INDIA

COUNTRY REPORT ON POPLARS AND WILLOWS

PERIOD: 2012-2015

NATIONAL POPLAR COMMISSION OF INDIA

Forest Research Institute
P.O. New Forest, Dehradun, Uttarakhand
INDIA
Activities Related to Poplar and Willow Cultivation and Utilisation

International Poplar Commission
25th Session, Berlin, Germany

BACKGROUND

According to the State of Forest Report 2015, the forest cover in India is 70.17 million ha or 21.34% of the total geographical area. Of this, 8.59 million ha (2.61%) is very dense forest, 31.54 million ha (9.59%) is moderately dense and the rest 30.04 million ha (9.14%) is open. The trees outside forest (TOF) are estimated to cover 9.26 million ha area which constitutes about 2.82% of the total geographical area of the country. Thus the total forest and tree cover of the country is 79.42 million ha or 24.16% of the total geographical area. The estimates of total growing stock of forest and TOF are 4.195 billion m$^3$ and 1.573 billion m$^3$, respectively. Thus the total growing stock of wood in the county is estimated at 5.768 billion m$^3$ which implies an average growing stock of 72.63 m$^3$ ha$^{-1}$ in 79.42 million ha of forest and tree cover (FSI, 2015). With just 2.5% of the land area of the planet Earth, India has to support nearly 17% of the world's human population besides a large livestock population. Therefore, the forests are under intense biotic pressure leading to degradation of forest resources. Forests have much lower growing stock (i.e. 72.63 m$^3$ha$^{-1}$) compared to the world average of 110m$^3$ha$^{-1}$. Likewise, average mean annual increment of forests in India is very low at less than 1 m$^3$ha$^{-1}$ yr$^{-1}$ compared to the world average of 2.1 m$^3$ha$^{-1}$ yr$^{-1}$.

Supply of industrial round wood and timber from forest areas has been dwindling. Trees outside forest (TOF) are the major source of wood for the Indian industry. Most of the wood based industries like plywood and paper pulp are largely dependent on farm grown wood, rather than wood from natural forests and forest plantations. Huge volumes of logs, sawn timber, pulp and newsprint are being imported for meeting growing domestic demand. Substantial improvement in productivity of forest resources on sustainable basis and large scale growth/expansion of agroforestry plantations are important for meeting the national needs of timber and non-timber forest products, conservation of biodiversity-rich natural forests, and achieving the national goal of 33% effective forest and tree cover.

Technology based farm-forestry plantations with genetically improved, high yielding and fast growing planting stock of species have tremendous potential for supplementing agricultural production, and meeting the growing shortages of industrial timber on sustainable basis. Clonal farm forestry and agroforestry plantations can take intense biotic pressures off the natural forests and help conserve their rich biodiversity. We can achieve self-sufficiency in timber and wood
based products, and generate exportable surplus of value-added wood products over a period of
time in future.

Poplars and willows occupy a small geographical area at national level but they make
unique contribution to socio-economy and ecology of regions of their occurrence. Due to their
high growth rate, the importance of these forest resources in people’s livelihood far exceeds what
their geographical extent would suggest.

Area under poplar and willow in India is estimated at 420,100 ha. A large share (270,000
ha) is composed of *Populus deltoides* (poplar) plantations outside the forest. Timber from poplar
and willow is the backbone of vibrant plywood, board, match, paper and sports goods industries.
Indigenous species of poplars are reared in forests as well as private and government lands outside
the forest covering large areas in dry temperate region of high hills. Willow is widely planted and
managed in private, community and government land in high altitudes. Indigenous poplars
conserve soil and water; provide wood for packing cases, plywood, fuelwood, fodder, etc.
Willows are used for cricket bats, baskets, decorative articles and other handicrafts in the small
scale and cottage industries, besides their use in soil and water conservation, fuelwood and fodder
production for local communities. Poplars and willows have immensely contributed to
environmental and economic well-being of the state and reduced pressure on the forests. There is a
considerable scope for augmenting the role of poplars and willows in the ecology and economy of
the country.

**Highlights**

<table>
<thead>
<tr>
<th>Area under poplar and willow: 460,100 ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area under poplar: 317,800 ha (includes area under <em>Populus deltoides</em>: 270,000 ha in agrforestry plantations)</td>
</tr>
<tr>
<td>Area under willow: 137,300 ha</td>
</tr>
<tr>
<td>Area under mixture of poplar and willow: 5,000 ha</td>
</tr>
</tbody>
</table>

**Species of poplars:**

- Native: *Populus ciliata*, *P. gamblei*, *P. Jacquemontii* var. *glauca*, *P. rotundifolia*
- Exotics: *P. deltoides*, *P. alba*, *P. euphratica*, *P. nigra*, *P. laurifolia*

**Species of willows:** *Salix alba* ssp. *coerulea*, *S. alba* ssp. *alba*, *S. tetrasperma*, *S. acmophylla*, *S. fragilis*, *S. angustifolia*, *S. babylonica*, etc. (total 32 species are documented)

**Uses:**

- **Poplar:** Plywood, board, match, paper, artificial limbs, fodder (native species), fuelwood,
  charcoal, soil and water conservation, etc.
- **Willows:** Cricket bats, baskets, furniture, handicrafts, fuel, fodder, soil and water conservation, etc.
Populus deltoides (Major Plantation Species) at a Glance

Area: 270,000 ha comprising private agricultural land (notional area estimated at 500 trees/ha)

Plantation region: Western Uttar Pradesh, Punjab, Haryana, low outer areas in Uttarakhand, Himachal Pradesh and Uttar Pradesh; recently introduced on a large scale by ICFRE in Bihar

Soil and climate: Deep, fertile, irrigated, well-drained soil, sub-tropical climate; mostly above 28°N latitude

Pattern of planting: 60% plants as Block plantation and 40% plants as boundary plantation; always planted with agricultural crops

Crops: All grain, pulse and vegetable crops (except rice); during kharif season fewer crops can be intercropped in block plantations

Rotation: 6-8 years

Growth rate: 20-25 m³/ha/yr

Out-turn: 5.05 million tonne/yr fresh wood

Returns/ha to grower: Rs. 150,000 /ha/yr from poplar wood

Benefit:cost ratio: 2.13:1 (with intercropping), 1.92:1 (without intercropping)

Utility: Plywood, board, match, paper, charcoal, etc. (more than 30 products are made)

Stakeholders: Farmers, nursery owners, labourers, timber merchants, middlemen, transporters, industries, researchers, state forest departments and corporations, NGOs, unemployed youth, finance companies, etc.

Suitable clones of poplars have already changed the skyline in large area of Punjab, North-Western Uttar Pradesh, and parts of Haryana and Uttarakhand with assured and ample irrigation facilities. Poplars can produce moderate quality veneer logs at short rotation period of 6 to 8 years achieving high productivity of 20-25 m³/ha⁻¹ yr⁻¹. Because poplars are deciduous, winter crops can be grown along with poplars throughout the rotation period. Commercial scale plantations of poplars under agroforestry have been expanding since WIMCO-sponsored farm forestry project was launched in 1984 with refinance assistance of NABARD. Fast growing clones of poplars, supported with improved package of practices, excellent technical extension services, bank finance, and growing market demand for poplar wood have made poplar plantations on private farms a unique success story.

Indian Council of Forestry Research & Education, Dehradun (ICFRE) is implementing the Samudai Adharit Samanvit Van Prabandhan Evam Sanrakshan Yojna (Bihar Project) under Sam VikasYojna of Bihar State, sponsored by the Planning Commission, Govt. of India, through its Forest Research and Extension Centre (FREC), Patna. The project is planned to be completed in two phases. In Phase-I, Vaishali district has been completed and the remaining suitable parts of North Bihar are being covered in Phase-II. Thus poplar is being extended to non-poplar area.
I. POLICY AND LEGAL FRAMEWORK

Summarize major developments in national policies, laws or regulations which affected the cultivation or utilization of poplars or willows, in natural forests, planted forests and agroforestry. For example, include relevant policies concerning growing, harvesting, marketing, transportation, utilization and trading of poplars and willows; financial, fiscal or other incentives, environmental regulations which affect the growing of poplars and willows; and policies promoting the emerging use of poplars and willows for bioenergy (incl. fiscal incentives, subsidies etc.), carbon sinks and other environmental uses.

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

In India, poplar is largely grown on farm land by millions of small holders. It is grown as block plantations and boundary plantations those under agroforestry. India has enunciated Indian Agroforestry Policy 2014 and the business rule on agroforestry programme has now been vested with the Ministry of Agriculture and Farmers Welfare at Central level and with the state agriculture departments at the state levels (DARE, 2014).

India has also enacted Company’s Act 2013 wherein each corporate body earning a net profit of over Rs. 5 crore has to spend 2% of the profits under Corporate Social Responsibility (CSR) in around one and a half dozen activities. Agroforestry has also been included in CSR activities during 2014 and some companies have started promoting poplar plantations on farm land under CSR activities (Dhiman, 2015).

Planning Commission of India (now Niti Aayog) has given a special grant to Punjab, Haryana and Uttar Pradesh states for diversification of agriculture where farmers are advised to move away from paddy cultivation to sustain agricultural production. Poplar and eucalypts are among the few trees promoted under this diversification plan. The saplings are largely procured from the private nurseries and supplied free of costs to the farmers.

The state of Bihar has launched a scheme for planting of poplar in suitable areas in North Bihar. About 45 million plants of poplar are expected to be planted under the project. A research schemes has also be initiated for development of agroforestry models in Bihar.

The process of allowing establishment of new wood-based industry and expansion of industry is now vested with the states. This decision was taken during 2015, when prices of poplar wood crashed and after a lot of representations from the growers, Central Empowered Committee which earlier was supervising this aspect at national level, gave the powers to the states. Ministry of Environment, Forest and Climate Change will supervise the process.

Some changes have also occurred in the procedure of granting felling and transit permission in the state of Uttar Pradesh. The tree growers till these provisions were required to apply manually to the forest department for felling and transit of trees. Poplar growers in certain
districts of the states required permission of the forest department for transportation of their produce to wood markets. The new system requires obtaining revenue document showing growing of trees to be supplied to the Divisional Forest Officer who lodges the document on the e-web created for this purpose and the permission is granted by the state forest department. However, the procedure remains time and resource consuming and has yet not eased the problems of the tree growers.

The peeling machines in poplar-based industry have undergoing a noticeable change in the last few years. Peeling can be done to thinner core diameter. This is propelling farmers to harvest poplar at younger age than earlier.

The development of agroforestry, however, faces certain barriers due to unorganised markets, poor technical and financial support and lack of extension activities by the government, which must be addressed. Middlemen play a huge role in sale of poplar wood and often exploit the growers. The poplar-growing farmers face frequent fluctuations in prices of poplar logs; this factor was responsible for significant drop in planting levels of poplars during 2002 to 2004. At that time, due to distress sale, and removal of young plantations from field with virtually no replanting by farmers, shortage of poplar wood was soon felt in the market. Soon thereafter, as a result, the price started rising slowly in the late 2004. In December 2006, a high price of Rs. 600-650 per quintal ($14-15 per quintal) for oversized wood prevailed in the market. The price hovered above Rs. 1200 per quintal (about $20 per quintal) during 2012. It has now crashed to about Rs. 550 (about $9 per quintal) per quintal now. The price of poplar wood in the market is extremely sensitive to lots of known and unknown forces. The availability of more supplies in north Bihar and adjoining areas after a couple of years from now is likely to have a noticeable impact on this situation. Poplar growers in that region are sceptical about price they would get for their produce in the market.

The following measures are suggested to overcome the above problems: (i) facilitating open auction of wood from farmland, (ii) strengthening of extension wing of forest departments, (iii) development of agroforestry cooperatives, (iv) quality control and certification of planting material, (v) development of alternative uses of poplar wood, (vi) rationalization of transit rules, (vii) regulating timber import under open general licence (OGL), (viii) removing licence system on setting up of peeling and plywood units, (ix) establishing more plywood units in different areas to absorb increased supply of poplar wood, etc. A healthy buyer-seller linkage is crucial for development of a sustainable agroforestry-industry model.

Our traders are marketing huge quantities of poor quality imported logs which offer them high profits, whereas farmers do not get remunerative price for better quality farm-grown domestic timbers. Therefore, policy framework for integrated development of farm forestry and
wood-based industries is required and concerned state government must address this issue urgently in consultation with the central government.

Positive policy prescriptions have positive policy implications for growing of poplar. An example in sight is the policy reform related to trading of poplar wood by state of Himachal Pradesh in Northern India. In Himachal Pradesh, earlier ban was in force on carrying forest produce out of the state, the ban also covered trees which are grown by the farmers in and around their fields. In order to give a boost to the socio-economic upliftment of the people besides catering to the ecological needs and social aspects, growing of the trees especially of poplars in the farmers’ fields was advocated for ultimate accomplishment of these issues. Accordingly, Government of Himachal Pradesh in consultation with the State Forest Department of Himachal Pradesh modified this policy, which then enabled the farmers to take the produce out of the state after obtaining transit permits from local authorities. This decision of the government facilitated marketing, transportation and trading of poplars outside the state for consumption in the industries situated in other parts of the country. The liberalization in policy definitely contributed towards augmenting biomass production especially of poplars in the state.

Poplar plays a significant role in rural development by generating employment to many categories of skilled, semi skilled and unskilled workers and thus helps in achieving the Millennium Goal of poverty alleviation laid down by the Food and Agriculture Organisation. Dhiman (2008) estimated 90 to 100 million man days employment being generated from poplar activity in the country out of which 20 million man days is in making and maintaining plantations, 20 million man days in felling trees and their conversion into logs, grading, loading, unloading, stacking and handling timber and approximately 50 million man days in wood based industry involved in converting poplar wood into wood based products. Most of the operations involving poplar farming and utilization are located in the remote rural areas where poplar is grown on farm lands and where employment opportunities rarely exist because of poor developmental activities in those areas.

There is considerable need to focus on training and extension efforts in poplar cultivation. In a past study, the percentage of growers practising correct management of poplar plantations was examined in 3 sites located within 45 km of Forest Research Institute, Dehradun. The percentages for different practices followed correctly were found to be 61% for site selection, 27% for good planting material, 47% for spacing, 80% for irrigation schedule, 85% for fertiliser application, 35% for pesticide application and 9% for pruning (Kumar, 2004). Thus research, extension and policy framework must keep pace with one another.

There are difficulties in getting wood of single species for making of plywood. Therefore, the combi-plywood seems a solution to this problem. Combi-plywood is the combination plywood made of veneers of different species. Combi-plywood, using poplar with other farm-
grown trees, has been developed by Forest Research Institute, Dehradun. Now most of the plywood industries are using the poplar and eucalyptus veneers in combination for manufacturing the plywood.

The foregoing analysis of policy issues on poplars and willows emanates from experiences centred almost entirely around poplars. This is a pointer to the lack of focus by growers and researchers on *Salix* in India. This is despite the fact that wood of *Salix* serves as the raw material for a flourishing cricket bat and handicraft industry in India. Some of the dependent families have been involved in this profession for over seven decades and are recognized for their grass-root innovation. Thus the willow bioresource provides a sustainable livelihood, besides promoting ecological security of the fragile ecosystem in inner Himalayas.

There is a need for conservation and management of the willow diversity and genetic resource through an integrated approach involving the participation of communities, transfer of technology, capacity building on value addition and marketability of products for higher income generation, safeguarding the property rights to indigenous traditional knowledge and strategies for sustainable livelihood (Biswas and Hussain, 2008). The same is true for indigenous poplars too since their role has not been fully exploited vis-à-vis exotic poplars.

II. TECHNICAL INFORMATION

1. Identification, registration and varietal control

Report on accomplishments on identification and on proposals made for the registration of new cultivars of poplars and willows.

Guidelines of Indian Council of Forestry Research and Education for testing and release of new clones and varieties are in place (ICFRE, 2008). New clones and cultivars of poplars and willows in the country may be tested and released based on procedure laid down in the guidelines entitled ‘Approved Guidelines for Testing and Releasing of Tree Varieties and Clones’.

Plant Variety Authority (PVA) is in the process of finalizing the descriptors for poplar for the registration of poplar clones under the Protection of Plant Varieties and Farmer’s Rights Act (2005). It would be now easy to register poplar clones in India now. A set of descriptors has been submitted to Protection of Plant Varieties & Farmers’ Rights Authority Protection by Dr Y.S. Parmar University of Horticulture and Forestry, Solan.

Wimco Seedlings had sent six clones for registration with IPC. Some additional information desired by IPC has been supplied. Two more clones have also been screened and are being sent for registration with IPC (Dhiman, 2016).
Ten prominent clones of *P. deltoides* were subjected to peroxidase isozyme analysis (Singh, 2014). The clones were grouped into four groups based on their banding pattern. The clones, except G48 and L-34, showed distinct banding patterns.

Ten poplar clones viz. namely G3, G48, S7C1, S7C4, S7C8, S7C20, L34, PP5, Fierelo and D121 were characterized by Singh (2012) on basis of qualitative (leaf shape, leaf pigmentation, leaf serration, leaf tip type, ridge line, ridge shape) and quantitative (bud length, bud diameter, number of buds and internodal length) traits in nursery.

Lubna et al. (2013) described morphological characters of 17 accessions of *Salix* in Kashmir valley comprising *S. babylonica*, *S. pychnostachya* and *S. viminalis*.

2. Production Systems and Cultivation

   Report separately information on the application of new knowledge, technology and techniques in application of poplar and willow culture for different purposes, including production, protection or conservation:

   Poplar is a very prominent taxonomic group of tree species in plantation forestry in India. It occurs in natural forests too. Indigenous poplars occur only in the mountains, and are still to acquire greater role and share in afforestation/reforestation programmes and conservation activities in the country. Their natural population is small, and gradually declining. Bulk of the plantations are composed of *Populus deltoides*, an exotic species.

(a) Nursery practices and propagation techniques including applications of biotechnology - particularly plant propagation, reproductive materials, use of GMOs etc.

   Among planted poplars, *Populus deltoides*, *P. ciliata*, *P. nigra* and *P. alba* are routinely propagated using stem cuttings, whereas *P. gamblei*, a difficult-to-root species, is propagated using root cuttings. Dhiman (2013d) described three unorthodox asexual means for mass multiplication of poplars:(i) mass multiplication from root sprouts, (ii) stem cuttings with budded scions, and (iii) propagation from leaf cuttings. The first two are operationally applied for mass multiplication, while the third one needs further research.

   Aggarwal et al. (2012) developed an efficient plant regeneration protocol through micropropagation for *P. ciliata* using leaf explants and thidiazuron. Petiole explants were also successfully cultured to regenerate *P. ciliata* (Aggarwal et al., 2015).

(b) Planted Forests with emphasis on the choice of cultivars, type of plants, spacing and layout of plantations; planting and tending (fertilization, irrigation, weeding, pruning, thinning etc.); management (growth, rotation in relation to yields and industrial requirements).

Planted forests comprise two dominant species:
P. alba:
This species is planted in Western Himalayas (i.e. parts of Lahaul, Kinnaur and Kashmir) at 2,500 to 3,300 m altitude. It is severely lopped for fodder.

P. euphratica:
It is planted in cold desert area in Western Himalayas (i.e. parts of Ladakh and Spiti) at 2400 to 4000 m altitude. It is also severely lopped for fodder. These two species are so widespread that some authors believe them to be indigenous.

In Uttarakhand state (especially Haldwani region) the State Forest Development Corporation has raised planted forest of P. deltoides for production of industrial wood. It is worked using clearfelling system at rotation of about 12 years. Planted forest of P. gamblei has been raised in North Bengal.

Mushtaq et al. (2014) stated that Salix alone comprise a total population of around 37 million trees (departmental and private) in Jammu and Kashmir with further scope for expansion as permanent marketable carbon sinks owing to the availability of about 15,082 km² of wasteland that could be used for plantation forestry.

A survey of Salix alba plantations in Anantnag, Bandipora, Baramulla and Ganderbal districts of Jammu and Kashmir revealed the maximum and minimum stem volume of 739.34 and 595.09 cum ha⁻¹ in Bandipora and Anantnag districts respectively (Shah et al., 2015). The biomass production varied from 429.27 Mg ha⁻¹ in Anantnag to 532.61 t ha⁻¹ in Bandipora.

Salix alba occurs naturally in the entire Lahaul valley, Himachal Pradesh up to an altitude of 3,850 m (Rawat and Everson, 2013). About 81% of households indicated the scarcity of willow trees, whereas, 19% of households were satisfied with the willow trees they owned. The majority of willow species were planted in middle altitudes on privately owned irrigated lands.

(c) Indigenous Forests, with emphasis on experiences and experiments concerning silvicultural treatments, harvesting, management, protection and regeneration.

Indigenous forests comprise natural stands of indigenous poplars that occur in Northern and North-Eastern India. Indigenous poplars comprise following species:

P. ciliata:
It is the most extensive indigenous poplar distributed throughout the Himalayas at 1,300 to 3,500 m altitude (Kashmir to Arunachal Pradesh). Used for packing cases, match sticks, fuel, fodder; also suitable for plywood and hardboards.
P. gamblei:
Southernmost species of indigenous poplar in India (27°-30°N latitude). Occurs in Eastern Himalayas (North Bengal, Sikkim and Arunachal Pradesh) at 600 to 1,300 m altitude. The species is used for packing cases and match industries. It has a good growth rate and is suitable for hybrid development.

P. Jacquemontii var. glauca:
Distributed in Eastern Himalayas (North Bengal and Sikkim) at 2,500 to 2,900 m altitude and bears bi-sexual flowers.

P. rotundifolia:
Occurs in Eastern Himalayas (close to Bhutan border) at 2,300 to 3,050 m altitude.

Some authors consider P. alba and P. euphratica as indigenous species as they grow and naturally regenerate in several areas.

Among indigenous species, only P. ciliata is grown to a noticeable extent in plantation programmes in the Himalayan region of North India. It is planted by State Forest Departments near villages in mixture with other hardwood species. It has also been recommended for agroforestry plantation around orchards. Due to fast growth rate, it has the potential and scope of being promoted in the plantation programmes in its natural zone of occurrence. Presently, the species constitutes a small proportion of trees in the conifer-dominated Himalayan region.

Populus gamblei, an eastern Himalayan poplar, has been found growing around 27 degrees latitude and between 88 to 95 degrees longitude from West Bengal, Sikkim, Arunachal Pradesh to Nagaland, as scattered tree in sporadic pockets, and sometime as pure stand specially at an elevation of 350-1600 m (Chandra, 2015).

Other indigenous species of Populus are not preferred in plantation programmes although they regenerate naturally.

Verma (2014) found Salix alba as the dominant of the three tree species distributed at 3400-3800 m altitude in Hango valley, Kinnaur, Himachal Pradesh. Among the shrub species, Salix fragilis was the dominant among the 15 species of shrubs at 2800-3300 m altitude in Rakchham-Chitkul Wildlife Sanctuary, Kinnaur.

Kaiser et al. (2014) found Salix tetrasperma as a dominant tree species in Dugadda area in Garhwal Himalaya.

(d) Agroforestry and Trees Outside Forests with emphasis on their effects on forest and agricultural crops or livestock and diversification of the landscape.
(i) Choice of poplar species

*P. deltoides* is the only species that is planted extensively in agroforestry fields and areas outside the forest in the country. It was introduced in India in the late 1950s. It is planted in the plains of North-West India, i.e., Western Uttar Pradesh, Punjab and Haryana and to some extent in the outer plains/valleys of Uttarakhand and Himachal Pradesh. This species has been introduced on a large scale (6.60 million plants) in Bihar State (Vaishali District) under central Government Scheme by ICFRE and a target of 45 million plants has been fixed in second phase of the scheme to be implemented in other districts of north Bihar.

*P. alba* and *P. euphratica* are planted by rural communities in and around their private land. *P. nigra* is mostly planted as avenue plantation in Kashmir valley and it does not contribute significantly to wood supply.

(ii) Planting method

*P. deltoides* is planted on a significant scale in India. *P. deltoides* and constitutes the backbone of agroforestry in irrigated plains of Northern India.

**Table 1. Some important statistics about *P. deltoides* in agroforestry in India.**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>States where planted</td>
<td>Punjab, Haryana, Western Uttar Pradesh, outer plains/valleys in Uttarakhand and Himachal Pradesh; a major initiative on introduction in Bihar has been launched by ICFRE</td>
</tr>
<tr>
<td>Planting sites</td>
<td>Irrigated agricultural lands (i.e., as agroforestry plantations)</td>
</tr>
<tr>
<td>Rotation age</td>
<td>6-8 years</td>
</tr>
<tr>
<td>MAI in farmers’ field</td>
<td>20-25 m³/ha/yr in block plantations, 2-3 m³/ha/yr in boundary plantations</td>
</tr>
<tr>
<td>Spacing</td>
<td>5m x 4m or 4m x 4m, 5m x 5m, 7m x 3.5 m, 8m x 3m, 7m x 3.5m spacing as block plantation; or at 2m-4m spacing in linear rows along field boundaries</td>
</tr>
<tr>
<td>Combination Crops</td>
<td>Sugarcane, mentha, wheat, potato, mustard, maize, pulses, vegetables, fodder crops, medicinal plants etc (but not rice)</td>
</tr>
<tr>
<td>Size at harvest</td>
<td>Around 30” gbh</td>
</tr>
<tr>
<td>Area under <em>P. deltoides</em></td>
<td>270,000 ha</td>
</tr>
</tbody>
</table>

None of the indigenous poplar are known to thrive in the poplar growing area in the plains. *P. deltoides* clones have been found suitable for growing in the North-Western India over 28°N latitude. Besides the planting region of poplar which comprises plains and fertile valleys in North-Western India above 28°N latitude, introduction trials are also underway in other areas.

Planting of poplar was greatly affected by the price fall during 2002-2004. On an
average, 1.5 to 2 million plants were annually planted during 1993 to 1998 which rose further to about 4 million plants per annum in certain years during 1999 to 2001. But price crash reversed the trend and reduced the planting to 1.5 to 2 million during 2003 (Dhiman, 2004). With the rise in price of poplar wood again, the demand for planting stock grew. Acreage under annual planting during 2011-12 approached upper limit as many nursery growers could not find buyers and saplings of many nurseries remained unsold during this planting season.

The price of poplar wood which peaked to around Rs. 1200 per quintal during 2012-2013 has now declined to about Rs. 550 per quintal now. Sale of poplar plants in the nurseries declined to a very low level during planting season in 2015.

(iii) **Plantation management**

Poplar is planted only in irrigated lands in Northern Indian plains. Block plantations are raised by farmers with large landholding. Owing to the existence of fewer risks and high profits in poplar cultivation, large farmers and absentee landlords prefer to put their lands under block plantations of poplar rather than pure agriculture or boundary plantation options. Usually, spacing of 5 m x 4 m to 4 m x 4 m (and sometimes 3.5 m x 3.5 m) are adopted. Small and marginal farmers plant poplar on field boundaries at about 3 m spacing between adjacent plants. Agricultural crops such as sugarcane, wheat, potato, mustard, maize, pulses, vegetables, fodder crops, medicinal plants etc. are grown in the inter-spaces. Rice is not grown in block plantation of poplar. Pure poplar is seldom raised. If raised pure, the spacing is kept about 3m x 3m and the stems remain thin which fetch low price in the market.

When poplar is planted on the field boundaries, kharif as well as rabi crops can be grown in field throughout the rotation of poplar. In block plantation of poplar, the usual kharif crops can be grown for two years only; thereafter shade-bearing crops like ginger, turmeric etc. are planted. However, rabi crops can be grown as usual. Poplar plantations also serve as windbreaks. The earliest benefit accruing from poplar trees to the farmers is fuelwood from pruning.

Intercropping is almost always preferred as it provides scope for essential food production besides ensuring higher growth rate of poplar due to frequent irrigation and hoeing operations for agricultural crops. Dhiman (2012a) reported the results of a survey of 220 plantations from 172 villages, 69 tehsils, 28 districts in four major poplar-growing states viz. Punjab, Haryana, Uttar Pradesh and Uttarakhand. Wheat was found as main crop grown in 51.67% cases followed by sugarcane, fodder (shorghum/berseem), maize, jawar/bajra, rice, dhencha (green manure) and others. The intensity of cropping was more in winter (rabi) season than in summer (kharif) season. In a case study in Haryana, Deswal *et al.* (2014) reported that an average farmer earned 46% higher income from poplar-based agroforestry compared to rice-wheat crop rotation. In Tarai region of Uttarakhand, poplar-based agroforestry was better than
*Melia, Leucaena* and *Eucalyptus* based agroforestry achieving higher biological yield of wheat crop (Sarvade *et al.*, 2014).

Chahal *et al.* (2012) recorded highest net income (Rs. 64,355 /ha/yr) with poplar + sugarcane followed by poplar + turmeric (Rs. 59,543/ha/yr) and lowest by poplar + rainfed wheat (Rs. 18,719 /ha/yr). Poplar alone gave net income of Rs. 20,188/ha/yr. The traditional rice-wheat crop rotation provided Rs. 22,970/ha/yr as net income. This underscores the hypothesis that two-tier cropping is more profitable than monocropping.

Chauhan *et al.* (2015) recorded greater economic benefits from *P. deltoides* in block plantation than boundary and sole cropping of rice-wheat (B:C ratio of 3.30, 1.90 and 1.61, respectively).

Wheat variety NW-1067 and rice variety Narendra Usar-2 were found most suitable for intercropping with *P. deltoides* in sodic land (Sirohi *et al.*, 2012).

*P. deltoides* irrigated at 40 mm CPE (cumulative pan evaporation) gave highest grain yield of wheat than 60, 80 and 100 mm CPE (Singh, 2013).

Dillseed and celery showed greater promise of inter-cultivation with poplar (Kaur *et al.*, 2012). Intercropped colocasia yielded lower under Pear x kinnow combination than under poplar, presumably due to existence of more shade under poplar (Sangwan, 2014). Jat and Thakur (2012) found that *Matricaria chamomilla* performed better under *P. deltoides* than in the open and recommended growing of this high value cash crop as intercrop with *P. deltoides* for greater economic returns. Rani *et al.* (2013) recommended growing of flowering annuals like *Coreopsis tinctoria*, *Coreopsis lanceolata*, *Phlox drumondii* and *Gaillardia pulchelia* with *P. deltoides* than wheat for greater economic returns. Singh *et al.* (2015) recommended growing of soybean variety PS1225 (yield 2996 kg/ha) with *P. deltoides* during second year of plantation.

*P. deltoides* showed relatively less adverse effect on pre-bearing behaviour of pear than other common agroforestry trees in Punjab (Sangwan *et al.*, 2015). This indicates its better compatibility with pear rootstock and trees during pre-bearing stage.

Rawat and Everson (2013) reported that *Salix fragilis* and *S. alba* are important elements of cold desert agroforestry and are used as subsistence resources. *S. fragilis* is cultivated more commonly than *S. alba*. A higher density of *S. fragilis* was recorded at Khoksar (3,200 m) in plantation forestry on south-facing slopes.

Dhiman (2015d) reported that biparitite, tripartite and qudpartite agreements are in vogue in agroforestry with special reference to poplar based agroforestry in India. These agreements are for most of activities related to tree culture, intercrops and both of them and largely honoured (with few exceptions) by the stake holders.

### 3. Genetics, Conservation and Improvement

Report research and applications of technology in genetics, conservation and tree improvement achieved by the following categories:
(a) Aigeiros section

In a provenance study of *P. deltoides* comprising populations collected from southern part of the USA, Singh *et al.* (2013b) found that collar diameter of seedlings were in the order of Southeast Atlantic > Eastern Gulf > East Central. Using parents of existing superior clones, 66 control-pollinated and 20 open-pollinated families were also produced.

Kumar reported results of clones developed from open-pollinated seed introduced by FRI Dehradun. FRI-AM-59, FRI-AM-58, FRI-AM-44, FRI-AM-41 and FRI-AM-54 were among the best performers in three sites (Kumar and Singh, 2012). In another study of 69 new clones of *P. deltoides* in Punjab, clones FRI-AM-53, FRI-AM-70, FRI-AM-51, FRI-AM-6 and FRI-AM-45 outperformed the commercial clone G48 (Singh *et al.*, 2014).

In a trial of 12 clones at Hoshiarpur, Punjab, Luna *et al.* (2012) observed greatest volume production in clone WSL-39. Saralch *et al.* (2013) observed greater growth of clone WSL-22 than five other clones in pure poplar plantation as well as agroforestry plantation in Ludhiana, Punjab. Khan *et al.* (2013) found greater plant height and collar diameter in clones S7C4 and S7C2 in Kanpur, located in the Central part of Uttar Pradesh.

Singh *et al.* (2015b) suggested the use of G48, ST-70, D121 and ST-63 as parents for crossing programme based on general combining ability.

Dhiman *et al.* (2014) reported occurrence of natural hybrid between *P. suaveolens* (female) and *P. ciliata* (male). Out of 64 hybrid seedlings, 62 resembled the mother parent in leaf and stem traits.

(b) Leuce section

(c) Tacamahaca section

Masoodi *et al.* (2014) recorded greater growth of *P. ciliata* seedlings from forests where this species is a climax species in comparison with other forests.

(d) Other sections

(e) Willows

From a study of *Salix* clones introduced in Himachal Pradesh, Singh (2012) found clones SI-63-016, J-799, PN-722, NZ-1002, PN-733, PN-731, SN-2, Sx61,194 and 084/03 superior to check clones for the growth traits. These clones were proposed for multi-location testing.

Eighteen selected clones of *Salix* were studied for genotype x environment interaction in Himachal Pradesh (Singh *et al.*, 2014c). The clones J-799, SI-63-007 and NZ-1002 were found most adaptive for volume and SI-63-007 for dbh.

Sharma *et al.* (2015f) evaluated 15 promising clones of tree willow in the field in Himachal Pradesh. At five years clones namely J-194, J-799, J-795, PN 722 and NZ 1002 were found most suitable for larger planting.
Singh et al. (2015a) screened *Salix* hybrids from control pollination and open pollination. The selected clones were recommended for field trial.

4. Forest Protection

Report on the incidence, scale and impacts of damage in poplars and willows by biotic and abiotic agents:

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

Rattan et al. (2012) reported that the incidence of leaf spot caused by *Myrothecium roridum* in poplar nurseries is gradually increasing in Punjab’s sub-mountainous and central plain region. A chemical method has been proposed for inhibition of the fungus.

Dhiman et al. (2013a) reported that mealy bug is emerging as an important pest of *Populus deltoides* in Punjab. Bagwari et al. (2015) reported the occurrence of a new leaf spot disease in several clones of *P. deltoides* caused by *Curvularia eragrostidis*.

Chattopadhyay (2014) reported infestation of *P. deltoides* leaves by a defoliator in Ranchi, Jharkhand where this tree was introduced recently.

*P. deltoides* has been found suitable for planting in sites affected by nematode *Meloidogyne incognita* as it proved to be a non-host for this nematode (Sharma et al., 2012b). L-50/88 and L-156/89 showed greater resistance against poplar defoliator *Clostera restitura* in Punjab (Singh and Sangha, 2012).

Clone WSL-22, G48, S7C15 and Udai showed greater resistance against *Clostera fulgurita* in Punjab (Sangha, 2013).

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

5. Harvesting and Utilization

Report on the application of new knowledge, technologies and techniques in:

(a) Harvesting of poplars and willows.

(b) Utilization of poplars and willows for various wood products

Poplar wood has been rated as more suitable than mango wood for bending by vapour phase ammonia treatment. Moisture content above FSP (Fibre Saturation Point) is more suitable for bending (Saloni et al. 2012).

Poonia and Tripathi (2015) found that microwave treatment at 2.45 GHz frequency, 64.4 Wcm⁻² intensity and dipping in preservative revealed a remarkable increase in wood permeability of *P. deltoides* for preservatives and resins and aided timber drying as well.
Dhiman (2013e) reported development of sap stain in poplar wood between harvesting and usage as a serious problem that reduces the quality and output of products made from such wood. He also elaborated usage of bleaching powder (H₂O₂) with small fraction of NaOH that helps in bleaching match splints and in recovering the wood for this usage.

Singh et al. (2014e) successfully used billets and branches of *P. deltoides* for cultivation of *Ganoderma lucidum*, a medicinally important mushroom. A protocol was developed for economic cultivation of this mushroom on *P. deltoides* substrate.

Giving an account of wood-based industry in South Kashmir, Gowher (2012) stated that 625 operational industrial units existed in Anantnag and Pulwama. Cricket bat making (using willow wood) the largest wood-based industry in Anantnag while it was next to wooden box making in Pulwama. Veneer peeling employed maximum workers among all wood-based industries.

(c) Utilization of poplars and willows as a renewable source of energy (“bioenergy”).

6. Environmental Applications

Report on the application of new knowledge, technologies and techniques for cultivation of poplars and willows for:

(a) Site and landscape improvement (bank stabilisation, combating desertification and salinization, shelterbelts and windbreaks, soil rehabilitation, urban and peri-urban forestry for climate modification etc).

Biomass, soil organic content, carbon sequestration, nutrient content etc. have been estimated in different sites by various researchers.

Kapoor and Rawat (2013) suggested use of *P. ciliata* as a nurse crop for shade bearer conifers as they observed greater survival of *Abies pindrow* and *Picea smithiana* when these species were planted with nurse crop of *P. ciliata*.

(b) Phyto-remediation of polluted soil and water (buffer zones, contaminated sites, waste water management/treatment etc).

Fluoride contaminated (200 ppm and 500 ppm) irrigation water severely impaired physiological response viz. stomatal conductance, photosynthetic CO2 assimilation, chlorophyll fluorescence yield, etc. of *P. deltoides*.

Eight endophytic bacteria have been isolated from the roots of *Populus deltoides* growing in non-contaminated sites in Garhwal Himalayas, Uttarakhand (Bisht et al., 2014). SBER3 isolate was able to metabolize wide range of polyaromatic hydrocarbons (PAH) and other...
hydrocarbon viz. anthracene, naphthalene, benzene, toluene and xylene on minimal salt basal medium (MSB) as sole source of carbon and energy. SBER3 degraded 45.6% of PAH in soil model system after 120 days.

III. GENERAL INFORMATION

1. Administration and Operation of the National Poplar Commission or equivalent Organization

(a) Indicate here any changes in the composition of the Commission, amendments to its statutes, changes of address, etc.

The Executive Committee of National Poplar Commission was notified on Feb 10, 2012 with the following composition:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Director General, Indian Council of Forestry Research and Education (ICFRE), Dehradun</td>
<td>Chairman</td>
</tr>
<tr>
<td>2</td>
<td>Representative of Ministry of Environment, Forests and Climate Change, GOI (Deputy Inspector General of Forest, Research and Training)</td>
<td>Member</td>
</tr>
<tr>
<td>3</td>
<td>Director, Forest Research Institute, Dehradun</td>
<td>Member</td>
</tr>
<tr>
<td>4</td>
<td>Deputy Director General (Research), Indian Council of Forestry Research and Education (ICFRE), Dehradun</td>
<td>Member</td>
</tr>
<tr>
<td>5</td>
<td>Director, Projects and International Cooperation, Indian Council of Forestry Research and Education (ICFRE), Dehradun</td>
<td>Member</td>
</tr>
<tr>
<td>6</td>
<td>PCCF of Himachal Pradesh/ Jammu and Kashmir, State Forest Department (on rotational basis for a period of two years each)</td>
<td>Member</td>
</tr>
<tr>
<td>7</td>
<td>PCCF of Uttarakhand/ Uttar Pradesh, State Forest Department (on rotational basis for a period of two years each)</td>
<td>Member</td>
</tr>
<tr>
<td>8</td>
<td>PCCF of Punjab/Haryana, State Forest Department (on rotational basis for a period of two years each)</td>
<td>Member</td>
</tr>
<tr>
<td>9</td>
<td>PCCF of Bihar/West Bengal, State Forest Department (on rotational basis for a period of two years each)</td>
<td>Member</td>
</tr>
<tr>
<td>10</td>
<td>PCCF of Sikkim/ North Eastern States, State Forest Department (on rotational basis for a period of two years each)</td>
<td>Member</td>
</tr>
<tr>
<td>11</td>
<td>National Focal Point, NPC, Indian Council of Forestry Research and Education (ICFRE), Dehradun</td>
<td>Member</td>
</tr>
</tbody>
</table>
12. Representative from NGOs

13. Prof. Kulvir Singh Bangarwa, Hisar Agricultural University (Representative from universities)

14. Dr. Ramesh Chand Dhiman, WIMCO Seedlings Ltd. (Representative from industries)

15. Representative from progressive farmers

16. Representative from private sector

17. Technical Advisor of NPC

18. Head, Silviculture Division, Forest Research Institute, Dehradun

Subsequently, Sh. Gulshan Ahuja, APCCF, Haryana was nominated as a co-opted member of NPC. Dr. Dinesh Kumar as Technical Advisor, Sh. Shailendra Semwal, SIDHAST as representative from NGOs and Sh Ajit Singh, Nanauta, Saharanpur as representative from progressive farmers were added as members of the NPC. Sh J.K. Bihani, Managing Director, Galaxy Plywood Industries, Yamunanagar and Dr N.B. Singh, Professor, Dr Y.S. Parmar University of Horticulture and Forestry, Solan were also included in the Commission.

(b) Report briefly on meetings, congresses and study tours, and on other activities of a general nature organized by the Commission at the national level.

(1) Meeting of National Poplar Commission on November 1, 2012

The meeting recommended expanding the scope of the NPC to cover fast-growing species other than poplar and willow too. A working group may be created to identify short-rotation species for their inclusion under NPC. It was suggested to constitute Working Party to cover different aspects of poplars and willows. Cultivation of poplar may be extended to other areas of India keeping in view site suitability. A network may be developed to link all stakeholders of poplar for information sharing. The meeting also recommended creating a corpus for proper functioning of NPC. The Secretariat of NPC would be established at FRI Dehradun.

(2) Meeting of National Poplar Commission on March 12, 2013

The NPC recommended for increasing the availability of superior planting material and cultivation technology of poplar to farmers in eastern Uttar Pradesh to increase their productivity. A project proposal to address this need was okayed by the Commission for sending to Council for Science and Technology, Uttar Pradesh. It was advocated that a purchase policy should be developed for wood and notional support price should be provided for poplar. The
policy may be periodically revised. Futures trading which is popular in Scandinavia, may also be examined for application in India. The Commission complimented the efforts of Forestry Research and Extension Centre, Patna in development of model polar plantations in Vaishali district, Bihar under Samudai Adharit Samanvit Van Prabandhan Evam SanrakshanYojna (Bihar Project) and desired to take steps to make it play bigger role in capacity building during second phase of the project. It was suggested that farmers and industries should also be invited to the meetings of NPC. The Commission expressed concern at the shortage of funds for research on poplar and sought financial help of state forest departments and industry in this direction. It was also brought to the notice of the NPC that horticultural nurseries are registered under the Seed Act, and similar mechanism can be followed for registration of poplar nurseries.

(c) Indicate also the difficulties encountered by the Commission in the course of its work and any lessons learned

The 46th Executive Committee Meeting of the IPC at Dehradun advocated reforms in IPC to make it more broad-based by including other fast-growing species in its domain. However, the required changes are yet to be made in IPC. Poplars and willows represent an important, but small forest resource in India, if considered at the national level. These species are confined to north India. Only 1.22 per cent trees in agroforestry plantations belong to poplar, while willow does not even figure in the list of 40 most important (by number of stems) agroforestry species. Reforms are required in IPC and matching changes need to be made in National Poplar Commission so that this body would have a significant role in Indian forestry.

2. Literature

List here publications on poplars and willows issued in the period under review, (2012-2015) including technical papers presented at meetings, congresses, etc.


Dhiman, R.C. and Gandhi, J.N. 2015b. Growing Sweet Corn under a series of poplar plantations. Accepted for publication in Indian Journal of Agroforestry (Accepted).


Dhiman, R.C., Gandhi, J.N. and Singh, Y.P. 2015. Heat injury to freshly planted poplar seedlings in nurseries. Accepted for publication in Indian Farmers’ Digest.


Sharma, N.K., Singh, R. J. and Kumar, K. 2012a. Dry matter accumulation and nutrient uptake by wheat (Triticum aestivum L.) under poplar (Populus deltoides) based agroforestry system. ISRN Agronomy.


3. Relations with other countries

Include here information also on the international exchange of cuttings and plants of poplars and willows, training etc.

India organised the 24th Session of the International Poplar Commission and 46th Session of its Executive Committee during Oct 29 to Nov 2, 2012.

Forest Research Institute, Dehradun obtained cuttings of one cultivar of *Salix alba* from Hungary.

4. Innovations not included in other sections

List here any new developments not included elsewhere.

Bhat *et al.* (2013) reported about the incidence of aero-allergy, characterized by lung and throat infection, from *P. deltoides* seed cotton in Kashmir valley during April-May months. Detailed clinical studies are required. Gangoo *et al.* (2015) recommended lateral pruning (at least 50% clear bole) as a means of reducing cotton menace as well as producing quality timber in *P. deltoides*. Banyal (2014) suggested to plant male and female cultivars in suitable ratio to manage the problem of flying cotton.

A new edible variety mushroom, *Laetiporus sulphureus* var. *himalayensis* var. *nov.*, was collected from *Salix alba* in the Trans-Himalayan part of Leh district, Jammu and Kashmir (Yangdol, 2014).

IV. SUMMARY STATISTICS (Questionnaire)

Complete the attached questionnaire on poplars and willows summarizing statistics of key parameters in poplar and willow resources, production, utilization, trade and future trend.

See the following pages
**INTRODUCTION**

The questionnaire on poplars and willows is designed to complement the Country Reports for the 25th IPC Session in 2016.

Response to the questionnaire is crucial for FAO to allow country, regional and global analyses of status and trends in forest sector development and to assist in improving formulation of policies, preparing outlook studies and undertaking planning, management, monitoring and reporting.

We understand the difficulties that experts may find in providing such information, however in lack of detailed statistical data, aggregated data and/or best professional estimates are also very much appreciated.

**CONTACTS**

For queries in completing this questionnaire please contact:

IPC-Secretariat, IPC-Secretariat@fao.org, or
Mr. Walter Kollert, IPC-Secretariat@fao.org

**Thank you very much for your cooperation !**

We would appreciate your contact details in case we may have any queries

<table>
<thead>
<tr>
<th>Country</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
<td>Dr Dinesh Kumar</td>
</tr>
<tr>
<td>Position of contact person:</td>
<td>Technical Advisor (National Poplar Commission, India) and Scientist F, Silviculture Division, Forest Research Institute, Dehradun, India</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:kumard@icfre.org">kumard@icfre.org</a></td>
</tr>
<tr>
<td>Telephone:</td>
<td>+91 135 222 4610</td>
</tr>
</tbody>
</table>

**References:**


Question 1: Total area of poplars and willows 2015 and area planted from 2012 to 2015 (area change over the last 4 years)

The main FAO forest categories can be classified as:

<table>
<thead>
<tr>
<th>Forest category</th>
<th>Total Area 2015 (ha)</th>
<th>Total area by forest function in %</th>
<th>Area planted from 2012-2015. (reforestation and reforestation) (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indigenous</strong></td>
<td></td>
<td>Production</td>
<td></td>
</tr>
<tr>
<td>Poplars</td>
<td>47,000</td>
<td>40% roundwood, 20% biomass</td>
<td>0</td>
</tr>
<tr>
<td>Willows</td>
<td>108,000</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Mix of P&amp;W</td>
<td>5,000</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>160,000</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Planted</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poplars</td>
<td>800</td>
<td>90% roundwood, 5% biomass</td>
<td>100</td>
</tr>
<tr>
<td>Willows</td>
<td>1000</td>
<td>10% roundwood, 40% biomass</td>
<td>-</td>
</tr>
<tr>
<td>Mix of P&amp;W</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>1,800</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Please note that the total of the four forest functions cannot be more than 100% horizontally.
### Agrofor./TOF

<table>
<thead>
<tr>
<th></th>
<th>Poplars</th>
<th>270,000</th>
<th>100</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>-45,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willows</td>
<td></td>
<td>28,300</td>
<td>25</td>
<td>40</td>
<td>10</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Mix of P&amp;W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>298,300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-45,000</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>460,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-44,900</td>
</tr>
</tbody>
</table>
Question 2: Wood removals in 2015

Please quantify by forest category, species and/or cultivar the wood removals in cubic metre (m³) of each respective product. If possible group the total removals according to industrial roundwood and fuelwood/woodchips.

<table>
<thead>
<tr>
<th>Forest category and species, cultivar or clone</th>
<th>Wood removals 2015 in m³</th>
<th>for industrial roundwood</th>
<th>for fuelwood, woodchip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total removals</td>
<td>Veneer/plywood</td>
<td>Pulpwood</td>
</tr>
<tr>
<td><strong>Indigenous poplars</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. ciliata</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. gamblei</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. Jacquemontii var. glauca</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. rotundifolia</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><strong>Indigenous willows</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Several species</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><strong>Planted poplars</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. deltoides</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. nigra</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. alba</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><em>P. euphratica</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
<tr>
<td><strong>Planted willows</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. alba ssp. coerulea</em></td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Data availability</th>
<th>Fuelwood</th>
<th>Chips</th>
<th>Mechanical woodpulp</th>
<th>Chemical woodpulp</th>
<th>Particleboard</th>
<th>Fibreboard (hardboard, MDF)</th>
<th>Veneer sheets</th>
<th>Plywood</th>
<th>Sawn timber</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. alba var. alba</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. tetrasperma</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. acmophylla</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. fragilis</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td>Data not available</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Question 3: Forest products from poplars and willows 2015**

Please list by forest category the products that have been produced from poplars and willows in 2015. Please use roundwood equivalents (1000 m$^3$ r) as measuring unit. The general conversion factors for each single product are given below (in case your country specific conversion factors are not available):

<table>
<thead>
<tr>
<th>Product</th>
<th>Measuring unit of the product</th>
<th>Conversion factor to roundwood equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuelwood</td>
<td>metric tonnes or m$^3$ stacked wood</td>
<td>1 metr. tonne = 4 m$^3$ (r)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 m$^3$ stacked wood = 1.8 m$^3$ (r)</td>
</tr>
<tr>
<td>Forest category</td>
<td>Fuelwood chips</td>
<td>Industrial roundw. (logs, pulpw.)</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Indigenous</strong></td>
<td>From poplars</td>
<td>Data not available</td>
</tr>
<tr>
<td></td>
<td>From willows</td>
<td>Data not available</td>
</tr>
<tr>
<td><strong>Planted</strong></td>
<td>From poplars</td>
<td>Data not available</td>
</tr>
<tr>
<td></td>
<td>From willows</td>
<td>Data not available</td>
</tr>
<tr>
<td><strong>Agrofor./TOF</strong></td>
<td>From poplars</td>
<td>Data not available</td>
</tr>
<tr>
<td></td>
<td>From willows</td>
<td>Data not available</td>
</tr>
</tbody>
</table>
Question 4: Your opinion is important to us! Please reflect on the prevailing trends until 2030 in the development of poplars and willows in your country!

What is your opinion on the following issues:

Please put a cross in the column you think most appropriate.

<table>
<thead>
<tr>
<th></th>
<th>Increase</th>
<th>Decrease</th>
<th>Remain as it is</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The conversion of <strong>natural</strong> poplar and willow forests to other land uses will...</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>The area of <strong>planted</strong> poplar and willow forests will....</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>The area of poplars and willows for bioenergy plantations will .....</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investments in poplar and willow tree breeding programs will .....</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government investments in the poplar and willow sector will ...</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private investments in the poplar and willow sector will ...</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The significance of poplars and willows for <strong>productive</strong> purposes will ........</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The significance of poplars and willows for <strong>environmental</strong> purposes will ........</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The rejection by environmental groups of <strong>planted</strong> poplar and willow forests will ........</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>The acceptance by the general public of poplars and willows being important natural resources will.......</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
---END OF QUESTIONNAIRE---
Compiled by
Dr Dinesh Kumar, Scientist Silviculture Division, Forest Research Institute, Dehradun, Uttarakhand
Dr R.C. Dhiman, General Manager, WIMCO Seedlings Ltd., Bagwala, Rudrapur, Uttarakhand