 400 ha in 1996.

Other countries which reported significant areas of planted poplar included **France** with 236 000 ha (253 700 ha in 1998 and 245 000 ha in 1993), **Turkey** with 130 000 ha (145 000 ha in 2000, 157 000 ha in 1996), and **Italy** with 118 800 ha (118 800 ha in 2000). **Argentina** reported 63 500 ha of poplar plantations, while **Chile** reported 15 000 ha.

The global area of planted willows was 176 000 ha, of which 90 000 ha were for wood production (51%) and the balance for environmental purposes. Few countries established willows in agroforestry systems, except for **New Zealand**.

Most of the planted willow is in **China**, 80 000 ha, followed by **Argentina**, 46 000 ha, **New Zealand,** 20 100 ha, and **Sweden,** 15 100 ha. **Argentina** has the largest area of production plantations of willow, 46 000 ha, followed by **China**, 21 000 ha, and **Sweden**, 15 000 ha (for renewable energy). **Romania** submitted a report in 2003 to the First International Conference on the Future of Poplar Culture (Italy) in which it reported 24 200 ha of planted willow. **China** has the largest area of willow planted for environmental purposes (59 000 ha), planted as an anti-desertification measure, followed by **New Zealand**, 20 000 ha for river bank stabilization.

3. Production trends

Tables 5 and 6 detail the annual removals from natural forest associations and planted forest, agroforestry and trees outside forests, respectively. Reported annual removals from natural stands of poplar were significant in only the **Russian Federation** (100 million m^3) and **Canada** (16 million m^3).

Only the **Russian Federation** reported significant removals of willow from natural stands, of 15 million m^3 yearly.

Five countries reported annual removals of more than 1 million m^3 of poplar wood from planted forests - **Turkey** (3.8 million m^3), **China** (1.85 million m^3), **France** (1.8 million m^3), **Italy** (1.4 million m^3), and **India** (1.2 million m^3). All of the outturn of **India** came from agroforestry systems. Agroforestry production was also significant in **Italy** (0.5 million m^3), and **China** (0.2 million m^3).

Argentina reported removals of planted willow of 340 000 m^3/year, and **Bulgaria** reported 311 000 m^3/year.

4. Area trends

Table 7 details area trends in poplar and willow formations, including natural forest associations, planted forests and agroforestry/trees outside forests.

Increases in natural poplar associations were reported for **China,** the **Russian Federation** and **Croatia**. Decreases were reported in **Belgium**, **Bulgaria**, **Germany**, **Serbia & Montenegro,** and the **United States of America**.

Increases in natural willow associations were reported for **China**, **Croatia** and **Spain**. Decreases were reported in **Bulgaria**, **Germany**, the **Russian Federation,** and **Serbia & Montenegro**.

Increases in planted poplars were reported for **Argentina**, **Canada**, **China**, **Finland**, **France**, **Italy**, **Spain**, the **United Kingdom,** and the **United States of America**. Decreases were reported for **Belgium**, **Croatia**, **Germany**, the **Russian Federation**, and **Turkey**.

Increases in planted willows were reported for **Argentina**, **Belgium**, **China**, **Sweden** and the **United Kingdom**. Decreases were reported for **Bulgaria**, **Croatia**, **Germany**, the **Russian Federation**, and **Spain**.

Areas of poplars in agroforestry/trees outside forests increased in **Bulgaria**, **Canada**, **China**, **Germany**, **Serbia & Montenegro**, **Spain**, and the **United States of America**. Decreases were reported in **Belgium** and **Turkey** only.

Areas of willows in agroforestry/trees outside forests increased in **Bulgaria**, **China**, and the **United States of America**, and decreased in **Belgium** and **Germany** only.

5. Main products

Table 8 details, primarily for poplars, the main forest products in order of economic importance (priorities ranked 1 to 8) for each country.

Pulp, paper and cardboard was the most favoured end use in Europe (**Belgium**, **Finland**, **Serbia & Montenegro** [1]; **Bulgaria, Croatia, France, Germany, Italy** [2]; and **Spain** and the **United Kingdom** [3]), North America (**Canada** and the **United States of America** [1]); **China** [1] and **Argentina** [1].

Packaging (pallets, boxes and crates) was also a favored end use in Europe (**Bulgaria, France** and the **United Kingdom** [1]; **Belgium, Serbia & Montenegro** and **Spain** [2]; and **Croatia, Finland, Germany** [3]), **Republic of Korea** and the **Russian Federation** [2]; and **Canada, China** and **India** [3].

Reconstituted wood panels were the favoured end use in **Germany** [1]; **Argentina, Canada** and the **United States of America** [2]; and **Bulgaria** and **Italy** [3].

Plywood was the favoured end use in **India, Italy** and **Spain** [1]; **China** and **Turkey** [2]; and **France, Serbia & Montenegro** and the **United States of America** [3].

End use for matches was favoured in **Chile** and the **Russian Federation** [1]; **India** [2] and the **Republic of Korea** and **Sweden** [3].

Furniture manufacturing was generally ranked as a lower priority by most countries, however of economic importance in **Belgium** and **Chile** [3].

Fuelwood or production of biomass for energy was generally ranked as a lower priority by most countries, however of economic importance in **Sweden** and the **United Kingdom** [2] and **Turkey** [3].

"Other" end uses for lumber and general construction were reported as priorities in **Turkey** [1]; **Finland** [2] and **Argentina** [3]; handicrafts and wicker work in **Chile** [2] and the **Russian Federation** [3]. The **Republic of Korea**, **Serbia & Montenegro** and **Sweden** [1] higlighted that their principal purpose for their poplar and willow resources was for environmental or conservation purposes, thus providing valuable services rather than forest products.

6. Main cultivars in use

Table 9 shows the main cultivars reported by member countries. The cultivars were ranked from the most planted to those less planted. There is no indication of the proportion of the current national planting programme, or of the existing area, established to each cultivar so it is not possible to give a true estimate of the importance of each cultivar in terms of present use.

Populus euramericana cultivars were mentioned by many countries, including **China,** the **Republic of Korea** and **Turkey** where they are the main cultivars planted. I-214 is mentioned as being important by European several countries. Cultivars of *P. deltoides* are most important in **Argentina**, **India** and **Serbia & Montenegro**.

Hybrids of *Salix matsudana* and the unhybridized species were mentioned as being important by **China** and **New Zealand**, and of *S. babylonica* with *S. alba* by **Argentina**.

7. Ownership

The ownership status in percentage of poplars and willows growing in natural forest and plantations is shown in Tables 10 and 11, further broken down into natural forest or plantations, and into the purpose.

The table below shows the percentage ownership of the four countries with the greatest areas of natural poplar forest by percentage.

	Production			Environmental		
	Public	Corporate	Small holders	Public	Corporate	Small holders
Canada	80	n.a.	n.a.	n.a.	n.a.	n.a.
Russian Federation	95	5		95	5	
USA	37	6	57	50	25	25
China	53	28	19	91	5	4

The natural poplar resource managed for environmental purposes in these countries, and others reporting, is generally in public ownership, while the picture is less clear for the natural poplars grown for wood production.

The largest reported area of natural willow forests is in the **Russian Federation**, which are presumed to be in public ownership. In **France** the natural willow forests are in private ownership, divided between small and corporate owners.

A constraint to the interpretation of these figures is that Tables 10 and 11 do not show the actual areas of natural forest devoted to environmental and production purposes, only a relative ranking.

The figures for poplar plantations for wood production purposes of the five countries with the largest areas of poplar plantation are shown in a table below by percentage.

	Plantation			Agroforestry		
	Public	Corporate	Small holders	Public	Corporate	Small holders
China	57	34	9	51	38	11
India						100
France	1	99				
Turkey			100			
Italy	10.7		89.3			

Neither the five countries, nor the others in Tables 10 and 11, show any linkage between ownership and the type of economy – free market, or centrally planned - although there appears to be a trend towards ownership by small holders.

The table below shows the ownership of planted willows for production or environmental purposes in the four main countries by percentage.

	Plantation			Agroforestry		
	Public	Corporate	Small holders	Public	Corporate	Small holders
China						
(production)	50	12	38	88	3	9
(environmental)	88	3	9	100	-	-
Argentina						
(production)		70	30			
New Zealand						
(environmental)						100
Sweden						
(production)			100			

III. TECHNICAL INFORMATION

1. Identification, registration and varietal control

Belgium reported the registration of four new clones of *Populus deltoides*, **China** 20 new varieties, **India** six new clones, and **Serbia & Montenegro** registered two, all of the same species. **Belgium** reported five promising clones of a cross of *P. trichocarpa x P. maximowiczii*. **Italy** provisionally reported 14 new clones – nine for wood production, and five for short rotation energy supply.

France reported a new list of 44 registered poplar cultivars. The report from **Belgium** draws attention to the need to maintain old cultivars, whose performance may be re-evaluated in the future, a position supported by **France** which stresses that there exists the risk of the disappearance of cultivars now excluded from the list of cultivars registered for commercial use. **France** refers to the reference collection of poplar cultivars in **Germany**, used for testing of new clones, with which France is collaborating.

The **United States of America** drew attention to the most up-to-date overview of the genus *Populus*, its taxonomy, and the characteristics of commercial poplar clones and cultivars in the book *Poplar Culture in North America* by Dickmann, D.I. *et al* (2001). The most up-to-date overview of willow taxonomy and clones planted in the United States was given by Kopp *et al* (2001).

2. Cultivation

Few developments in nursery practices or propagation techniques have been reported, although **Italy** reported on improvements to reduce the cost of chemical application. Countries have included details of bio-technology under III.3 - Selection and breeding (below).

Many countries included details of existing techniques for the establishment of planted forests but few new developments were reported. **Argentina** reported several new and on-going experiments on cultivation. **China** reported new cultivation techniques for the pulpwood

plantations reported in Section I. **Croatia** reported that most land now available for block plantations is land marginal for agricultural production. **France** described an experiment on the stability of poplar stands related to cultivar and site conditions, following the devastating storm of 1999; the results could offer an explanation of the different performance of cultivars under the effects of wind. **Italy** reported on the conclusions of growth and yield studies initiated in the early 1990s on three clones in five sites. **Italy** also reported a trend towards wider planting distances.

Herbicides are in general use in many developed economies. For example, **Canada** established an Herbicide Working Group to expand the range of available herbicides for use in short-rotation-intensive culture hybrid poplar plantations. **Turkey** initiated studies on the economics of block plantations.

The **United States of America** reported a return to fundamental principles of matching clone to site. "The major changes that are occurring include the realization by industry that the poplar material must be adapted to the area to be planted. In the past there was a belief by many that certain poplar and willow clones could be grown universally. As a result there has been a reemphasis on regional testing of new clonal material in the different regions". The United States of America also reported a trend toward widespread plantations to develop large piece size for solid wood products, which have higher value.

Natural forest management was reported by some countries. **Bulgaria** reported on the management of the riparian forests of several islands in the river Danube, differentiated into natural parks and reserve zones, while there was also substantial interest in flood plain forests. **China** reported measures to save the remaining areas of *Populus euphratica*. **Croatia** reported that management was practised in areas of natural forest which, as in several other countries, were often mixed with other species. **Egypt** reported that *Populus euphratica* grew naturally in newly reclaimed lands which suffer from salinity, where the produce is used for local consumption as fuel wood. **Turkey** described natural forests of about 7 000 ha mainly of *Populus tremula*. Some natural stands of *Populus euphratica* occurred in South and South-east Anatolia.

Mostly positive experience was reported in agroforestry and the growing of trees outside forests. **Argentina** and **Bulgaria** reported on extension activities. **Egypt**, in reporting on its long-standing linear plantations of *Populus nigra, P. alba, P. euramericana*, also stated that some owners have begun to plant poplars on farms. In **India**, however, where there has been for some time an agro-forestry programme of over 30 000 ha in certain States to supply veneers for matches and plywood, it was reported that prices were falling, leading to a reduction in the numbers of poplars planted in 2003. **New Zealand** reported work to encourage the use of poplar and willows for fodder. Guidelines have been developed for the management of trees for forage production and other related topics.

The **United States of America** reported that there has been a surge in the importance given to agroforestry. At least six major agroforestry centres that plant poplars and willows were operating, with the goal of promoting good stewardship of the land and along streams. There has been too an increase in funding for agroforestry schemes to plant trees along streams and rivers to prevent soil erosion, agricultural chemical runoff, enhance wildlife habitat and provide bio-energy and wood products for the rural economy. This funding is aimed at improving an impending crisis of hypoxia in the northern Gulf of Mexico created from runoff from Midwestern agricultural regions.

3. Selection and breeding

As usual, most voluntary papers to this Session of the IPC have been to the Working Party on Poplar and Willow Genetics, Conservation and Improvement.

Several countries reported work on gene-mapping. Among others, **Belgium** reported that a genetic map had been prepared for a cross of *Populus trichocarpa x P deltoides*, while AFLP (Amplified Fragment Length Polymorphism) maps had been constructed for *P. deltoides*, *P. nigra* and *P.trichocarpa*. These pedigrees, the report stated, "offer a resource of large significance for mapping and marker-assisted selection." **China** reported on a genetic linkage map and QTL (Quantitative Trait Loci), genetic engineering to include various genes conferring resistance to insect attack and diseases. Two academic research groups in **Canada** were reported to be involved in studying *Populus* (and *Picea*) genomics. Their purpose was to understand the function of genes that control forest health and wood formation in forest trees. Both groups drew on a wide range of national and international collaborators and partners[1]. **France** reported on-going work under the programme POPYOMICS, specifically in relation to tree breeding of *Populus deltoides* for resistance to *Melampsora larici-populina* but also for the better management of genetic diversity. In addition, a great deal of research is being done into biotechnologies related to the metabolism of lignins, studies on the formation of wood, such as the identification of genes involved in the formation of tension wood, etc. **Germany** reported studies on transgenic aspen clones. The **Republic of Korea** reported work on gene sequencing and genetic transformation. **Spain** analyzed the diversity of *Populus nigra* populations in the Ebro river basin using molecular markers. The **United States of America** reported that there has been a dramatic increase in research funding for poplar genomics and as a result the International *Populus* Genome Consortium announced that the genome of a *Populus trichocarpa* pedigree had been sequenced and that quaking aspen *Populus tremuloides* was nearly completed.

Both **India** and **China** submitted several voluntary papers on genetic mapping and variability to the relevant Working Party.

Egypt reported that *Salix viminalis*, *S. papylonica* and *S. tetrasperma* were being investigated for genetic polymorphism, in addition to external morphology and description. The **United Kingdom** reported that an important five-year project had recently started to improve poplar and willow short-rotation coppice through breeding and genomics.

(a) *Aigeiros* section (*P. deltoides*, *P. nigra*, *P. euramericana*)

Most interest in this Section is on *Populus nigra*, where many European countries reported their activities under the European Forest Genetic Resources Programme (EUFORGEN) programme of the International Plant Genetic Resources Institute (IPGRI) and the EU-funded EUROPOP (which concluded in 2001). Continuing conservation *ex situ* was reported from several countries – **Belgium**, **Croatia**, **France** and **Serbia & Montenegro**, while *in situ* conservation was reported by **France** and **Serbia & Montenegro**.

Recent collections have been made by **Croatia** on the Sava, Drava and Mura rivers while in the Danube river basin selection will begin since this terrain is partly inaccessible although it represents the most valuable marshland forests region of European black poplar. **Spain** completed the investigation of natural populations of *P. nigra* in the mid-Ebro valley. **Turkey** discovered new natural populations of *P. nigra* in Anatolia; work will continue into the natural distribution in Anatolia.

Belgium reported research on the effects of exotic poplar plantations on native black poplar. **New Zealand** reported selections which have been made from crosses between species in the Aigeiros and Tacamahaca sections.

[1] It was subsequently reported that the poplar genome had been mapped – see the following website: http://www.sciencedaily.com/releases/2004/09/040922073048.htm.

(b) *Leuce* section

Most reports concerned work on *Populus alba*. **India** carried out natural variation studies on *P. alba.* **Spain** reported on-going work (with the Center for International Forestry Research (CIFOR)) which has recently concentrated on a study of its genetic diversity using molecular markers and on salt tolerance of different populations in various hydro-geographic areas. In **Turkey** another study was started in 2004 to determine *Populus alba* clones which were resistant to extreme site conditions and selection of *Populus alba* individuals was started throughout Turkey.

Italy reported extensive work on *P. alba* as a model species for the application of various techniques based on recombinant DNA, along six main lines of work.

The **Republic of Korea** reported that intensive research has continued on *P. davidiana*, and **Finland** reported that 17 field trials of aspen (*P. tremula*) and hybrid aspen (*P. tremula* x *P. tremuloides*) were established in the period 1998 – 2002, to compare 55 hybrid aspen and five aspen clones at different sites for growth characteristics, resistance and wood quality.

(c) *Tacamahaca* section (e.g. *P. ciliata, P. trichocarpa*)

China reported crosses of *P. deltoides* with *P. cathayana*. The only other report in this section was from **India**, where natural populations of *P. ciliata* have been screened for trees resistant to *Melampsora*.

(d) Other sections

China reported crosses of *P. euphratica* with *P. simonii* and *P. euphratica* with *P. nigra*.

(e) Willows

Argentina reported that a willow improvement programme had re-started, while **China** reported on its ongoing breeding programme. In **Belgium** the emphasis in the willow breeding programme was on indigenous tree-forming willows, namely *Salix alba* (White willow), *S. fragilis* (Crack willow) and their hybrids *S.* x *rubens* and *S.* x *rubens* var. *basfordiana*. Research was conducted into resistance to *Brenneria salicis* (Watermark disease), inter- and intra-specific crossings, and use and technology of willow wood. **Chile** reported the evaluation of species and cultivars of tree-forming willows for artisanal use, principally sub-genere *Vetrix* and *Salix,* obtained from local populations and imported clones and cultivars. **Croatia** reported that selection of arborescent willows had been carried out in the natural populations, and that work was done on intra species hybridization. *Salix matsudana* was used as the partner to the inter-species hybridization of the autochtonous white willow.

In **New Zealand** the willow breeding programme continued, largely to improve willow resistance/tolerance to the sawfly, *Nematus oligospilus.* Seedlots of *S. lucida* var. *lasiandra* were collected in northern California and southern Oregon (USA) in 2000, for evaluation of sawfly resistance and performance in New Zealand conditions. In **Sweden** the collection of *Salix* species and clones, which started 30 years ago, continued, but now by a private company.

4. Forest Protection

This Section concerns reports on the incidence and impacts of damage in poplars and willows by biotic and abiotic agents:

(a) Biotic factors, including insects, diseases and other animal pests, and economic aspects, success of control measures undertaken and damage prevention in the future

Diseases. Many national reports describe progress – or sometimes lack of progress – in controlling the poplar rust *Melampsora larici-populina*. **Belgium** has continued major study on the importance and distribution of poplar rust in the Walloon Region from 1999 to 2003 and characterization of the *Melampsora larici-populina* races. The results confirm the diversity and the continuing evolution of the *Melampsora larici-populina* rusts. The analyses also discovered new virulent types. Studies continued on breeding and selection of poplars for resistance to *M. larici-populina*. **Canada** reported, in Québec Province, the first recorded occurrence of *Melampsora larici-populina* in a nursery. **Croatia** reported that since the disease occurs in the latter part of the growing season, it does not represent a significant danger. **France** reported that the period has been characterized by the systematic development of important attacks of poplar rust, which has led to a reduction or halt in the use of susceptible cultivars. Research has continued into the recognition of pathogens to the rust, and resistance of species and cultivars of poplar to the rust, among others. **India** reported the disease on *P. ciliata*, and noted the most and least susceptible clones. **Italy**, which presented data relevant to the climatic variation and moisture stress from 2000-03, reported that the situation had remained the same as in the previous period. **Serbia & Montenegro** reported that 2001 and 2004 were very favourable for the spread of leaf diseases in general.

Marssonina brunnea is another foliar disease figuring in national reports. **France** reported clonal tests for resistance, **Italy** noted low levels of infection in 2001 and 2003, while **Serbia & Montenegro, Spain** and the **United States of America** reported attacks. **Croatia** and **Serbia & Montenegro** reported significant damage from bacterial cancer, *Xanthomonas populi*, while **France** reported the evaluation and selection of material for resistance. **Argentina** reported on the importance of attack from *Septoria musiva* stem canker, and **Canada** reported that disease has been spreading into areas where it was previously not present, but the **United States of America** stated that native cottonwoods are for the most part resistant to *Septoria*, thus providing opportunities for breeding for resistant hybrids.

Insects. **Argentina** reported that *Platypus sulcatus* caused significant damage to poplars and that work to find control methods was continuing while **Italy** reported that a potential threat to poplar cultivation was represented by the recent introduction to a restricted area of central Italy of *Platypus mutatus*. **Chile** reported that the main damage to poplars is caused by *Tremex fusicicornis*, which affects weakened trees. **France** reported continued and spreading massive attacks of *Phloeomyzus passerinii*, but noted that different cultivars showed varying susceptibility to attack. **India** reported that the poplar defoliator, *Clostera cupreata,* is considered the most damaging pest of poplar; it has inflicted large scale defoliation specially to *Populus deltoides* which has been planted in large areas in three of the main poplar-growing Provinces. **Italy** reported that 30 percent of the total national cost of poplar phytosanitary protection was spent on the control of the borer *Cryptorhynchus lapathi*. **Serbia & Montenegro** reported that there had been large scale attacks of gypsy moth, *Porthentria dispar*, in 2000, 2001, 2003 and 2004. **Spain** mentioned continuing, but controlled, attacks of *Paranthrene tabaniformis,* as did **Italy**.

Regarding willows, **Belgium** has continued studies on the watermark disease of willows in agricultural areas. **Chile** reported serious damage by *Nematus desantini* which can cause death. **New Zealand** reported that the Willow sawfly (*Nematus oligospilus*), a sawfly that feeds exclusively on willows, has spread since its arrival in 1997 throughout the country, causing extensive defoliation to willows on the East Coast of the North Island. Together with the local government, an integrated research and management programme has been designed, covering the definition of the impact; understanding the insect; developing resistant willows; and remedies. **Sweden** summarized its experience by stating that the effects of insects were so

far relatively small, but populations of various insects could be expected to build up, now that the number and size of willow plantations has increased.

(b) Abiotic factors, including winds, floods, droughts, pollution and others, and economic aspects, success of control measures undertaken and damage prevention in the future

Bulgaria reported that over the last few years there was an increase in damage by abiotic factors. The reasons for this are long-term droughts together with the dry winds and the small amount of rainfall. **France** reported several studies on resistance to drought. The **United States of America** summarized the situation: "Given the current scenarios of concomitantly increasing levels of atmospheric CO_2 and ozone coupled to more variable and extreme weather in the next century, damage to poplars and willows by insects and pathogenic fungi is likely to escalate substantially in the future."

Sweden reported that "intensively managed willow plantation is a benevolent catering system of tasty, never-ending free meal for … moose" but that geese may help to control weeds in willow plantations, where they eat the weeds but not the trees.

Croatia stated that the price of poplar wood in many places has been reduced due to the presence of shrapnel in the wood.

5. Logging and utilization

Relatively few reports of new developments in logging and utilization were made, a trend confirmed by the few voluntary papers submitted to the Working Party on Logging and Utilization of Poplar and Willow. **Croatia** may have summed up the situation "There is more utilization rationalization … today in the organization than in technical innovation of equipment".

Many countries reported work on timber testing for studies on wood properties, paper and pulp quality, e.g. **France**, **Serbia & Montenegro**. **Belgium**, in addition to these standard tests, investigated also influence of elevated CO_2 on wood properties. **Italy** reported work on multilaminar wood (MLW) with poplar and eucalyptus. The **United States of America** reported that although poplar is still used extensively for non-stress graded lumber for a broad range of applications, there is a trend towards growing poplars for solid wood products because of the higher market value for those products.

Research into the use of wood for bio-energy has attracted attention. **France** is participating in the European project FORENERGY, which has the aim of adapting to southern European conditions two Finnish techniques for the collection of wood for energy purposes. **Belgium** continued work on biomass for energy and carbon sequestration but noted that yield and carbon uptake might be far less than the values reported for high quality sites and under favourable conditions. A lot of sites that will be available for biomass production would be of marginal quality, jeopardizing the expected benefits. Likewise, **Germany** noted that short rotation areas cannot compete financially with agricultural food production, although the case was different for set-aside areas due to government funding. However, production shortfall or volume yield reductions of only 20 percent could lead to losses. **Italy** continued work in several sites on poplar as a carbon sink, and noted that soil working negatively affects the capacity of the site to absorb carbon.

Sweden, which remains positive about the use of biomass plantations, noted that 20 percent of all energy used in Sweden came from biomass and that well-developed district heating systems were established in most cities and town. The **United Kingdom** reported that some interest was being shown by power companies in short rotation forestry, in preference to short

rotation coppice, because of the lower bark ratio in the former, which gave a cleaner burn when co-fired with pulverised coal. Poplar was a potential candidate for this market.

Basket-making continued to be an important use for willows in **Chile** while **Argentina** reported on the establishment of "Operation Salix" which had the aim of valorising willows as a forest resource. **Finland** reported that willows were studied in a project "Herbal medicine production: breeding and cultivation of Salicaceae species as raw material for herbal product industry." This project includes the study of willow clones to biotic and abiotic (climate change, UV radiation) stress.

6. Environmental uses

Environmental issues have captured political and public attention for many years. Several countries reported on new knowledge, technologies and techniques for the cultivation of poplars and willows for environmental uses, although this trend was not confirmed by the numbers of voluntary papers submitted to the Working Party on Environmental Uses of Poplars and Willows. The **United States of America** report summed up the overall situation in several countries, in stating that there has been an increased public awareness of environmental policy issues such as air and water pollution, global climate change, soil erosion and carbon sequestration. In the United States of America this awareness has resulted in hundreds of small poplar plantations for riparian buffers, wastewater treatment and reuse, phytoremediation, and some carbon sequestration.

China reported on the extensive use of poplars for shelterbelts and sand dune stabilization. The **United Kingdom** reported the use of poplar to provide shelter and ground cover for free-range chickens; the produce is sold as "Woodland eggs".

In terms of site and landscape improvement, including forestry for climate amelioration, **Canada** reported that a programme had been initiated (Forest 2020) to establish a demonstration network of fast-growing plantations, of which poplar was a major component, to establish plantations on previously non-forested lands (primarily agricultural lands) as a method of carbon storage. Within the context of the recently-ratified Kyoto Protocol, one company that manages a large-scale short-rotation hybrid poplar plantation crop in Alberta has recently secured a contract with Environment Canada to sell its "*verified GHG emission reductions*" from plantations established between 2004 and 2007 which may be a pre-cursor to the carbon trading that will take effect in 2008. Furthermore, the Montreal Botanical Garden has been active in research of *Salix* (willow) species in short rotation coppice management and *Salix viminalis* achieved a biomass production of a little more than 70 tonnes of dry matter per hectare at the end of the second three-year cycle on fertilized plots - the highest woody biomass production ever reported in Canada. **France** reported studies on the effects on the soil of short and very short rotations.

Bulgaria reported willow planting on the Danube for river bank stabilization. **Chile** has reported a programme of extension for tree planting on river banks, both to stabilize them and to reduce sedimentation.

Actual or potential applications of poplar and willow planting for phyto-remediation have been mentioned in several national reports, including **Italy**. **Chile** reported that laboratory studies had been started on willows in relation to the absorption of heavy metals. **New Zealand** reported the creation of poplar clones that accumulate high concentrations of boron, a common contaminant in timber industry sites which have been used commercially for the remediation of a five-hectare wood-waste dump. **Serbia & Montenegro** reported field work on phyto-remediation using poplar for cadmium phyto-extraction. **Sweden** reported that some willow species and clones have a high potential for taking up heavy metals from the soil.

Experiments are proceeding or are planned to try to purify polluted soils by growing willow on them. The biomass will be harvested and burnt, where the heavy metals can be captured in the smoke, in the fly ash and in the bottom ash.

The potential of poplars and willows to absorb nitrogen arising from intensive livestock farming has been reported by several countries. The **Republic of Korea** reported research into the planting of poplars and willows on landfill sites, and into irrigation with livestock waste water. A project in **New Zealand** investigated the efficacy of using poplars and willows in a self-renewing, coppicing system to reduce the amount of nitrate leaching from dairy shed effluent that was normally applied to pasture. **Serbia & Montenegro** reported laboratory work on the effects of different concentrations of nitrate on growth of poplar cuttings. **Sweden** reported that research had shown that one hectare of willow plantation could take up 150-200 kg nitrogen per year.

IV. GENERAL INFORMATION

1. Administration and operation of the National Poplar Commissions

Most countries reported that their national poplar commissions continued to function and to organize meetings. **Bulgaria** reported the appointment of new members of the National Poplar and Willow Commission, **China** on the re-election of its National Poplar Commission, while **Italy** reported a revision of the Statute governing the National Poplar Commission to reduce *i.a.* the number of members. Only **New Zealand** and **Serbia & Montenegro** reported that they had no national commission, although they had made other arrangements for national representation.

Several countries reported regular or irregular meetings organized by their National Poplar Commission – examples include **Belgium**, **Canada**, **China**, **France**, **Italy**, **Republic of Korea**, **New Zealand**, **Spain**, **Turkey**, **United Kingdom**, and the **United States of America.**

2. Literature

A massive amount of literature related to poplars and willows has been published, by most countries, since the last Session in 2000. A separate Working Paper (IPC/4) of all publications, by country, has been prepared, which is also available on the IPC website.

Attention is drawn to one publication in particular, which was produced on the occasion of the 21st Session of the IPC, jointly hosted by Canada and the United States of America, in Portland, Oregon in September 2000, namely *Poplar Culture in North America*, by Dickmann, Isebrands, Eckenwalder and Richardson (National Research Press, Ottawa, 2001).

Attention is also drawn to ongoing work, not reported elsewhere, to revise the classic *Poplars and Willows*, which was published in 1979 by FAO under the auspices of the IPC.

3. Relations with other countries

Nearly all national reports include details of the strong relationships that have been maintained between members of the IPC, including joint meetings, reflecting its important "networking" function. There are too many to be individually listed.

Mention should, however, be made of an initiative by **Italy** during the period, to organize the First International Conference on the Future of Poplar Culture, hosted by the Italian National Poplar Commission with the Italian Ministry of Foreign Affairs and the Ministry of Agricultural and Forest Policies. The meeting, in collaboration with FAO and attended by many members of the IPC, was held at the headquarters of FAO, from 13 to 15 November 2003 in Rome, Italy. In summary, the aims of the Conference were to:

1. Inform decision-makers at the European and international level about the role that poplars and willows can play in social and economic development, and other functions.
2. Discuss the implications of integration of the forest sectors of the European Union (EU), candidate countries to the EU, and the broader Pan-Europe region for the forestry sector and poplar culture.
3. Outline the role of the International Poplar Commission (IPC) in providing a network to facilitate transfer of technology.

The conference participants concluded that poplars and willows had an exciting future, within an expanded European Union, for its economic, social and environmental benefits. Full details were published in a report and may also be found at the following address: http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=5441&langId=1

V. ISSUES AND TRENDS

The following section attempts to identify some of the issues and trends affecting the growing and use of poplars and willows, based on an analysis of the national reports and the voluntary papers submitted to the 22nd Session of the IPC.

- Government policies, especially in the energy and environmental sectors, have generally affected the growing of poplars and willows positively, but the effects of changes in agricultural policies may be negative.
- Overall, national reports include more mention of willow cultivation and use than previously reported.
- There is continued awareness of the value of natural stands of poplars and willows for tree improvement. Programmes for the conservation of natural poplars are strong in Europe, but are proving difficult in some countries.
- The area of planted poplars and, to a lesser extent, willows appears to be increasing globally, but decreasing or stable in Europe, increasing or stable in Asia, increasing in North America and increasing or stable in South America.
- Programmes concerning the genetic modification of poplars are being vigorously followed in many countries, both with developed and developing economies, and the poplar genome has been mapped. There is significant progress in genetic manipulation to provide resistance against pests and diseases, improve technical properties and growth and yield.
- But insect and disease attacks remain a serious cause of reductions in forest hygiene, growth and stem quality in poplars.
- The use of poplars and willows for carbon sequestration and renewable energy are developing as areas that are attracting attention in several countries.
- Phyto-remediation using poplars and willows is moving from the development to the implementation stage in several countries particularly in Europe and North America. The use of poplars for the absorption of nitrogen is attracting attention.
- Poplars and willows are increasingly used for forest landscape restoration, rehabilitation of degraded lands, and combating desertification, with particular reference to the Near East, North Africa and Asia.
- The cultivation of poplars and willows is no longer considered only a form of forestry land-use. It is increasingly seen as part of the integrated rural landscape in which these crops can contribute to sustainable livelihoods and integrated rural development, including agriculture, with livestock and cash crop production, horticulture, and viticulture.
- The planting of poplars and willows in smallholder woodlots and in agroforestry systems are contributing increasingly to land use in Asia, especially China and India, and South America.
- The utilization of poplars and willows is diversifying into a wide range of solid and reconstituted wood and fibre products.

- There have been a vast number of publications produced since 2000, reflecting the research interest in poplars and, to a lesser extent, willows.
- The number of contacts and exchanges between and within member countries of the IPC confirm strong interest in the growing and utilization of poplars and willows and suggest that the IPC is fulfilling its purpose.

ANNEX

Table 1. Natural poplars and willows area and main purpose

Table 2. Species composition of natural poplar and willow stands

Table 3. Planted poplar area by purpose

Table 4. Planted willow area by purpose

Table 5. Annual removals from natural forest associations

Table 6. Annual removals from planted forests and agroforestry/trees outside forests

Table 7. Area trends in poplar and willow formations

Table 8. Forest products in order of economic importance

Table 9. Main cultivars in use

Table 10. Ownership of forests and trees managed for wood production purposes

Table 11. Ownership of forests and trees managed for environmental purposes.

NOTE. The tables in this annex do not purport to be a comprehensive analysis of the global status and trends on poplars and willows. The information reported is valuable; however, it is incomplete and has not been validated.

Table 1. Natural poplars and willows area and main purpose

	Purpose				
Country	**Wood production**	**Environmental**	**Poplars (000 ha)**	**Willows (000 ha)**	**Mixed Poplars and Willows (000 ha)**
Canada	***	**	28 287.0	0.0	0.0
Russian Federation	***	**	21 900.0	2 850.0	0.0
United States of America	***	**	17 653.0	0.0	0.0
China	*	***	2 100.0	60.0	0.0
Germany	**	***	100.0	0.0	0.0
Finland	**	***	67.0	0.0	0.0
France	*	***	39.8	66.6	0.0
India	**	***	10.0	15.0	0.0
Italy		***	7.2	35.1	0.0
Turkey	***	**	7.0	0.0	0.0
Croatia	***	**	6.9	6.7	200.0
Bulgaria	***	**	6.3	0.0	0.0
Republic of Korea		***	6.0	0.0	0.0
Spain	**	***	0.0	0.0	36.1
Serbia & Montenegro	**	***	0.0	0.0	16.5
Overall total			**70 190**	**3 033**	**253**

Table 2. Species composition of natural poplar and willow stands

Country	Poplars	Willows	Other tree species
Canada	P. tremuloides, P. balsamifera		Picea sp. and Pinus sp.
Russian Federation	P. tremula, P. suaveolens, P. alba, P. nigra, P. laurifolia, P. maximowiczii, P. canescens, P. davidiana	S alba, S. fragilis, S. triandra, S. pentandra, S. caprea, S. viminalis, S. acutifolia, S. cinerea, S. dasiclados, S. mirsinifolia, S. purpurea, S. myrtilloides, S. glauca, S. polarica	Chosenia arbutifolia
United States of America	P. deltoides, P. grandidentata, P. tremuloides, P. trichocarpa		Betula, Fraxinus, Ulmus, Quercus, Salix
China	P.davidiana, P.euphratica	S. integra, S. gordejevii	Betula sp., Quercus sp., Alnus sp.,
Germany	P. tremula, P. alba, P. canescens		Betula
Finland	P. tremula		
France	P. nigra, P. tremula, P. alba	S. alba, S. atrocinerea, S. aurita, S. caprea, S. cinerea, S. elaeagnos, S. fragilis, S. purpurea, S. triandra, S. viminalis	
India	P. euphratica, P. alba, P. gamblei, P. jaquemontii var glauca, P. rotundifolia	S. acmophylla, S. angustifolia, S. calyculata, S. daltoniana, S. daphnoides, S. divergens, S. elegans, S. eriophylla, S. eriostachya, S. flabellaris, S. furcata, S. hastata, S. ichnostachya, S. insignis, S. lindleyana	Poplar: Quercus, Rhododendron, Abies, Cedrus, Pinus, Betula, Alnus. Willow: Quercus, Rhododendron, Abies, Cedrus, Pinus, Betula, Alnus, Juglans, Morus, Toona
Italy	P. alba, P. nigra, P. tremula, P. canescens	S. caprea, S. alba, S. viminalis , S. purpurea, S. eleagnos	
Turkey	P. tremula, P. euphratica		Quercus spp., Alnus spp., Betula spp.
Croatia	P. nigra, P. alba		Not specified
Bulgaria	P. tremula, P. nigra, P. alba, P. canescens	S. alba, S. purpurea	Q. robur, Fraxinus oxycarpa, Morus alba, Platanus orientalis, Alnus glutinosa
Republic of Korea	P. davidiana, P. glandulosa, P. maximowiczii, P. simonii, P. koreana		
Spain	P. alba, P. tremula, P. nigra	S. alba, S. fragilis, S. caprea	Alnus glutinosa, Fraxinus spp., Ulmus spp., Frangula agnus, Rhamnus alaternus, Platanus spp., Sambucus nigra
Serbia & Montenegro	P. nigra, P. alba	S. alba	F. angustifolia

Table 3. Planted poplar area by purpose

Country	Type	Wood Production (000 ha)	Environmental (000 ha)	Overall Country (000 ha)
Argentina	Planted Forests	63.5	0.0	63.5
	Agroforestry and TOF	0.0	0.0	0.0
		63.5	**0.0**	**63.5**
Belgium	Planted Forests	35.0	0.0	35.0
	Agroforestry and TOF	0.0	0.0	0.0
		35.0	**0.0**	**35.0**
Bulgaria	Planted Forests	18.6	2.0	20.6
	Agroforestry and TOF	0.0	0.0	0.0
		18.6	**2.0**	**20.6**
Canada	Planted Forests	8.3	0.0	8.3
	Agroforestry and TOF	5.9	0.0	5.9
		14.3	**0.0**	**14.3**
Chile	Planted Forests	8.0	0.0	8.0
	Agroforestry and TOF	7.0	0.0	7.0
		15.0	**0.0**	**15.0**
China	Planted Forests	1 500.0	2 400.0	3 900.0
	Agroforestry and TOF	500.0	500.0	1 000.0
		2 000.0	**2 900.0**	**4 900.0**
Croatia	Planted Forests	13.2	0.0	13.2
	Agroforestry and TOF	0.0	0.0	0.0
		13.2	**0.0**	**13.2**
Finland	Planted Forests	1.5	0.0	1.5
	Agroforestry and TOF	0.0	0.0	0.0
		1.5	**0.0**	**1.5**
France	Planted Forests	236.0	0.0	236.0
	Agroforestry and TOF	0.0	0.0	0.0
		236.0	**0.0**	**236.0**
Germany	Planted Forests	50.0	0.0	50.0
	Agroforestry and TOF	0.4	0.0	0.4
		50.4	**0.0**	**50.4**
India	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	1 000.0	0.0	1 000.0
		1 000.0	**0.0**	**1 000.0**
Italy	Planted Forests	118.8	0.0	118.8
	Agroforestry and TOF	0.0	0.0	0.0
		118.8	**0.0**	**118.8**
New Zealand	Planted Forests	0.1	0.0	0.1
	Agroforestry and TOF	0.1	10.0	10.1
		0.1	**10.0**	**10.1**
Russian Federation	Planted Forests	25.0	1.0	26.0
	Agroforestry and TOF	0.0	5.0	5.0
		25.0	**6.0**	**31.0**

Table 3. Planted poplar area by purpose (Cont.d)

Country	Type	Wood Production (000 ha)	Environmental (000 ha)	Overall Country (000 ha)
Serbia & Montenegro	Planted Forests	32.1	0.0	32.1
	Agroforestry and TOF	3.8	0.0	3.8
		35.9	**0.0**	**35.9**
Spain	Planted Forests	53.8	0.0	53.8
	Agroforestry and TOF	6.8	6.2	13.0
		60.5	**6.2**	**66.7**
Sweden	Planted Forests	0.2	0.0	0.2
	Agroforestry and TOF	0.0	0.0	0.0
		0.2	**0.0**	**0.2**
Turkey	Planted Forests	130.0	0.0	130.0
	Agroforestry and TOF	0.0	0.0	0.0
		130.0	**0.0**	**130.0**
United Kingdom	Planted Forests	1.3	0.0	1.3
	Agroforestry and TOF	0.0	0.0	0.0
		1.3	**0.0**	**1.3**
United States of America	Planted Forests	35.0	10.0	45.0
	Agroforestry and TOF	0.0	0.0	0.0
		35.0	**10.0**	**45.0**

Overall Planted Forests	**2 330**	**2 413**	**4 743**
Overall Agroforestry and TOF	**1 524**	**521**	**2 045**
Overall total	**3 854**	**2 934**	**6 788**

Table 4. Planted willow area by purpose

Country	Type	Wood Production (000 ha)	Environmental (000 ha)	Overall Country (000 ha)
Argentina	Planted Forests	46.0	0.0	46.0
	Agroforestry and TOF	0.0	0.0	0.0
		46.0	**0.0**	**46.0**
Belgium	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
Bulgaria	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
Canada	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
Chile	Planted Forests	0.2	0.0	0.2
	Agroforestry and TOF	0.0	0.0	0.0
		0.2	**0.0**	**0.2**
China	Planted Forests	20.0	59.0	79.0
	Agroforestry and TOF	1.0	0.0	1.0
		21.0	**59.0**	**80.0**
Croatia	Planted Forests	4.2	0.0	4.2
	Agroforestry and TOF	0.0	0.0	0.0
		4.2	**0.0**	**4.2**
Finland	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
France	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
Germany	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
India	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
Italy	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
New Zealand	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.1	20.0	20.1
		0.1	**20.0**	**20.1**
Russian Federation	Planted Forests	0.2	0.6	0.8
	Agroforestry and TOF	0.0	0.1	0.1
		0.2	**0.7**	**0.9**

Table 4. Planted willow area by purpose (Cont.d)

Country	Type	Wood Production (000 ha)	Environmental (000 ha)	Overall Country (000 ha)
Serbia & Montenegro	Planted Forests	0.0	1.5	1.5
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**1.5**	**1.5**
Spain	Planted Forests	1.1	0.0	1.1
	Agroforestry and TOF	0.0	4.3	4.3
		1.1	**4.3**	**5.4**
Sweden	Planted Forests	15.0	0.1	15.1
	Agroforestry and TOF	0.0	0.0	0.0
		15.0	**0.1**	**15.1**
Turkey	Planted Forests	0.0	0.0	0.0
	Agroforestry and TOF	0.0	0.0	0.0
		0.0	**0.0**	**0.0**
United Kingdom	Planted Forests	2.0	0.0	2.0
	Agroforestry and TOF	0.0	0.0	0.0
		2.0	**0.0**	**2.0**
United States of America	Planted Forests	0.3	0.0	0.3
	Agroforestry and TOF	0.0	0.0	0.0
		0.3	**0.0**	**0.3**

Overall Planted Forests	**89**	**61**	**150**
Overall Agroforestry and TOF	**1**	**24**	**25**
Overall total	**90**	**86**	**176**

Table 5. Annual removals from natural forest associations
(thousands of m^3)

Country	Natural stands	
	Poplars	**Willows**
Russian Federation	100,000	15,000
Canada	16,000	
China	150	1
Finland	150	
Turkey	30	
United Kingdom	n.s.	n.s.
Egypt	n.a.	n.a.
Republic of Korea	n.a.	n.a.
Serbia & Montenegro	n.a.	n.a.
United States of America	n.a.	

Table 6. Annual removals from planted forests and agroforestry/trees outside forests
(thousands of m^3)

Country	Poplars			Willows		
	Planted	Agroforestry/TOF	Total	Planted	Agroforestry/TOF	Total
Turkey	3 800.0		3 800.0			0.0
China	1 610.0	240.0	1 850.0	1.7	0.3	2.0
France	1 799.0		1 799.0			0.0
Italy	911.4	515.8	1 427.1			0.0
India		1 200.0	1 200.0			0.0
Spain	691.1		691.1	15.8		15.8
Belgium	537.0	n.a.	537.0	n.a.	n.a.	0.0
Argentina	469.6		469.6	340.0		340.0
Russian Federation	300.0	80.0	380.0	2.5	7.0	9.5
Serbia & Montenegro	260.8	28.9	289.7	10.0	2.3	12.3
Bulgaria	211.8		211.8	310.9		310.9
Germany	200.0	1.0	201.0			0.0
Croatia	161.9		161.9			0.0
Chile	90.0	53.0	143.0	4.0		4.0
Canada	25.0	18.0	43.0			0.0
United Kingdom	30.0		30.0	5.0		5.0
Sweden	1.0		1.0	1.0		1.0
Finland			0.0			0.0
New Zealand	n.s.	n.s.	0.0	n.s.	n.s.	0.0
Egypt	n.a.	n.a.	0.0	n.a.	n.a.	0.0
Republic of Korea	n.a.	n.a.	0.0	n.a.	n.a.	0.0
United States of America	n.a.		0.0			0.0

Table 7. Area trends in poplar and willow formations (natural, planted and trees outside forests)

Country	Natural Poplars	Natural Willows	Planted Poplars	Planted Willows	Agrof-TOF Poplars	Agrof-TOF Willows
Argentina			>	>		
Belgium	<	=	<	>	<	<
Bulgaria	<	<	=	<	>	>
Canada	=		>		>	
Chile		=	=	=	=	=
China	>	>	>	>	>	>
Croatia	>	>	<	<		
Egypt	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Finland	=		>			
France			>			
Germany	<	<	<	<	>	<
India	=	=	=	=	=	=
Italy			>			
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Republic of Korea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Russian Federation	>	<	<	<	=	=
Serbia & Montenegro	<	<	=	=	>	=
Spain	=	>	>	<	>	=
Sweden				>		
Turkey	=	=	<	=	<	
United Kingdom	=	=	>	>		
United States of America	<	=	>	=	>	>

Note:
">" indicates a Positive trend
"<" indicates a Negative trend
"=" indicates a Stable trend

Table 8: Forest products in order of economic importance

Country	Pulp, paper, cardboard	Reconstituted wood panels	Plywood	Matches	Packages (pallets, boxes, crates)	Furniture (made of solid wood, not industrial panels)	Fuelwood (including biomass for energy)	Other (specify)
Argentina	1	2	4	5	6	7	8	3 (sawing)
Belgium	1	4	5	7	2	3	6	
Bulgaria	2	3	4	8	1	5	6	7 (sawing)
Canada	1	2			3			
Chile			5	1	4	3	7	6 (sticks) 2 (furniture and handicraft products)
China	1	5	2	7	3	4	6	
Croatia	2	-	5	-	3	4	6	1
Egypt	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Finland	1				3			2 (constructions)
France	2		3		1	4		
Germany	2	1	4	7	3	5	6	
India	4	6	1	2	3	5	7	
Italy	2	3	1	7	4	5	6	
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Republic of Korea	6	7	8	3	2	5	4	1
Russian Federation	4	5	8	1	2	6	7	3 (wicker work and tannin)
Serbia & Montenegro	1		3		2		4	
Spain	3	4	1	5	2	7	8	6 (sticks)
Sweden	4			3			2	1 (vegetation filters)
Turkey	6		2		5	4	3	1 (construction)
United Kingdom	3	6	4	7	1	5	2	
United States of America	1	2	3		5		4	6 (environmental)

Table 9. Main cultivars in use

Country	Poplars	Willows
Argentina	Populus deltoides cv.I 72/51 Catfish 2, A129/60	Salix babylonica x Salix alba cv. 131/27; S. babylonica var. Sacramenta
Belgium	Most used: Koster, Muur, Vesten, Oudenberg, Grimminge; Less used: Hoogvorst, Hazendans, Ghoy, Gaver, Robusta, Isières, Raspalje, Beaupré, Boelare, Ogy	
Bulgaria	I 214; I 45/51; P. Agathe; BL; P. Robusta; PMC	Bg 2/64; R 204; R 202
Canada	Too many to list. Every region and company uses different varieties	
Chile	Populus x canadensis "I-214"; Populus x canadensis "I-488"; Populus deltoides "I-63/51"; Populus nigra "Italica" ("Chile")	Salix viminalis
China	P. ×euramericana cv. 'Neva'; P. ×euramericana cv. 'Guariento'; P. ×euramericana cv. 'DN113'; P. ×euramericana cv 'Nanlin95'; P. ×euramericana cv 'Nanlin895'; P. ×euramericana cl. 'I-214'; P. ×euramericana cv. 'Bellini'; P. ×euramericana cl. 'NE222'; P. ×euramericana cl. '74/76'; P. ×euramericana cl. 'N3016'; P. deltoides cl. 'Lux'; P. deltoides cl. 'Harvard'; P. deltoides cl. 'San martino'; P. deltoides cv. '55/65'; P. deltoides cl. '2KEN8'; P. deltoides cv. '725'; P. ×xiaohei T. S. Hwang et Liang; P. nigra; P. ×xiaozhuanica W.Y.Hsu et Liang; P.×Liaoyu'1' Y.S.Li et Y.Dong Sp.nov.; Populus deltoids cv. 'shanlin 3'; P.×Simopyramidalis chon-Lin Cv.; Populus×Liaoyu'2' Y.S.Li et Y.Dong Sp.nov; P. tomentosa Carr.; P. alba L. var. pyramidalis; Bge. P. hopeiensis Hu et Chow	S.matsudana var.anshanensis; S.× jiangsuensis; S. × jiangsuensis cv.'J799'; S. × jiangsuensis cv.'J903'; S. × jiangsuensis cv.'J 172'; S. matsdana; S. matsudana × S. alba; S. × jiangsuensis cv.'795'; S.suchowensis × S.integra cv.'JW8-26'; S.integra × S.suchowensis cv. 'JW9-6'
Croatia	I-214'; '618'; '475'; '725'; '450'; '55/56'; 'S-1-8'; 'S-6-36'; 'S-6-20'; 'Pannonia'; 'Tiepolo'; 'M-1'; 'L-12'; 'BI Constanzo'; San Martino'; 'Triplo'	107/65/6'; 'V158'; 'V160'; 'B44'; 'B72'; 'V093'; 'V052'; 'V240'; 'Mađ 40'; ' V 161'; 'MB 368'
Egypt	not available	not available
Finland	P.tremula and P. tremula x P. tremuloides	
France	'I-214'; 'Dorskamp'; 'I-45-51'; 'Ghoy'; 'Raspalje'; 'Flevo'; 'Triplo'; 'Koster'; 'Beaupré'; 'Boelare'	
Germany	Muhle Larsen; Max 1-5; Androscoggin; Beaupré; Rap	
India	G48; D121; L34/82; Uday; SLC15; WSL22; WSL39; G3; S-7C8	
Italy	'I 214'; 'BL Costanzo'; 'Boccalari'; 'San Martino'	
New Zealand	Kawa; Veronese; Shinsei; P. deltoides x P. nigra hybrids such as Argyle and Crowsnest	S. matsudana x S. alba hybrids; S. matsudana

Table 9. Main cultivars in use (Cont.d)

Country	Poplars	Willows
Republic of Korea	Populus euramericana "Eco28"; P. alba × P. glandulosa "No. 3(Clivus)", "No. 4(72-30, 72-31); P. koreana × P. nigra "Suwon"	
Russian Federation	Russian hybrids: Marilandica; Robusta; Voronezhsky Giant (Veresin); Hybrid No10 (Bogdanov)	Russian hybrids
Serbia & Montenegro	Populus deltoides, cl. "Drava" (55/65); Populus deltoides, cl. "Tisa" (457); Populus deltoides, cl. "Dunav" (S-1-8); Populus deltoides, cl. "Krka" (S-6-20); Populus deltoides, cl. "Sava" (S-6-36); Populus deltoides, cl. NS-1-3; (Populus x euramericana) x P. deltoides, cl. NS-11-8; Populus x euramericana, cl. "Panonia"	Salix alba, cl. B-74; Salix alba, cl. B-72; 3. Salix alba, cl. B-44; 4. Salix alba, cl. NS-107/6; 5. Salix alba, cl. NS-79/2; 6. Salix alba, cl. NS-73/6; Salix alba, cl. NS-107/65/1; Salix alba, cl. NS-107/65/7
Spain	I-214; Campeador; Luisa Avanzo; I-MC; I-488; Canadá blanco; Belloto; Negrito de Granada; NNDv; Beaupré	S.alba; S.fragilis; S.caprea
Sweden	Populus trichocarpa, P.deltoides	Salix viminalis; S.dasyclados; S.fragilis; S.Schwerini
Turkey	Populus Euramericana; Populus deltoides; Populus nigra	Salix alba, Salix excelsa, Salix acmophylla
United Kingdom	Ghoy; Gaver; Gibecq; Hoogvorst; Hazendans; Tricobel; Ralpaljie;	Tora; Sven; Olof; Torhild; Stott; Parfitt
United States of America	not available	not available

Table 10. Ownership of forests and trees managed for wood production purposes
(percentage of total forest (%))

Country	Forest Type	Poplars				Willows			
		Public	Private Corporate	Private Smallholder	Other	Public	Private Corporate	Private Smallholder	Other
Argentina	1 Planted forests		80	20			70	30	
Belgium	1 Planted forests	15		85		5		95	
	2 Agroforestry &TOF	15		85					
Bulgaria	1 Planted forests	89	2	5	4				
Canada	1 Planted forests	n.a.	70	n.a.	n.a.				
	2 Agroforestry &TOF		90	10					
	3 Natural	80	n.a.	n.a.	n.a.				
Chile	1 Planted forests		50	50				100	
China	1 Planted forests	57	34	9		50	12	38	
	2 Agroforestry &TOF	51	38	11			65	35	
	3 Natural	53	28	19					
Croatia	1 Planted forests	90	n.a.	n.a.	n.a.	90	n.a.	n.a.	n.a.
	3 Natural	90	n.a.	n.a.	n.a.	90	n.a.	n.a.	n.a.
Egypt	1 Planted forests	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	2 Agroforestry &TOF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	3 Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Finland	1 Planted forests			100					
France	1 Planted forests	1	99						
Germany	1 Planted forests	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	2 Agroforestry &TOF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	3 Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
India	2 Agroforestry &TOF			100					
Italy	1 Planted forests	11		89					
New Zealand	1 Planted forests			100					
	2 Agroforestry &TOF			100				100	
Republic of Korea	1 Planted forests		50	50					

Table 10. Ownership of forests and trees managed for wood production purposes (Cont.d)
(percentage of total forest (%))

Country	Forest Type	Poplars				Willows			
		Public	Private Corporate	Private Smallholder	Other	Public	Private Corporate	Private Smallholder	Other
Russian Federation	1 Planted forests	100				99	1		
	2 Agroforestry &TOF					99	1		
	3 Natural	95	5						
Serbia & Montenegro	1 Planted forests	95		5					
	2 Agroforestry &TOF	100							
Spain	1 Planted forests	11		88	1				
Sweden	1 Planted forests			100				100	
Turkey	1 Planted forests			100					
	3 Natural	100							
United Kingdom	1 Planted forests	20		80		1	5	94	
United States of America	1 Planted forests		80	20					
	3 Natural	37	6	57					

Table 11. Ownership of forests and trees managed for environmental purposes
(percentage of total forest (%))

Country	Forest Type	Poplars				Willows			
		Public	Private Corporate	Private Smallholder	Other	Public	Private Corporate	Private Smallholder	Other
Belgium	1 Planted forests					100			
Bulgaria	3 Natural	87	1	2	11				
Chile	2 Agroforestry &TOF			100					
China	1 Planted forests	95	2	2		88	3	9	
	2 Agroforestry &TOF	85	9	5		100			
	3 Natural	91	5	4					
Egypt	1 Planted forests	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	2 Agroforestry &TOF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	3 Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
France	3 Natural	3	97			2	98		
Germany	1 Planted forests	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	2 Agroforestry &TOF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	3 Natural	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
India	3 Natural	100				100			
New Zealand	2 Agroforestry &TOF			100				100	
Republic of Korea	3 Natural	100							
Russian Federation	1 Planted forests	98	2			98	2		
	2 Agroforestry &TOF	95	5			99	1		
	3 Natural	95	5						
Serbia & Montenegro	1 Planted forests	100							
	3 Natural	72		28					
Spain	3 Natural	16		83	1				
United States of America	1 Planted forests		20	80			5	95	
	2 Agroforestry &TOF		10	90					
	3 Natural	50	25	25					