Poplar and Willow News

Newsletter of the International Poplar Commission
Issue N° 2, November 2013

IPC
INTERNATIONAL POPLAR COMMISSION

Dear readers,

We cordially invite you to enjoy this newsletter, where we present the main news and events, recent publications, information, articles and documents related to poplars and willows.

We thank all those persons who contributed to this newsletter.

We invite you to send articles of interest for the next edition to share your knowledge, experiences and reflections to the e-mail: salicaceas@gmail.com

The editorial committee

UPCOMING EVENTS

3rd Announcement

Environmental Applications of Poplar and Willow Working Party Workshop meeting

'Erosion Control: the role of Poplars and Willows in holding slopes'

10 - 12th March 2014
Emerald Hotel, Gisborne,
New Zealand

We have the honour and pleasure to invite you to the next technical and business meeting of the IPC Environmental Applications Working Party (WP6) to be held in Gisborne, New Zealand from 10th to 12th March 2014.

The 3rd announcement of this meeting including the programme and registration form can be downloaded from the IPC web page:

www.fao.org/forestry/26214/en/

Salicaceae Symposium 2014 – Fourth International Congress of Salicaceae in Argentina

Will be held in the city of La Plata, Buenos Aires, Argentina from 19 to 21 March 2014, under the slogan "Willows and Poplars for regional development".

The Fourth International Congress of Salicaceae is a major and important scientific meeting, where local and foreign researchers, academics, technicians, producers, extension agents and students of forestry and agriculture will meet to participate, analyze and exchanged ideas on progress and research in Salicaceae, becoming one of the most important events of the sector.

We invite all professionals, students and entrepreneurs in the sector to submit their papers to share research, experiences and knowledge on the Salicaceae.

For further information please contact us at the email address jornadasalicaceas@gmail.com

ARTICLES OF INTEREST

ARGENTINA

Recent willow plant breeding creations in Argentina

by Teresa Cerrillo

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Technical Secretary of the Group of Genetics, Breeding and Conservation of the International Poplar Commission.

The willows *(Salix spp)*, characterized by the facility for propagation, rapid growth and high adaptability to a range of diverse ecological conditions, constitute a valuable alternative for sustainable forestry in many countries (Ball et al, 2005). Its wood is considered equivalent to the poplar (Avanzo, 1987; Leclerq, 1996), with potential for sawing, vinnering and papermaking (Atencia, 2010; Martinuzzi, 2010).

They are also valued for use in silvopastoral systems, energy use and environmental services such as phytoremediation and erosion control (Paiero et al, 2007).

In Argentina, the main willows growing area is in the Paraná Delta, with ecological and edaphic conditions appropriate for the gender, in particular, by the abundant availability of water. Of the 83.000 hectares planted with poplars and willows in the region, it is estimated that 85% are willows (Borodowski, 2011), being considered as a crucial resource for a substantial increase of the forest area in the region (Alvarez, 2010). Approximately 90% of willow produced is now used for the production of pulp and particle board, there is a growing demand for quality wood sawing and / or vinner.

In the search for materials that respond successfully clonal growth criteria, health, shape, wood quality for different industries and adaptability, the National Institute of Agricultural Technology (INTA) runs a Willow Breeding Program, completed in 2012 with the obtaining of six new clones. The evaluation and selection of the six clones took place between 2003 and 2011 at INTA, with the support from the Program for Domestication and Improvement of Species for High Value Applications (PROMEF), the Forestry Production Department of the Ministry of Agriculture, Livestock and Fisheries from Argentina and along with an agreement between the company Papel Prensa SA.

The previous stages that gave rise to these new clones of willow (the performing of hybridizations and achieving ortets) were made between 1988 and 1998 under the Willows Improvement Program of the Center for the Research and Forestry Experiences (CIEF) in agreement with INTA based on a classic scheme of genetic improvement (Cerrillo, 1989). Through crosses between parental germplasm introduced from collections of various countries (New Zealand, Canada, USA, Spain and Italy), were originated around 10.000 individuals.

The new plant breeding creations were evaluated through a network of trials, first in the Delta and then in other regions of the country, showing outstanding forest characteristics on the basis of a number of criteria: growth, health, shape, wood quality and adaptability (Cerrillo et al, 2013).

As parental material were used individuals of the species: *Salix matsudana, Salix alba* and *Salix nigra,* introduced from the collections of the Forest Research Institute (Palmerston North, New Zealand), Unità di Ricerca per le Produzioni Legnose Fuori Foresta -ex Istituto di Sperimentazione pe la Pioppicoltura- (Casale Monferrato, Italy) and the Agricultural Research Service (Zaragoza, Italy).

In the Delta is relevant the tolerance to prolonged periods of flooding, quality possessed by four of the six selected clones, allowing its recommendation to the areas of greatest risk of flooding. They would have application in: sustainable timber production (as forest certification schemes, silvopastoral systems, biomass production and phytoremediation). The wood of these clones have characteristics that make them suitable for sawing / vinner, and in the case of the manufacture of newsprint, four clones were equated with commercial clone Soveny Americano (excellent for paper, but of poor forestry performance) which positions most of them in a convenient quality "dual purpose".

The six improved willows have the registrations in the National Register of Cultivars of the Argentine National Seed Institute (INASE) (approval in Resolution 80/13), appearing in the National Catalogue (www.inase.gov.ar) with the names: AGRONALES INTA-CIEF, GÉMINIS INTA-CIEF, IBICUY INTA-CIEF, LEZAMA INTA-CIEF, LOS ARROYOS INTA-CIEF and YAGUARETÉ INTA-CIEF.

With a prospective vision and based on the variability generated, may be gradually incorporated into the production system other new high-yielding clones belonging to combinations of species: *Salix matsudana, S. alba y S. nigra*. Furthermore, in order to preserve the variability and taking into account possible future limitations of climate change is being considered with greater emphasis the study of *Salix humboldtiana*, unique Salicaceae specie native from South America, for its inclusion in the breeding programme.

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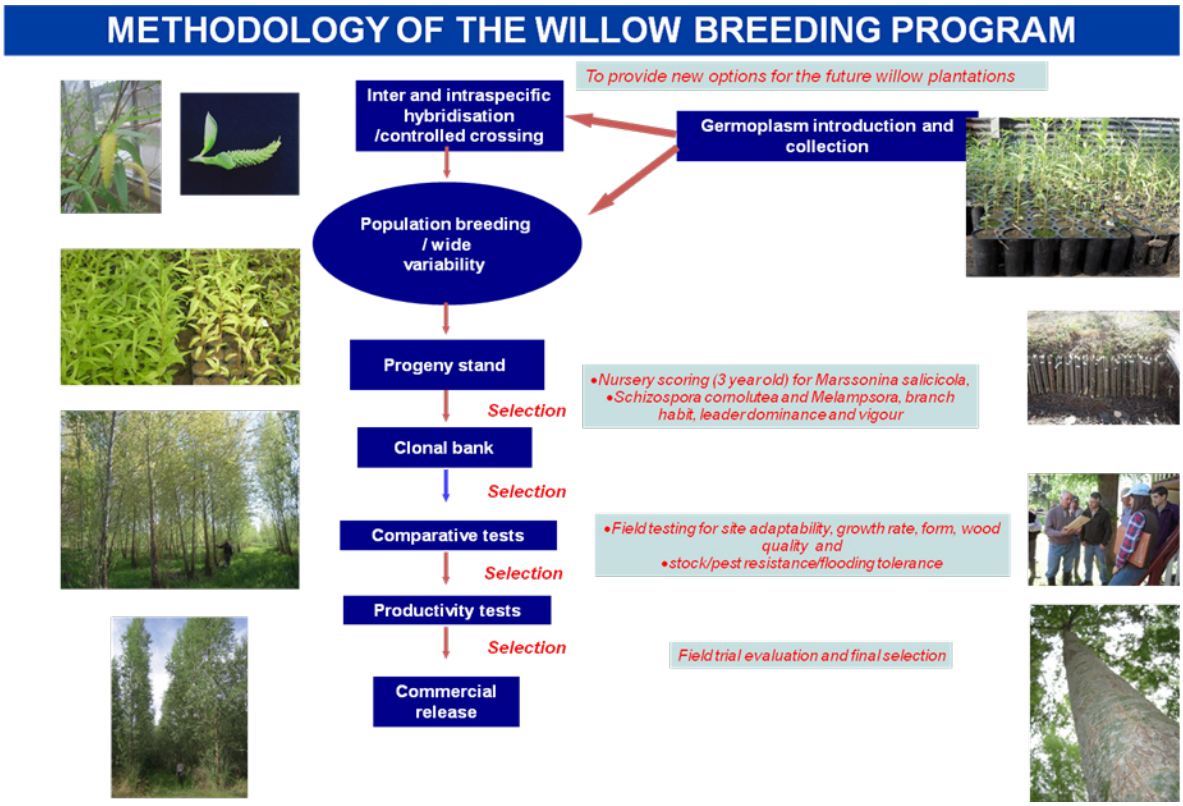
Below are some photos to illustrate the article and to show some examples of the selected clones.



INDIA

Expanding the planting window for poplars

by R C Dhiman

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Populus deltoides (Eastern Cottonwood) is the main poplar species planted in India. A major share of its plantations is made in a 1000 km narrow belt located in the Indogangetic plains south of the Himalayan foothills. This region is characterized by very hot and warm summers (maximum temperature invariably exceeds 45°C in summers), short and heavy monsoon season that receives around 1200 mm rainfall in mainly July-August, a very short winter season and a brief leafless stage in poplars during January-February, sudden weather change during pre-and post-winter seasons, lower latitudinal limits (even below 28oN), lower altitudinal limits (200-400 m above sea level), and variable site soil conditions (river sand to heavy clayey soils). No poplar species has ever existed in this region prior to the trial of P. deltoides that was introduced in this belt by WIMCO – a safety match industry for matchwood production around four decades ago. Over 30 million poplar saplings are planted by around sixty thousands farmers annually in and around their agricultural fields during winter months.

The planting season extends about a week period on either side depending on weather conditions. Poplar planting overlaps with farm operations and also invariably gets obstructed with winter rains which are common in the poplar growing region. Further, the intercrops and their stage of growth, procurement of saplings from commercial nurseries, their conditioning in fresh water, and arrangement of labor crews for planting affect its timely planting. Growers invariably shift fresh planting to next year if they are not able to get adequate time for planting poplar from overlapping farm and agricultural operations. This report is based on research findings and operational experience on field plantings during autumn and spring seasons on relatively large geographical area and with many growers.

Autumn planting

The apical bud set in nursery saplings starts around mid October which could also be delayed to first week of November with some management interventions. Fully grown nursery saplings with apical bud set are selected for autumn planting.

The foliage of such saplings is sprayed with a chemical composition (comprising lower concentration of ethylene along with some other additives) to advance the leaf senescence. The saplings are uprooted in two days time on spray, conditioned in fresh water for around 24 hours, immediately planted on transporting to field site and adequately irrigated.

Extended storage of saplings may lead to their re-flushing and hence the delay in planting is avoided. Weather conditions during the autumn season are still warm enough to initiate root development in fresh planted saplings and even a few of them get sprouted before entering into dormancy in winters. Autumn planting has been demonstrated to the growers during the last two seasons and around 10,000 saplings were planted by a dozen growers during October-November, 2012 in three north Indian states of Haryana, Uttar Pradesh and Uttarakhand. The survival of these plantations was very high.

Farm operations especially irrigation regimes for some intercrops like wheat and seed pea do not synchronize with poplar requirement and their cropping is avoided during the fresh winter planting and also the vice-versa. Fields with such agricultural crops are now planted along with sowing of these crops in October-November. Autumn planting is sensitive in term of handling physiologically active uprooted saplings and need better handling and care before and after uprooting.

Spring planting

Poplar is not planted in actively growing stage as it quickly dries on uprooting from soil. Poplar saplings uprooted during dormant stage, shifted and maintained in containers could be planted anytime with assured and repeated irrigations after planting. Biodegradable containers made of jute, saplings rolled with wet soil and covered with sugarcane leaf made tubes, and polythene containers have been used with success.

Delayed planting too late after spring season leads to loss in fresh year growth, suppression of poplar saplings from tall intercrops like sugarcane, maize.

Below are table 1 and figure 1 to illustrate this article.

Table-I. Comparison of poplar planting in three seasons.

Sr. No.	Particulars	Autumn	Winter	Spring
1	Planting period	15th Oct. onward	25th Dec. to 10th March	March, April and May
2	Sapling condition	Semi-dormant i.e., apical bud recently set in, green leaves on the greater part of stem. Axillary buds loose	Leafless and dormant. Axillary buds firm.	Fresh sprouts actively growing.
3	Stem	Semi hard	Mature and hard	Fresh shoots tender but lower stem is woody and hard
4	Bark	Smooth, soft and green	Mature, rough and on lower stem in a transforming phase to corky type	Fresh shoots with green and smooth bark; old shoots with mature, rough and corky type
5	Root system	Trimmed and open	Trimmed and open	Covered in containers with soil media and actively growing
6	Sensitivity	Highly sensitive, need immediate planting after quick conditioning in fresh water and adequate care.	Planting could be delayed if saplings on uprooting are well maintained in fresh water till planting	Saplings maintained in containers with soil medium with proper irrigation system could be planted late
7	Utility	Better for synchronizing planting and crop operations. Mortality, if any, is replaced during winter and spring seasons, Better survival and normal growth in the following season	Normal survival and growth	Mainly for replacement of mortality in fresh year plantations, though many growers have successfully made fresh plantations on harvesting wheat and pea crops

Fig.1: Top left- Conditioning of saplings in fresh water for autumn planting; Top right- Fresh plantation demonstrated to IPC delegates on 2nd Nov., 2012; Below left- Plantation photographed in first week of June, 2013 that was established on 28th Oct., 2012 in presence of IPC delegates in Yamunanagar, Haryana; and Bottom right- Saplings in polythene containers maintained for spring/summer planting

IRAN

Introduction of successful salt and dry tolerance hybrid poplar (*Populus euphratica Oliv. x P. alba* L. var, "mofid") in I.R.Iran as a new achievement for poplar plantation

by Jafari Mofidabadi, A[1]., Jafari. I[2].

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Introduction

The deficit of wood production in meeting the demand is increasing in many countries. Establishment of plantations with poplar, salix and other fast growing forest tree species is one of the most effective ways to meet the growing demand for wood. Moreover poplar and fast growing plantations will decrease the demand pressure on natural forests and will also help to protect natural resources such as water, soil and wildlife in many countries.

Fast growing plantations can be also a very profitable way of cultivation and provide an alternative source of income for farmers. The history of poplar culture in the Iran dates back more than 100 years. Since those many attempts have been done such as breeding, tree improvement

and silviculture research and caused great advances in country.

Introduction of salt and drought tolerance hybrid poplar (Populus euphratica oliv. × P. alba L. var, "mofid") plants is a new excellent research achievement of tree improvement. The achievement have encouraged government to make a plane for increasing wood production in 20000 ha of low land in south part of country which naturally occupied by noncommercial poplar species Popolus euphratica Oliv.

In this report we intend to present successful long breeding program (15 Year) which has caused to introduce new high tolerance salt and drought resistance hybrid poplar (1, 2 and 4). This breeding program has been started in 1996 to produce hybrid tree through conventional crossing and in vitro culture of Populus euphratica oliv. and P. alba L. embryos and ended in 2012 by adaptation studies in three different provinces.

Material and Methods

Conventional crossing

There has been a long interest in the hybridization of poplars largely because of the benefits derived from capturing heterosis and combining traits to improve the quality and amount of wood production.

The importance of Populus euphratica oliv. has been recognized populations through its wide range in the sub-tropics, from China to Morocco, show varying degrees of tolerance to the salinity, periodic water-logging, cold and arid conditions (6).

Unfortunately, overuse has removed many of the stems of better from, so that natural stands now usually appear small and crooked (5).Due to excellent characteristics, Populus euphratica oliv. was always being chosen as a parental species in poplar hybridization.

Therefore ten years old grown Populus euphratica oliv. tree in research center of Alborz in karaj (with origin of Gotvand-Karoon river in Khozistan province) was artificially hybridized with Populus alba L. (1996-1997).

But incompatibility barrier made it difficult and impossible to get hybrid plants.

Application of ovule-embryo culture

Ovule-embryo cultures have been used to overcome incompatibilities barrier. 45 days old ovule were isolated and transferred to MS medium for embryo nutrition. Two hybrid plants (Populus euphratica Oliv. × P. alba L.) were recognized based on medium phenotype of parents (Fig .1) and successful transferred to the green-house in 1998 (2).

Proliferation of Populus euphratica Oliv. × P. alba L. hybrid plants:

Proliferation of Populus euphratica oliv. × P. alba L. hybrid plants took pleased in 1999-2000 through method of tetrad for adaptation studies in three different provinces (Khozestan, Charmehall –o-Bakhtiyari and Orumiyah).

Fig.1: ***Phonotypical performance*** of Populus euphratica oliv. × P. alba L. Var." Mofid" hybrid (Middle) with its parents .
Right= Populus euphratica oliv. (Female parent)
Left= Populus alba L. (Male parent)

The results of adaptation in Khozestan (2003-2005):

This experiment has been conducted on one of Karoon river branches in Dezpol with salinity soil and hot weather. The conditions which made it difficult for growing of any other poplar species except Populus euphratica oliv.

The analysis of five year growing data base on average in height, breathe diameter and survival rate of seedling indicated that there were highly significant differences between Populus euphratica oliv. x P. alba L. hybrid poplar plant with Populus euphratica Oliv. as a control (p 0.001).

Populus euphratica oliv. × P. alba L. var "mofid" hybrid with 10.67 cm, 789 cm and 100% respectively for breath diameter, height and survival rate or seedling appeared to best poplar tree for poplar plantation of such areas.

The data on Populous alba L. as a control estimated 6.07 cm, 389 cm and 100 % of for breath diameter, height and survival seedling rate respectively. Therefore, Populus euphratica oliv. × P. alba L. var "mofid" hybrid have been suggested to the government for poplar plantation of such area.

The results of adaptation in West Azarbyjan (Orimiyeah) (2003-2005):

There were highly significant differences observed between Populus euphratica Oliv. × P. alba L. var "mofid", Populus alba L. × P.euphratica Oliv. and Populus alba L. (control) for average of five growing seasons of height, breath diameter and survival rate of seedling at (p 0.001).

Populus euphratica Oliv. × P. alba L. var "mofid" with average height of 488.56 cm and 5.80 cm as an average for breath diameter and 100% of survival rate of seedling appeared to be better than Populus alba L. × P.euphratica Oliv. and Populus alba L. as a control in this areas. Populus euphratica oliv. × P. alba L. var "mofid" have been introduced to the area with 4 ml/cm2 salinity (Fig. 2).

The results of adaptation in Charmehall Bakhtiyari (2003-2005):

Analysis of data derived from 5 year adaptation studies in Charmehall Bakhtiyari province indicated that there was a significant difference between Populus alba L. x P. euphratica Oliv., Populus euphratica oliv. x P. alba L. and Populus nigra 0.05. Populus alba L. x P. euphratica Oliv. with 524 cm average height and 49 cm as an average of breath diameter appeared to be best for poplar plantation in this area.

Due to occurrence of unusual cold temperature (less than -45oC in 1383, burning of apical bud has been observed in Populus euphratica oliv. x P. alba L. trees. Therefore cold conditions are a limitation factor for Populus euphratica oliv. x P. alba L. and cannot be suggested for poplar plantation in this area.

Fig.2: Performance of 4 years old Populus euphratica oliv. × P. alba L. Var." Mofid" (Right), Populus alba L. as control (middle) and Populus alba L. × P. euphratica Oliv. in adaptation study ***(Orimiyeah),***

Reference:

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NEWS OF THE NATIONAL POPLAR COMMISSIONS AND COUNTRIES

CANADA

Agroforestry in Atlantic Canada

by Jim Richardson

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The Association for Temperate Agroforestry (AFTA www.aftaweb.org) is a non-profit organization devoted to the promotion of agroforestry in a North American context. Since its inception in 1989, one of the primary activities of this society of scientists and agronomists has been a biennial North American Agroforestry Conference. As mentioned prospectively in news from Canada in the last issue of the newsletter of the International Poplar Commission, the 13th such conference took place in Charlottetown, the capital city of Prince Edward Island (PEI), the smallest province of Canada. The economy of PEI is largely dependent on agriculture, fisheries and tourism, with potatoes being the most important crop. Most farmers also own woodlots, of managed mixed-wood native forest or conifer plantations, so agroforestry is a natural complement.

The 13th North American Agroforestry Conference had the general theme of 'Agroforestry – innovations in agriculture' and attracted more than 100 participants from Canada and the USA, as well as several countries in Europe, South America and Africa. Over the course of a day and a half of technical sessions, 64 invited and volunteer oral presentations and 25 posters were presented.

These dealt with a range of topics including: Agroforestry and greenhouse gases; Poplar, willow and biomass; Economics, policy and outreach; Riparian and silvopasture; Windbreaks and alleycropping; and Non-timber forest products. Nearly half of the presentations concerned poplars or willows directly and all were relevant to poplar and willow scientists and managers. Authors of oral and poster presentations were invited to submit formal papers following the conference for peer review and consideration for publication in a special issue of the journal Agroforestry Systems, which is likely to appear in early 2014.

During the conference, a full day was devoted to field visits to research, development and operationally commercial agroforestry sites in PEI. A total of five sites were visited across the central part of the island. These included shelterbelt rejuvenation in intensive potato production using a variety of tree species including white spruce (Picea glauca), European larch (Larix decidua), red maple (Acer rubrum), white ash (Fraxinus americana) and American mountain ash (Sorbus americana).

Production of hazelnuts (Corylus americana) was shown in an orchard with 18 different varieties being tested. Haskaps or blue honeysuckle berries (Lonicera caerulea), native to Kamchatka and northern Japan, are a relatively new and tasty crop being tested in PEI; they are somewhat akin to highbush blueberries (Vaccinium corymbosum) and well suited to cool temperate and boreal climates. Commercial lowbush blueberry (Vaccinium angustifolium) production fields were also visited on a site where the importance of shelterbelts to the development and maintenance of native pollinator communities was discussed.

One of the highlights of the field day was a visit to a riparian buffer and willow biomass variety trial hosted by Agriculture and Agrifood Canada. The buffer plantation is designed to mitigate high nitrate leaching into water bodies from adjacent heavily-fertilized fields growing primarily potatoes. The willows were able to benefit greatly from the run-off, achieving the highest recorded willow yield in Canada of 3.2 kg/ha/year (measured on an individual tree basis). (See photo.) Though this particular buffer plantation, established in 2006, could not be fully harvested due to Provincial regulations applying to a zone within 15 m of water, other trial plots are testing willow varieties for biomass production for energy. Harvested on a 3- or 4-year coppice rotation, yields of up to 60 t dry matter / ha are possible. The primary market for the biomass is seen as farm use, displacing high-priced fossil fuels.

An optional one-day pre-conference tour started in the adjacent Province of New Brunswick. In Fredericton the provincial capital, the Canadian Bioenergy Centre, part of the Wood Science and Technology Centre of the University of New Brunswick, was visited. The Centre develops and tests equipment and technology related to use of wood for energy, particularly in the form of pellets, and includes a lab accredited for testing wood pellets against North American and European standards.

The second stop was at a multi-species, multi-tiered plantation established in 2004 to evaluate carbon sequestration and non-timber forest products. Thirty different species and varieties of shrubs and trees are being compared, ranging from blackberries (Rubus spp.) to hybrid larch (Larix xeurolepis) and tamarack (Larix laricina), and including Salix species.

The final field stop in New Brunswick demonstrated small-scale commercial production of shiitake mushrooms on hardwood bolts. The operation, with 1000 bolts, was producing 0.45 kg of mushrooms per year on each bolt, to be sold at more than $11 per kg wholesale. The same operator also ran a small hardwood seedling nursery growing black walnut (Juglans nigra), oak (Quercus sp.), butternut (Juglans cinerea), horse-chestnut (Aesculus sp.) and American chestnut (Castanea dentata) in pots and plugs in a small greenhouse.

Photos from the 13th North American Agroforestry Conference can be seen on the conference website (http://2013naac.com/conference/2013-naac-photos) as well as on the website of the Poplar Council of Canada (www.poplar.ca/article/pei-2013-photo-gallery-156.asp).

The annual meeting of the Poplar Council of Canada was held in conjunction with the conference in PEI. During the meeting, reports from the past year were received, plans for the coming year were reviewed and Board membership was confirmed. Amongst other business, the possibility of changing the name of the Council to give explicit recognition of willows was discussed. The 2014 annual meeting will be held in Vancouver, British Columbia in conjunction with the 6th International Poplar Symposium being held there July 20-23 (www.2014ipsvi.com for more information).

The location for the next AFTA conference, in 2015, is still to be determined. As demonstrated by presentations and field visits during the conference in PEI in its, agroforestry, as studied and practised in North America, involves a much broader range of species than the already broad range represented by the Salicaceae. The focus on benefits to be derived from integrating tree and shrub crops with agricultural crops and/or livestock rather than on the crops per se, emphasizes the importance of purpose for agroforestry systems.

This could be a key consideration for the International Poplar Commission as it seeks new revitalized directions.

IPC EXECUTIVE COMMITTEE (2012-2016)

Elected members	Countries
Esteban Borodowski	Argentina
Marijke Steenackers	Belgium
Barbara Thomas	Canada
Meng-Zhu Lu	China
Catherine Bastien	France
Georg von Wuehlisch	Germany
V.K. Bahuguna	India
Dinesh Kumar	India
Naldo Anselmi	Italy
Sasa Orlovic	Republic of Serbia
Martin Weih	Sweden

MEET THE MEMBERS OF THE EXECUTIVE COMMITTEE

Dr. Barb Thomas, Canada

completed her BSc (Horticulture) and MSc (Forest Genetics) at the University of British Columbia and her PhD (Forest Biology and Management) on trembling aspen (Populus tremuloides) at the University of Alberta in 1996, in Canada.

For the past 20 years, she has run a consulting company, Genstat Consulting, working as an industrial forest genetics researcher and since 1997 has also been an adjunct professor at the University of Alberta. Since 2009 Barb has been the Chair of the Poplar Council of Canada (www.poplar.ca) which is located in Edmonton, Alberta, Canada.

Since 1997 Barb has been responsible for the aspen, poplar and hybrid poplar research and breeding programs at Alberta-Pacific Forest Industries Inc. in northeastern Alberta where a collection of more than 25,000 genotypes resides. She has also worked in partnership with the provincial government assisting with policy development and has been a member of the Alberta Forest Genetic Resources Council of Alberta for the past 10 years. Areas of research have included fertilizer strategies to enhance growth and survival, Septoria musiva resistance screening and protocol development, above and below ground carbon balances, drought resistance and optimization of greenhouse production of planting stock including production methods for mass propagating hybrid aspen clones. More recent work has focussed on screening of balsam poplar for use on degraded and challenging reclamation sites.

Dr. V.K. Bahuguna, India

an officer of Indian Forest Service, is presently holding the position of Director General, Indian Council of Forestry Research and Education, Dehradun and chancellor of Forest Research Institute Deemed University, Dehradun. He works in the rank of Secretary to the Indian government and he is Chief Technical Advisor to the Government of India on forestry research

At the national level his job has revolved around policy formulation and planning. He has contributed significantly to corporate planning and management and as forest and wildlife administrator. He headed the Tripura Forest Development and Plantation Corporation with distinction making it one of the best 14 corporate houses in India for high productivity and efficiency. Dr Bahuguna received Queen's Award for Forestry for the year 2000 from Commonwealth Forestry Association, UK. He was elected Vice-Chairman of Asia Pacific Association of Forestry Research Institution (APAFRI) at its 6th Assembly meeting in Guangzhou, China in 2012 and as Member, Governing Council of Commonwealth Forestry Association (International) twice (2001, 2007). He was president of the organizing committee of IPC session in India during 2012. He has about 40 international assignments/visits, and more than 200 publication to his credit. With several innovative approaches he is spearheading forestry research for economic empowerment of people. Email: bahugunaifs@gmail.com, bahugunaifs@yahoo.com.

Dr. Dinesh Kumar, India

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RESEARCH ON POPLARS AND WILLOWS

Sex ratios and clonal growth in dioecious Populus euphratica Oliv., Xinjiang Prov., Western China.

Anne Petzold, Tanja Pfeiffer, Florian Jansen, Pascal Eusemann, Martin Schnittler.

Trees. June 2013, Volume 27, Issue 3,

pp 729-744.

Link:http://link.springer.com/article/10.1007/s00468-012-0828-y?wt_mc=alerts.TOCjournals.46

Influence of Ca/Mg ratio and Cd2+ and Pb2+elements on low molecular weight organic acid secretion by Salix viminalis L. roots into the rhizosphere.

Zuzanna Magdziak, Mirosław Mleczek, Zygmunt Kaczmarek, Piotr Golinski.

Trees. June 2013, Volume 27, Issue 3,

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Link:http://link.springer.com/article/10.1007/s00468-012-0821-?wt_mc=alerts.TOCjournals.468

DRIS-based fertilization efficiency of young hybrid poplar plantations in the boreal region of Canada.

Raëd Elferjani, Annie DesRochers, Francine Tremblay.

New Forests. July 2013, Volume 44, Issue 4,

pp 487-508

Link:http://link.springer.com/article/10.1007/s11056-012-9358-0?wt_mc=alerts.TOCjournals.11056

Xylem cell length under drought and its value for predicting radial growth of SRF poplar cultivars (Populus spp.).

Matthias Meyer, Alexander Solger, Doris Krabel.

Trees, October 2013, Volume 27, Issue 5,

pp 1353-1363

Link:http://link.springer.com/article/10.1007/s00468-013-0883-z

Concomitant analysis of cambial abscisic acid and cambial growth activity in poplar.

Matthias Arend, Jörg Fromm.

Trees, October 2013, Volume 27, Issue 5, pp 1271-1276

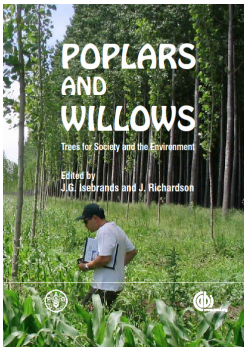
Link:http://link.springer.com/article/10.1007/s00468-013-0875-z

NEW REFERENCE WORK ON POPLARS AND WILLOWS

POPLARS AND WILLOWS: TREES FOR SOCIETY AND THE ENVIRONMENT

edited by J.G. Isebrands and J. Richardson

A co-publication of the Food and Agriculture Organization (FAO) of the United Nations and the Centre for Agricultural Bioscience International (CABI)



Natural and planted forests of poplars and willows cover about 95 million ha in the world. In many industrialized and developing countries they have become significant resources in agriculture and forestry, which are ideally suited for supporting rural livelihoods, enhancing food security, alleviating poverty and contributing to sustainable development.

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based in Wisconsin, USA and Mr. Jim Richardson, a bioenergy and forestry consultant, based in Ottawa, Canada. An outstanding feature of the book is its nearly 2500 references.

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