Federal Ministry of
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Poplars and Willows in Germany: Report of the National Poplar Commission

Time period: 2008-2011

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Poplar Commission
of the
Federal Republic of Germany

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Contents

I Policies and Legislation

Policies

a) Cultivation of poplars and willows in short-rotation coppices on arable land

During the period under review, the cultivation of poplars and willows in short-rotation coppices (SRC) increasingly developed into a practicable form of energy wood production. This applies to the supply with appropriate planting material, to the availability of specialised contractors for planting and harvesting measures and to practical knowledge with regard to establishing and maintaining such plantations. But knowledge on the development of such plantations in the course of their calculated stand time and on the predictability of the expected biomass yields related to a certain site type is still lacking. In addition, there is a demand for productive poplar and willow clones. Several projects were supported with experimental plantations by the *Fachagentur Nachwachsende Rohstoffe* (Agency for Renewable Resources) and other institutions with a view to answering questions about the practical cultivation, profitability and the selection of suitable species and varieties.

For the production of renewable energy, this form of land use is generally recognised as the form that combines high CO_2 fixation with low CO_2 avoidance costs and that can at the same time use agricultural marginal land and is therefore not necessarily in direct competition with food production. The ability of poplars and willows to fix atmospheric nitrogen allows for the production of large amounts of biomass without further increasing nitrogen deposition in soils and groundwater. It is this ability in particular that makes biomass production in short-rotation coppices so sustainable. The total area of short-rotation coppices in Germany has increased to 4,000-5,000 ha and continues to increase significantly.

Although the promotional policy under the Renewable Energies Act (EEG) has increased the prices of woody solid fuels (firewood, wood chips, pellets), they are still only 60% of the price of natural gas and 50% of the price of heating oil and are less volatile.

b) Genetic conservation of black poplar (*Populus nigra* L.)

Most pure black poplar occurrences only consist of relict stands with over-mature trees. Efforts have been continued to preserve the remaining population through *in situ* and *ex situ* measures. The gene banks of several *Länder* (NW, RP, HE, SN, BB, ST) contain black poplars of certified purity and origin for renaturation measures in the respective region. Black poplar stands have been approved for harvesting generative reproductive material for genetic conservation purposes in accordance with the Act on Forest Reproductive Material (*Forstvermehrungsgutgesetz* -

FoVG). Seed samples from gene conservation units have been made available to American poplar breeders.

c) Agroforestry systems

According to the EURopean AgroForestry Federation (EURAFF), the term agroforestry system (AFS) means that field crops (trees) and agricultural crops are cultivated on the very same plot. Positive interactions between woodland and arable crops require that the entire growing area be regarded as a so-called agroforestry system. In addition to ecological (ecotonal structures, biotope network) and climatic (increased roughness of the landscape) benefits, timber production and agricultural crop rotation patterns have also been integrated into this system. The cultivation of poplars, willows and black locust in rows in short-rotation plantations alternating with agricultural crops is studied as a new form of cultivation in the scope of various projects. The positive effects are very promising.

Legal measures

With the elimination of the compulsory set-aside under Regulation (EC) No 73/2009, areas with short-rotation plantations and agroforestry systems have been classified as eligible permanent crops. The rotation periods must be shorter than 20 years each.

In order to maintain this eligibility for aid, the tree species poplar, willow, black locust, birch, alder and ash (CN code 0602 90 41) may be cultivated in short-rotation plantations and agroforestry systems.

By amendment to the Federal Forest Act (BWaldG) of 31 July 2010, short rotation plantations and agroforestry systems are no longer considered forest (Article 2 (2) no 1 BWaldG). This implies that no afforestation authorisation is required for the establishment of short rotation plantations outside forest land. The area can also be converted back for food production at any time without having to apply for a clearing and conversion authorisation. This approach is meant to facilitate the creation of short-rotation plantations outside forests. On the other hand, the establishment of short rotation plantations in forests is not regarded as regular forest management. A forest conversion authorisation would be necessary for this purpose.

An environmental risk assessment (ERA) is only required for areas greater 50 ha, but every short rotation plantation or agroforestry system must be regarded as an individual case. It is therefore advisable to notify such plantations to the lower nature conservation authority or the competent agricultural agency.

Permanent grassland areas are subject to the obligation to conserve grasslands. Eligible permanent grassland areas must only be converted into short rotation plantations to a minor extent, as they are considered permanent cultures (see cross-compliance/obligation to maintain grasslands under Regulation (EC) No 73/2009 and Regulation (EC) No 1122/2009).

The provisions of the Act on Forest Reproductive Material (FoVG) also apply to short-rotation plantations outside forests.

II Statistical and Economic Data

Statistical data

Planting of poplars and willows in Germany's forests is presently rare. This is primarily due to the as yet low sales potential for poplar wood and the clearcut-free continuous cover forest management. Aspens and balsam poplars are introduced as pioneer crops in mixed stands only on calamity areas or other afforestation areas. It is therefore difficult to record area percentage figures. The most recent National Forest Inventory cites hardwoods with short life spans (birch, alder, poplar, willow, rowan and other deciduous trees) in summary at 10%. Poplars and aspens take up an area of up to 100,000 hectares. Willows, by contrast, are restricted to only a few wet and extensive sites.

The area of biomass plantations with poplar and willows on formerly agriculturally used non-forest areas has distinctly increased and is now between 4,000 and 5,000 hectares. A great increase in these areas is anticipated since the regulatory framework guarantees that they are considered agricultural areas and are therefore eligible for aid.

Production

The cultivation of poplar and willows as a basis for raw materials is of minor importance in the Federal Republic of Germany. We have no precise data on the current levels of poplar raw wood felling since poplar fellings and sales are recorded and entered in the databases together with the timber species group 'beech'. Annual poplar felling is estimated at 150,000 to 300,000 m^3, as old stands have been increasingly used and have not been replaced by new plantings. There are no separate records on the use of poplar raw wood.

The timber volume of approx. 50,000 t that is annually produced in short-rotation plantations concerns the energy market and is comparatively insignificant in this context as compared to the quantities of imported wood pellets which already amount to several million tonnes.

Imports and exports

The Federal Republic of Germany's foreign trade in poplar timber is of minor significance, as Germany has no poplar timber-based industries. A separate market for poplar timber has not developed to any major significance in Germany. But occasionally, export prices of approx. € 50/m^3 were realised near harbours for standard poplar log varieties.

Trends

Interesting markets are increasingly developing for energy use of poplar and willow timber in the form of wood chips to be used for the combined generation of power and heat in power stations in municipalities with district heating networks or other heat users.

III Technical Data

Identification, registration and plant variety protection

a) Identification

Under the FastWOOD project funded by the BMELV, the methods for the identification of poplar clones have been extended by molecular methods. There are now reliable identification methods for all marketable clones and varieties. Reference databases are in the making. These methods allow for the reliable and increasingly cost-effective control of the breeders' marketing rights for these varieties.

A common method uses microsatellite DNA polymorphisms. These are short, non-coding DNA sequences that are often repeated in the genome of an organism in non-coding regions of the chloroplasts – such as the nuclear DNA (syn. SSR – Simple Sequence Repeats or SSLP – Simple sequence length polymorphism). These DNA fragments are electrophoretically separated in a gel matrix and show characteristic banding patterns for the examined genotypes. Another method uses variations of individual base pairs in a DNA strand, referred to as single nucleotide polymorphisms (SNP marker). The variation is identified by way of sequencing the nucleotide base pairs and shows genotype-specific sequences that allow for exact distinctions. Moreover, knowledge about species-characteristic microsatellite markers or SNPs allows the determination

of the parent species of species hybrids, thus helping to reconstruct the genealogy of suitable poplar hybrids. These instruments support efficient breeding activities.

Biochemical analysis methods are also used for the conservation of the European black poplar with a view to ensuring that only pure species material is conserved. Since the European black poplar crosses spontaneously with the widespread hybrid clones, genetic mixing with native black poplars cannot be excluded.

b) Approvals

The following basic material for the production of forest reproductive material was approved in the period under review on the basis of experimental plantations under the provisions of the Act on Forest Reproductive Material (*Forstvermehrungsgutgesetz - FoVG*) and the accompanying ordinances in the category "Tested Reproductive Material".

Clone name	Cross	Gender	Number	Time limit
Matrix 11	P. maximowiczii × P. trichocarpa		95304	30.06.2021
Matrix 24	P. maximowiczii × P. trichocarpa		95305	30.06.2021
Matrix 49	P. maximowiczii × P. trichocarpa		95306	30.06.2021
Ahle 1	P. tremula × P. tremula	m	98404	30.06.2018
Ahle 2	P. tremula × P. tremula	m	98405	30.06.2018
Ahle 13	P. tremula × P. tremula	m	98408	30.06.2018
Ahle 4	P. tremula × P. tremula	m	98406	30.06.2018
Ahle 5	P. tremula × P. tremula	f	98407	30.06.2018
Ahle 16	P. tremula × P. tremula	m	98409	30.06.2018
Ahle 17	P. tremula × P. tremula	m	98410	30.06.2018
Münden 2	P. tremula × P. tremuloides	m	98506	30.06.2018
Münden 6	P. tremula × P. tremuloides	m	98507	30.06.2018
Münden 7	P. tremula × P. tremuloides	f	98508	30.06.2018
Münden 11	P. tremula × P. tremuloides	f	98509	30.06.2018
Münden 13	P. tremula × P. tremuloides	m	98510	30.06.2018
Münden 16	P. tremula × P. tremuloides	m	98511	30.06.2018
Münden 20	P. tremula × P. tremuloides	f	98512	30.06.2018

c) Registration

Since 2011, the Federal Agency for Agriculture and Food (BLE) in Bonn is maintaining the register of clones, clonal mixtures and parents of family approved in Germany by the authorities competent under *Land* law (www.ble.de).

Under Article 4 of the Act on Forest Reproductive Material (FoVG), approvals of these species of basic material may only be granted in the category "Tested". The vegetative production of forest reproductive material to be placed on the market also must be based on basic material of this category (Article 7 FoVG).

A list of poplar clones, clonal mixtures and family parents can be downloaded from
http://www.ble.de/SharedDocs/Downloads/02_Kontrolle/07_SaatUndPflanzgut/Pappelklone_mischungen.pdf?__blob=publicationFile.

An overview of poplar stool beds and the competent *Land* agencies can be downloaded from
http://www.ble.de/SharedDocs/Downloads/02_Kontrolle/07_SaatUndPflanzgut/Pappelmutterquartiere.pdf?__blob=publicationFile.

d) Arboriculture Register

Approved poplar clones and clonal mixtures are entered in an Arboriculture Register. The Arboriculture Register for poplars is maintained by
Regierungspräsidium Kassel, Steinweg 6, D-34117 Kassel.

e) Plant variety protection

Due to the low trade volume for poplar reproductive material and the comparatively high costs, variety protection is not often claimed.

Cultivation

a) Conventional rotation

Poplars, aspens and willows are not cultivated to any notable extent in conventional rotation. Due to the better economic situation of forestry holdings as a result of higher timber prices, there is a greater interest in planting pioneer crops. These allow earlier exploitations and profits. Balsam poplar hybrids as well as aspens and aspen hybrids (*P. tremula* × *P. tremuloides*) are particularly suitable as pioneer tree species. Thus, aspen hybrid species such as 'Holsatia', for instance, are selling better than in past decades.

b) Short rotation coppices

The various government-supported cultivation, breeding and testing programmes include, for example, ProLoc and FastWood. Other projects can be found at http://www.nachwachsenderohstoffe.de/projekte-foerderung/projekte/. Short rotation coppices were continued and expanded in Hesse, Lower Saxony, Saxony, Bavaria and, above all,

Brandenburg so that about half of the 4,000 ha of short-rotation plantation area in Germany are established there.

The results of the ProLoc project reveal that biomass growth is significantly dependent on water supply. An average water supply of 300 l/m² during the vegetation period and water-holding soils can produce yields of 10 t of dry matter per hectare annually. With high precipitation or groundwater impact also guaranteeing a continuous growth in dry periods, the yields can even be 20 t and higher; whereas with a poorer water supply, the annual dry mass increment per hectare can be 6 t or less.

The investment costs for establishing a plantation are high and vary depending on the tree species and the number of plants, which, in turn, depends on the utilisation purpose of the woody biomass produced. Total costs of € 1,800 – 5,500 (establishment, operating and harvesting costs) per hectare are calculated for biomass production with a large number of plants and short rotation periods, establishment costs for industrial utilisation with lower numbers of plants and longer rotation periods are € 1,600 per hectare, in both cases not including fencing, which can be calculated at an additional € 1,000 per hectare.

In addition to investment costs, harvesting and transport are also major cost factors that heavily depend on the production target. Harvesting costs of € 45-82/t of dry mass have been estimated if specially constructed harvesting machinery to harvest wood chips for energy exploitation at a maximum 4-year growth is used. These costs could be reduced by improved capacity utilisation of the harvesting machinery. Longer rotation periods result in thicker harvest material, which results in higher harvesting costs.

To evaluate the economic situation of plantations for energy use of woody biomass and an average plantation volume yield (10 t/ha) and lifetime (seven 3-4 year rotations), production costs between 30 and 45 €/t absolute dry weight woody biomass are calculated. If the operating risks are not taken into account and revenues of € 50/t absolute dry weight are calculated for the produced biomass, annuities (at 3.5% interest) of between 125 and 250 €/ha can be anticipated. The current prices of € 90/t absolute dry weight for wood chips will result in higher revenues. Under the present circumstances, short rotation plantations are no competition to agricultural food production. It seems reasonable to operate short-rotation plantations on agricultural marginal soils with water supplies that are too low or too high and on poor soils.

Biotic damages are a risk factor. Increased spread of plantation areas could cause significant economic damages due to better development opportunities of previously insignificant harmful organisms. The primary risk is, however, the price at which the produced material can be utilised. If oil prices remain at their present high for a long time or above it temporarily, woody biomass could be competitive as an energy source, particularly if rationalisation potentials could be developed for seedling production, harvesting and transport at increasing utilisation.

Breeding and selection

c) Conventional rotation

No breeding or selection took place for exploitation in conventional cultivation during the period under report. Genetic resources of the black poplar (*P. nigra*) in the form of pollen and seed were provided for breeding work in the USA.

d) Short rotation

In the course of production of renewable energies, the cultivation of poplars, aspens and willows is gaining increasing interest. There has been such great demand for seedlings in Germany that it could not be satisfied by domestic nurseries for a time that poplar seedlings had to be imported from Austria, Hungary, Italy and France and willow cuttings from Sweden. The demand for aspens could also not be satisfied.

According to the guidebook *Energieholzproduktion in der Landwirtschaft* (Energy Timber Production in Agriculture; 3rd edition, 2009; author: M. Hofmann) published by *Fachagentur Nachwachsende Rohstoffe* (Agency for Renewable Resources), eight poplar varieties are suitable: Hybrids 275 (Syn. NE 42), Max (multiclonal variety), *P. koreana**, 10/85, 20/85*, Androscoggin, Trichobel and Muhle Larsen and six willow varieties: Björn, Tora, Zieverich, Tordis, Inger and Sven for cultivation in short-rotation plantations. In 2011, about 80% Max clones and 15% Hybrids 275 were used. As for willows, the shift in preferences was even more significant. The clones Tordis and Inger with 35% each and Tora with 20% are used most, whereas clone Sven and new breed Klara only amount to 5% each (oral information by C. Neumeister). Many varieties have not yet demonstrated their suitability on agricultural sites, however. This clearly demonstrates that there is not only a great demand for varieties but that these must also be tested for suitability. This underlines the importance of projects like ProLoc in the scope of which the suitability of clones is tested on a wide variety of sites in various German regions.

Protection measures

Considerable damage events are not known for poplars and willows. Protective measures must, however, be taken, primarily in the first year of planting against browsing by game with fencing, against damage done by rodents and against competing vegetation. *Chrysomela (=Melasoma) populi* L. has done some damage, particularly feeding damage on the newly flushing coppice

shoots after harvesting. Feeding damage by *Chrysomela vigintipunctata* can also reduce growth increment in individual cases. After several years, however, there seems to be a balance between the beetles and their enemies so that damages become tolerable without protection measures (written communication by K. Döhrer). In years with extreme spring aridity, mortality was high (in parts even total). Supplementary irrigation, particularly during the young growth phase, is recommended to safeguard successful regeneration and to increase the increment.

Most occurrences of pure black poplars are damaged by fungi and insects. This particularly applies to foliar rust caused by *Melampsora larici-populina*. The over-maturity of the trees in the occurrences, mostly in relict stands, can be considered the cause of the alarming health condition. The genetic resources must therefore be protected and regeneration measures introduced.

Exploitation and utilisation

a) Exploitation

Poplars and willows grown in conventional rotation periods are exploited according to normal forestry practices. Poplar raw wood is graded according to the statutory provisions on raw wood grades.

The woody biomass produced in short-rotation plantations is used in the form of wood chips, e.g. for wood-based materials, but mainly for energy production.

b) Utilisation

The biomass produced in short-rotation plantations is mostly used as solid fuel, which is mainly burnt as wood chips in adapted boiler systems. With greater volumes of woody biomass, increased pelletisation would be conceivable. Methods for the gasification of woody biomass (pyrolysis) or the liquefaction of fuels (Fischer-Tropsch process) have not yet been developed to the point of practical application.

Scientific studies and other activities

Old poplar tests, clone collections and neglected mother plantations have been examined and secured within the scope of new breeding activities and the FastWOOD project. Many of the existing clones have been identified with the help of molecular markers. The clones are also tested for their suitability for biomass production in short-rotation plantations.

General Information

National Poplar Commission

The National Poplar Commission is chaired by the head of Directorate-General 5 (Bio-Based Economy, Sustainable Agriculture and Forestry) of the Federal Ministry of Food, Agriculture and Consumer Protection.
The Secretariat of the National Poplar Commission is maintained by the Federal Ministry of Food, Agriculture and Consumer Protection.

Relations with other countries

A collection of 58 clones, bred at the University of Minnesota (USA), of the cross-breeds *P. deltoides* × *P. deltoides* (5), *P. deltoides* × *P. nigra*, (39) *P. deltoides* × *P. maximowiczii* (9), (*P. trichocarpa* × *P. deltoides*) × *P. deltoides* (3) and *P. deltoides* × (*P. trichocarpa* × *P. deltoides*; 2) was made available in 2010 to the Institute of Forest Genetics of the von Thünen Institute in Germany and Poland and other scientific studies. For phytosanitary reasons, the clones were transferred into tissue cultures in order to avoid the unintended introduction of harmful organisms.

A total of six progenies of the crossbreeds *P. tremula* × *P. tremuloides* (4), *P. tremuloides* × *P. tremula* (1), *P. tremula* × (*P. tremula* × *P. tremuloides*); (1) were made available for field tests in Riga (Latvia) and Tartu (Estonia) in 2009.

Annex 1

This report is primarily based on the specialised contributions of the following individuals and institutes:

Bayerisches Amt für forstliche Saat- und Pflanzenzucht
Forstamtsplatz 1
83317 Teisendorf
http://www.forst-design3.bayern.de/asp/

Bund-Länder-Arbeitsgruppe
Forstliche Genressourcen und Forstsaatgutrecht
http://www.genres.de/en/forest-plants/

Karl Döhrer
Warburger Weg 26
34474 Diemelstadt

Fachagentur Nachwachsende Rohstoffe e.V. (FNR)
Dorfplatz 1
18276 Gülzow
http://www.fnr.de

Hochschule für Nachhaltige Entwicklung Eberswalde
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Alfred-Möller-Str. 1
16225 Eberswalde
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Kompetenzzentrum HessenRohstoffe (HeRo) e.V.
Am Sande 20
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Abteilung Waldgenressourcen
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http://www.nw-fva.de

Philipps-Universität Marburg
Fachbereich Biologie Naturschutzbiologie
Karl-von-Frisch-Strasse
35032 Marburg
http://www.uni-marburg.de/naturschutzbiologie

Regierungspräsidium Kassel
Baumzuchtregister
Steinweg 6
34117 Kassel

Sächsische Landesanstalt für Forsten
Graupa
Bonnewitzer Str. 34
01827 Graupa
http://www.forsten.sachsen.de/laf

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