Organized by Mendel University in Brno

Coppice forests: past, present and future

CONFERENCE INFORMATION, PROGRAM & BOOK OF ABSTRACTS

EDITED BY

Ondřej Vild

Brno, Czech Republic, 9 – 11 April 2015

COPPICE
CZ.1.07/2.3.00/20.0267

LONGWOOD

esf european social fund in the czech republic
EUROPEAN UNION
MINISTRY OF EDUCATION, YOUTH AND SPORTS
OP Education for Competitiveness
INVESTMENTS IN EDUCATION DEVELOPMENT

IN COOPERATION WITH:

UNDER THE PATRONAGE OF:

SPONZORED BY: Forests of the Czech Republic, State Enterprise

EDITED BY: Ondřej Vild

REVISED BY: Members of the conference Scientific Committee

ISBN 978-80-7509-247-2

SCIENTIFIC COMMITTEE

Matjaž ČATER (chair) Slovenian Forestry Institute, Slovenia
Gianfranco FABBIO, Forest Research Centre, Italy
Radim HÉDL, Institute of Botany of the CAS, Czech Republic
Jan KADAVÝ Mendel University, Czech Republic
Petr KUPEC, Mendel University, Czech Republic
Alex MOSSELER, Canadian Forest Service, Canada
Jana MÜLLEROVÁ, Institute of Botany of the CAS, Czech Republic
Radek POKORNÝ, Global Change Research Centre of the CAS, Czech Republic
Péter SZABÓ, Institute of Botany of the CAS, Czech Republic
Tomáš VRŠKA, Mendel University, Czech Republic

ORGANIZING COMMITTEE

Tomáš VRŠKA (chair) Mendel University, Czech Republic
Alena CABALOVÁ, Mendel University, Czech Republic
Tomáš MÁJEK, Mendel University, Czech Republic
Olga NAŠOVÁ, Mendel University, Czech Republic
Kateřina NOVOSÁDOVÁ, Mendel University, Czech Republic
Štěpánka ŘEHOŘKOVÁ, The Silva Tarouca Research Institute
Vít SKÁLA, Mendel University, Czech Republic
Markéta ŠPLÍCHALOVÁ, Mendel University, Czech Republic
Jan TROCHTA, The Silva Tarouca Research Institute
Ondřej VILD, Institute of Botany of the CAS

CONTENTS

Conference Information

Venue information:

Mendel University Brno

Zemědělská 1

Brno

Czech Republic

Coordinates:

N: 49.2102094

E: 16.6158769

About Brno

Brno is the second largest city in the Czech Republic with a population of 380 000. Within two hundred kilometers there are important European capitals: Prague, Vienna, and Bratislava. More than 90 000 students make Brno a dynamic city and the cultural hub of Moravia.
Brno is home to a number of significant institutions and historical sites, e.g. the Moravian Gallery, the Moravian Museum, the Brno National Theatre, Spilberk Castle, the Cathedral of St. Peter and St. Paul and Villa Tugendhat. It is hard to run out of things to do in Brno, but the city is not overwhelmed by tourists, so you can avoid large crowds and enjoy reasonable prices.

Currency
Please be aware that the currency in the Czech Republic is the Czech Crown. The exchange rate is approx. 1 EUR = 28 CZK.

Traveling to Brno, Czech Republic

By Air:

Around Brno there are 4 international airports – Prague (PRG), Wien (VIE), Bratislava (BTS) and Brno (BRQ).

At **Bratislava airport** you can go by bus 69 to the Main Railway Station (Hlavná stanica) every 20 minutes for 0.90 €. Duration is approximately 25 min. Trains from Bratislava hlavná stanica to Brno Hlavní nádraží go every two hours and cost around 200 CZK (7.50 €). The journey takes 1h 30mins.

From **Wien (Vienna) airport** you can take the buses of Tourbus (12.4 €; 1 bus per day) or Student Agency (17 €; 8 buses per day) to get directly to Brno. The journey takes 2h 30mins. For these direct buses it is recommended to have a reservation or buy a ticket online - http://www.studentagency.eu or http://www.tourbus.cz/port/tickets.
From the Airport you can also take the bus to Wien centre (Wien Meidling; 8 €, duration approx. 30 mins) and go to Brno by train (every two hours; 10 €, duration 2h)

From **Prague (Praha) airport** you can also use the direct bus connection by Student Agency (duration 2h 30 minutes, 10 €). Buy your ticket online at http://www.studentagency.eu.
Another possibility is to take the airport express (60 CZK = 2.5 €, duration 0.5h) bus to Prague Main Railway Station. Trains to Brno go every hour. The journey takes 2h 40mins and costs around 8 €).

Brno airport has direct a connection with the city centre by bus 76 (duration 0.2h, 25 CZK = 1 €)

By Car:

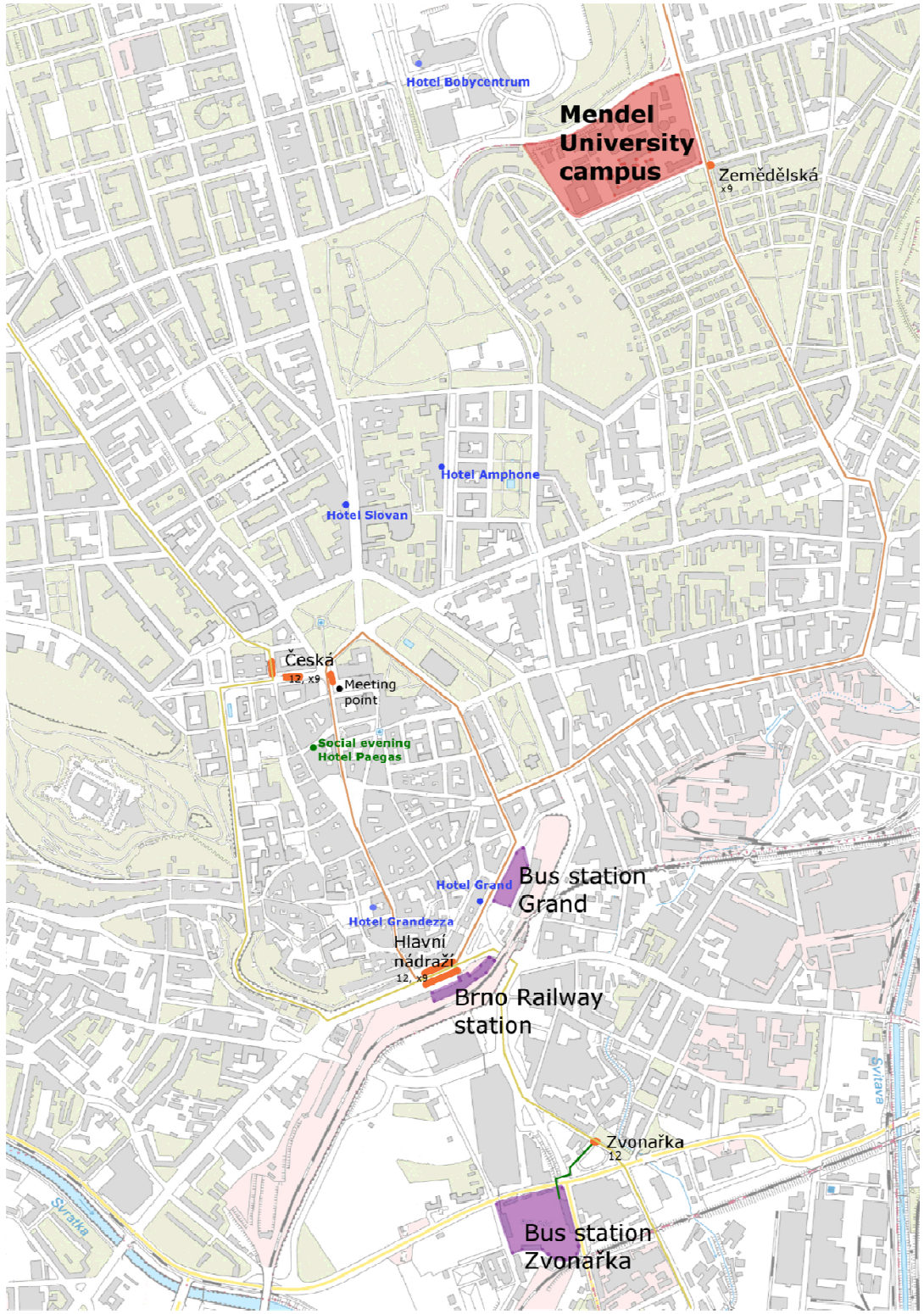
Brno lies in the heart of Europe on the crossroads of main highways from Vienna, Prague, Bratislava and Wroclaw. Czech highways can be used only with a valid highway sticker. The cheapest sticker costs 310 CZK (approx. 12 €) and is valid for 10 days. Parking on selected parking plots around the University is usually free of charge. Hotels normally have private parking places.

By Train:

Brno has good connections by international trains. Brno lies on the connecting line between main German cities (Hamburg, Berlin, Dresden) and Austria – Vienna, Slovakia – Bratislava and Hungary – Budapest. All trains arrive to **Brno Hlavní nádraží**. In front of the train station you'll find the main junction point for public transport in Brno.

By Bus:

Brno has two main bus stations – **Grand Hotel** (for buses of Student Agency, next to the train station) and **Zvonařka** (for all other companies). Form Zvonařska you have to walk a bit (green line on the map) to get to closest tram station towards Hlavní nádraží. Take tram number 12 in the direction Technologický park.



City centre with bus and train stations (violet), important tram stops with number of tram, Hotels (blue dot and name) and the Campus of Mendel University.

Traveling in Brno and to the conference venue

Brno has a public transportation system consisting of trains, trams and buses. Trams are marked by number 1–14, buses have numbers between 15 and 88 and night buses numbers 89 – 99.
Tickets can be purchased at the yellow ticket machines located at important stops. You can also buy tickets at the tobacconist's, from bus and tram drivers (for a higher price), at train stations and in post offices. Once on the bus or tram, don't forget to immediately validate your ticket. Ticket inspectors can check tickets at any time and fine those traveling without a valid ticket 40 EUR.

Prices of tickets:
In automatic machines (see picture on the right):

15 min – 20 CZK
60 min – 25 CZK
One day – 90 CZK

SMS ticket: (works only with a Czech SIM card
by sending the following text to 90206)

BRNO20 (20min - 20 CZK)
BRNO (75 min – 29 CZK)
BRNOD (One day – 99 CZK)

If you want to buy a ticket from the driver, the price is
35 CZK for 90 min.

The city centre has two main junction points – **Česká** and **Hlavní nádraží** (in front of the railway station). All trams pass one of these points. Tram number x9 serves both and goes to **Zemědělská,** where the conference venue can be found (approx. 20 mins from the railway station). During daytime this tram goes every 10 minutes.
Night buses run every hour (23:00 – 05:00). All night buses leave from Hlavní nádraží.

If you experience any problems with transportation, please contact us:

Jan Trochta **j.trochta@gmail.com**
+420 732 222 576

Conference Information

Registration and welcome drink
Registration and main conference room is in the main building of Mendel University – building **A** on the map. You can follow marks from Zemědělská tram stop (in lower right corner of campus map) to the registration desk to the building **A**. The welcome drink will be held in the same room as registration desk.

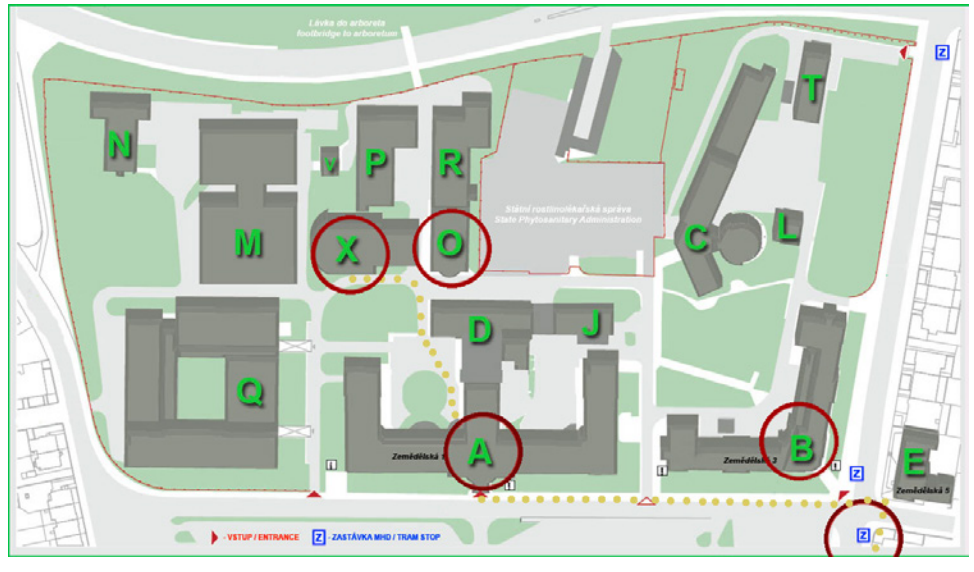
Confirmation letter
Participants who need a letter confirming their participation can ask for it by e-mail or in person at the registration desk.

Oral presentation
The main program starts in the "Auditorium maximum" in building **A**. Parallel sessions will be held in the ground floor of building **B** (B02) – Faculty of Forestry and Wood Technology. Routes will be marked by "COPPICE conference". The presentations will be strictly limited to 15 minutes each with 5 additional minutes for discussion. Keynotes have 30 minutes plus 10 minutes for discussion.

Poster presentation
Posters at the conference should be in A0 portrait format (841 x 1189 mm). Poster authors should hang their posters on the allocated board at the beginning of the conference. A separate poster session will be organized.

Meals and breaks
Lunch during the conference will be served in the "Menza" (Building **X** in map). Just get your plate and enjoy – the meals are included in the registration fee. Coffee breaks will take place in the same room as registration desk.

Social evening
The social evening will start in Hotel Pegas, Friday 10th April at 19:00. This place is marked on the map with green colour. Hotel Pegas has its own brewery and typical Czech cuisine.



Brno sightseeing tour

Thursday 9th April in 18:00 you can participate in a guided tour around the historical centre of Brno. The meeting point will be in the city centre next to tram stop "Česká". The meeting point will be a model of historical Brno town (see the map, page 8; picture on the right). The meeting point is marked on the map as a black dot. During the tour we will visit important places and buildings in the city centre. The tour will last for ca. 2 hours.

Field Excursions

Saturday, 11th April 2015 we will organize excursions to coppice sites in southern Moravia. You can select one of these excursions at the registration desk during registration. Lunches will be arranged for all groups during excursions (included in the conference fee). Please do not forget the rain coats or umbrellas – uncertain weather is expected in April!!! Departure for the excursions: 8:30 from the building A. Return to Brno will be the latest in 18:00.

The Pálava region

This region boasts probably the best preserved and documented oak, hornbeam and lime coppice woods in Moravia. Děvín Hill and the neighboring Milovice Wood occupy a hilly and picturesque landscape with arable fields and vineyards. During the excursion, participants will get to know the history of coppice management since the Middle Ages complete with original documents and old maps, research on vegetation change since the abandonment of coppicing in the 20th century, and experimental sites of restoration coppicing in cooperation with local nature protection authorities.

Podyji National Park

This excursion will focus on ancient oak and hornbeam coppices in a deep river valley and on the plateau near the valley. You will get to know the results of coppice research at the site – e.g. the structure and tree spatial patterns of oak coppices; interpretation of historical documents about coppicing; field survey and classification of ancient coppices etc. You will be able to see the unmanaged core zone of the National Park as well as examples of restoration management for biodiversity conservation.

Training Forest Enterprise of Mendel University

Two experimental plots with dominant (95 %) representation of Sessile oak (*Quercus petraea*) located on different bedrocks near Brno were chosen for research of simulated structure of coppice and coppice-with-standards forests. The experimental plot chosen for the excursion – Soběšice was established in 2009 in the forest district of Vranov under the Křtiny Training Forest Enterprise. The size of the plot is 200 x 200 m and it is separated into a mosaic of sub-plots with three different intensities of silvicultural treatments.

Hodonínská Dúbrava

During this excursion you will visit former coppices in the best-preserved remnant of sub-continental oak forests on sand in the Czech Republic. The site occupies a low plateau above the Morava river floodplain and is covered by wind-blown sands forming mildly undulating topography. Large areas of open-canopy dry-mesic oak forests with a herb layer rich in Pannonian forest-steppe species form the vegetation matrix, interspersed with shady oak-lime stands, forestry plantations and moist depressions with relic wetland plants.

Program

Wednesday 8 April 2015

17:00 – 20:00 REGISTRATION

Thursday 9 April 2015

8:00 – 9:00 REGISTRATION

9:00 – 9:30 OPENING SESSION
Vrška, Tomáš; Szabó, Péter; Klvač, Radomír; Mosseler, Alex

9:30 – 10:15 KEYNOTE LECTURE: **Coppice woods: temporal and spatial diversity creating rich wildlife assemblages**
Kirby, Keith

10:15 – 11:00 KEYNOTE LECTURE: **Shaping future coppice forestry on the legacy of the past: lesson learnt and perspectives**
Fabbio, Gianfranco

11:00 – 11:20 COFFEE BREAK

PARALLEL SESSION 1: SILVICULTURE AND REGENERATION (part 1), Room A01

11:20 – 11:40 **The effect of harvesting on stump mortality and re-sprouting in aged oak coppice forests**
Pyttel, Patrick; Fischer, Ulrich; Bauhus, Jürgen

11:40 – 12:00 **Impact of commercial willow Short Rotation Coppice plantation on water and soil**
Dimitriou, Ioannis; Mola-Yudego, Blas

12:00 – 12:20 **Beech forests in Central Apennines: adaptive management for structure and functions in transition**
Urbinati, Carlo; Iorio, Giorgio; Silvia, Agnoloni; Garbarino, Matteo; Vitali, Alessandro

12:20 – 12:40 **Generative regeneration of sessile oak in an overaged coppice forests**
Dobrovolný, Lumír; Martiník, Antonín

PARALLEL SESSION 2: ECOLOGY AND BIODIVERSITY (part 1), Room B02

11:20 – 11:40 **Historical legacy of coppice systems in herbaceous vegetation of central European forests**
Hédl, Radim; Chudomelová, Markéta; Kolář, Jan; Kopecký, Martin; Müllerová, Jana; Szabó, Péter

11:40 – 12:00 **Logging in the core zone of a national park benefits biodiversity. Multi-taxa survey in temperate oak-dominated forests**
Šebek, Pavel; Bače, Radek; Bartoš, Michael; Beneš, Jiří; Chlumská, Zuzana; Doležal, Jiří; Kovář, Jakub; Machač, Ondřej; Mikátová, Blanka; Plátek, Michal; Poláková, Simona; Škorpík, Martin; Stejskal, Robert; Svoboda, Miroslav; Trnka, Filip; Vlašín, Mojmír; Zapletal, Michal; Čížek, Lukáš

12:00 – 12:20 **Forest structure and herb species diversity in landscape with active coppicing**
Volařík, Daniel; Šebesta, Jan; Koutecký, Tomáš; Řepka, Radomír; Dreslerová, Jaromíra; Šenfeldr, Martin; Matula, Radim

12:20 – 12:40 **Legacies of past coppicing on the structure and vegetation diversity of beech forests in central Apennines, Italy**
Garbarino, Matteo; Allegrezza, Marina; Ciucci, Vanessa; Ottaviani, Cecilia; Renzaglia, Francesco; Tesei, Giulio; Vitali, Alessandro; Urbinati, Carlo

12:40 – 13:00 **Structure, diversity, productivity and management of coppiced woodland in Bohemian Karst – case study**
Černý, Tomáš; Karlík, Petr; Šálek, Lubomír; Jelenecká, Alžběta; Jelenová, Lenka

13:00 – 14:00 LUNCH

PARALLEL SESSION 1: SILVICULTURE AND REGENERATION (part 2), Room A01

14:00 – 14:20 **Sporadic tree species management for preserving biodiversity and increasing economic stands value: the PProSpoT experience**
Pelleri, Francesco; Sansone, Dalila; Fabbio, Gianfranco; Mori, Paolo

14:20 – 14:40 **Shrub interference in the establishment of beech seedlings in an abandoned coppice forest**
Harasawa, Natsuho; Kamitani, Tomohiko

14:40 – 15:00 **Conversion of *Fagus sylvatica* coppices to high forests: results from a thirty year experiment in Eastern Italian Pre-alps**
Alberti, Giorgio; Mariotti, Barbara; Maltoni, Alberto; Tani, Andrea; Piussi, Pietro

15:00 – 15:20 **Past, present and future of the coppice silvicultural system in the Italian north-west**
Motta, Renzo; Berretti, Roberta; Meloni, Fabio; Nosenzo, Antonio; Terzuolo, Pier Giorgio; Vacchiano, Giorgio

PARALLEL SESSION 2: ECOLOGY AND BIODIVERSITY (part 2)

14:00 – 14:20 **Site preferences of endangered species in a former coppice of high conservation value**
Roleček, Jan; Vild, Ondřej; Sladký, Jiří; Řepka, Radomír

14:20 – 14:40 **Analyzing the spatial structure of Persian oak coppice stands via nearest neighbor summary statistics in Zagros woodlands**
Erfanifard, Yousef; Kariminejad, Narges

14:40 – 15:00 **Coppice rotation on beech forests: some effect on plant species diversity**
Canullo, Roberto; Cervellini, Marco; Simonetti, Enrico; Campetella, Giandiego

15:00 – 15:20 **Successful sprouting in correlation to the health parameters on the example of Grey alders (*Alnus incana* (L.) Moench)**
Májek, Tomáš; Cech, Thomas

15:20 – 15:40 **Coppice management and nutrition**
Piussi, Pietro

15:40 – 16:00 COFFEE BREAK

16:00 – 17:25 POSTER SESSION

18:00 – 20:00 SIGHTSEEING TOUR

Friday 10 April 2015

8:00 – 8:30 REGISTRATION

8:30 – 9:15 KEYNOTE LECTURE**: De-eutrophication of forest ecosystems by coppicing?**
Ewald, Jörg

9:15 – 10:00 KEYNOTE LECTURE**: Coppicing in the past – examples of practice, context and consequences**
Bürgi, Matthias

10:00 – 10:15 COST - EUROCOPPICE PROJECT PRESENTATION

10:15 – 10:35 COFFEE BREAK

PARALLEL SESSION 3: ECOPHYSIOLOGY AND TREE ECOLOGY

10:35 – 10:55 **Resprouting ability and sprout growth dynamics in temperate trees**
Matula, Radim; Šrámek, Martin

10:55 – 11:15 **What do we know about oak coppice roots?**
Trochta, Jan; Pálková, Marcela; Vrška, Tomáš; Král, Kamil

11:15 – 11:35 **Transpiration of sessile oak seedlings and sprouts in relation to microclimatic conditions**
Pietras, Justyna; Stojanović, Marko; Pokorný, Radek

11:35 – 11:55 **Young coppice and standard sessile oak response under different light conditions**
Stojanović, Marko; Čater, Matjaž; Dobrovolný, Lumír; Pokorný, Radek

11:55 – 12:15 **Different harvesting intensity and soil CO^2 efflux in Sessile oak coppice forests**
Dařenová, Eva; Čater, Matjaž; Pavelka, Marian

12:15 – 12:35 ***Quercus pyrenaica* coppices II: degradation takes roots on its historical management**
Salomón, Roberto; Valbuena-Carbaña, María; Rodríguez-Calcerrada, Jesús; González-Doncel, Inés; Iglesias, Manuel; Zafra, Elena; Miranda, Jose Carlos; Morales, Cesar; López, Rosana; G.Gordaliza, Guillermo; Rodríguez-García, Aida; Guzmán, Paula; Otero, Cesar; Oleksyn, Jacek; Zytkowiak, Roma; Gil, Luis

12:35 – 12:55 **Hydric function of coppice forests - the effect of coppice forest on seasonal dynamics in soil moisture**
Kupec, Petr; Deutscher, Jan

PARALLEL SESSION 4: SOCIO-ECONOMICS

10:35 – 10:55 **Integrating forest management into conservation objectives: coppice management and forest habitats in Natura 2000 and Emerald network sites**
Mairota, Paola; Suchomel, Christian; Conedera, Marco; Verheyen, Kris; Heinsoo, Katrin; Buckely, Peter

10:55 – 11:15 **Traditional coppice in South East England: the importance of workforce engagement for development**
Bartlett, Debbie

11:15 – 11:35 **How a political compromise from 1721 led to the conservation of coppice woodlands**
Mölder, Andreas

11:35 – 11:55 **Ecological diversification of intensively managed agricultural portfolios with short rotation woody crops is economically profitable – An application of the Modern Portfolio Theory**
Hauk, Sebastian

11:55 – 12:15 **Structure, utilization and motivation of management of private owned coppice forests – a case study from South West Germany**
Suchomel, Christian; Jotz, Sarah

12:15 – 12:35 **Operational short rotation woody crop plantations: manual or mechanised harvesting?**
Vanbeveren, Stefan; Schweier, Janine; Berhongaray, Gonzalo; Ceulemans, Reinhart

12:35 – 12:55 **Survey of management of private owned coppice forests in Latvia**
Lazdina, Dagnija; Donis, Janis; Lazdins, Andis

13:00 – 14:00 LUNCH

14:00 – 14:30 KEYNOTE LECTURE**: Short-rotation willow coppice for biomass production and land reclamation in Canada**
Mosseler, Alex

PARALLEL SESSION 5: PRODUCTION (part 1)

14:30 – 14:50 **Potential use of tree and stand empirical growth models for coppice growth modelling**
Kneifl, Michal; Kadavý, Jan; Knott, Robert; Adamec, Zdeněk; Drápela, Karel

14:50 – 15:10 **Economic feasibility of growing short-rotation coppiced birch on cutaway peatlands for bioenergy**
Jylhä, Paula; Hytönen, Jyrki; Ahtikoski, Anssi

15:10 – 15:30 **Coppicing ability and biomass production of downy birch (*Betula pubescens* Ehrh.) – 4-year results**
Hytönen, Jyrki

15:30 – 15:50 **Rotation-end comparisons for *Eucalyptus* regeneration regimes (coppice versus replant) on four contrasting sites, South Africa**
Little, Keith MacMillan

PARALLEL SESSION 6: HISTORY AND DENDROCHRONOLOGY (part 1)

14:30 – 14:50 **Coppice woodland since the Middle Ages: spatial modelling based on archival sources**
Szabó, Péter; Müllerová, Jana; Suchánková, Silvie; Kotačka, Martin

14:50 – 15:10 **500 years of coppice-with-standards management in Flanders (Belgium): the case of Meerdaal Forest**
Vandekerkhove, Kris

15:10 – 15:30 **The rise and fall of coppicing - historical processes and consequences for nature conservation**
Müllerová, Jana; Szabó, Péter; Hédl, Radim; Dorner, Petr; Veverková, Alina

15:30 – 15:50 **Why coppices weren't a common practice in oak-elm-ash forests of the Bereg Plain?**
Demeter, László; Ferenc, Horváth; Biró, Marianna; Varga, Anna; Molnár, Zsolt

15:50 – 16:10 **Coffee break**

PARALLEL SESSION 5: PRODUCTION (part 2)

16:10 – 16:30 **Analysis of ecological behaviour and management tools for chesnut coppice stands in northwest Spain**
Menéndez-Miguélez, María; Álvarez-Álvarez, Pedro; Majada, Juan; Canga, Elena

16:30 – 16:50 ***Quercus pyrenaica* coppices I: scarce acorn yield is not related to clonal size**
Valbuena-Carabaña, María; Zafra, Elena; Salomón, Roberto; Gil, Luis

16:50 – 17:10 **Allometric biomass equations at three components of coppice originated oak forest in strandjas of Turkey**
Özdemir, Emrah; Yilmaz, Ersel; Makineci, Ender; Kumbasli, Meric; Keten, Akif; Beskardes, Vedat; Zengin, Hayati; Cinar Yilmaz, Hatice; Caliskan, Servet

PARALLEL SESSION 6: HISTORY AND DENDROCHRONOLOGY (part 2)

16:10 – 16:30 **Coppicing history and restoration for biodiversity conservation in the Podyji National Park**
Vrška, Tomáš; Pálková, Marcela; Adam, Dušan

16:30 – 16:50 **Forest management history and its environmental impacts in SW Slovakia (case studies)**
Feher, Alexander

16:50 – 17:10 **Management of coppice forests in Romania – a historical approach**
Nicolescu, Valeriu-Norocel; Hernea, Cornelia

17:10 – 17:40 POSTER AWARD ANNOUNCEMENT & CONCLUSION – PLENARY

Saturday 11 April 2015

8:30 – 18:00 FIELD EXCURSION

Lectures – Abstracts

Keynote lectures

COPPICE WOODS: TEMPORAL AND SPATIAL DIVERSITY CREATING RICH WILDLIFE ASSEMBLAGES

KIRBY, Keith

Oxford University, United Kingdom

KEYWORDS: Coppice biodiversity restoration nature conservation

Thursday 9th April, 9:30 – 10:15

Coppice systems are amongst the earliest forms of woodland management known and on some sites their use has been documented for centuries. It should not therefore be surprising that there are distinctive assemblages of plants and animals that have come to be associated with them. The richness of such assemblages and also the species that do not thrive under coppice are linked to the alternation of light and dark phases over quite short periods and the juxtaposition of stands at different stages in the coppice cycle, creating high temporal and spatial continuity of certain habitats.

Vascular plants in the ground flora, invertebrates of open glades and scrub, and small birds of the understorey may have become more abundant in coppice than they would under 'natural' forest conditions. By contrast epiphytes dependent on mature trees, species of large-sized deadwood and perhaps mature canopy-dwellers are less favoured by such management.

Coppice systems developed to meet the needs of local communities. As social and economic conditions have changed, so often coppice has gone into decline. The high forests that have replaced coppice differ in their spatial and temporal dynamics and consequently in their wildlife.

In the UK coppice has almost been lost except for where organisations have sought to maintain it for nature conservation purposes – which usually costs money. In other countries coppice is being maintained or restored but using modern techniques and to meet modern demands. In both situations the wildlife patterns produced are not always what were expected.

We need to understand better the critical aspects of coppice systems that allowed particular species or assemblages to thrive in the past and might do so again if we restore the system. Also what has changed in the woods or the surrounding landscapes that means we get different results even though we are apparently doing the same as before: for example the effect of greater isolation of woods in the landscape; the higher levels of deer in many countries; the abandonment of certain practices such as collection of litter or small twigs that had been part of coppice practice in the past; the effects of climate change.

We should remember that the assemblages we associate with coppice have probably changed over time in the past; we need to decide which elements we wish to carry forward and how coppice regimes need to change to allow this to happen.

SHAPING FUTURE COPPICE FORESTRY ON THE LEGACY OF THE PAST: LESSON LEARNT AND PERSPECTIVES

FABBIO, Gianfranco

Consiglio ricerca e sperimentazione in agricoltura, Italy

KEYWORDS: coppice, sustainability, past management, future forestry

Thursday 9th April, 10:15 – 11:00

Coppice is the management system more affected by socio-economic changes over the last 50 years. For millennia and up to mid-twentieth century, coppiced forests were the main provider of fuelwood for basic, daily needs as food cooking and domestic heating. The widespread diffusion of fossil fuels, reduced this leading role and coppice system turned, to some extent, to "a reminder of the past". Nowadays, green-economy issues call for a much increased demand of renewable resources, wood included, and coppice system comes back to play a prominent value for bio-energy production.

Many factors contributed to coppice downgrading: decreased significance of production, critical judgement of the intensive exploitation system, evidence of site fertility reduction into sensitive environments and, finally, the new-emerging multifunctionality issues. A major role was played anyway by the commonly missed perception of the manifold uses and misuses overlapping over centuries the exploitation for fuelwood. We have the evidence today of a vast array of conditions, from the relict cover of scattered trees up to dense, well-growing coppices where former management followed basic rules and supplementary uses were less intensive, or the position more favourable to support them as well.

The need to handle the management shifting in progress since the early seventies - a share of coppice forests no more harvested, rotations' lengthening or cultivation abandonment – laid the bases for an experimental applied research dealing basically with (i) the still unknown dynamics of coppice following the suspension of harvesting, i.e. the outgrown or stored coppice evolutive pattern; (ii) ways and times of a pro-active silviculture aimed at its conversion into high forest. All of this may be read as the establishment - ahead of his time – of an adaptive management approach. Findings from trials established forty years ago provided supplementary knowledge and outcomes enforceable to coppice management today. Two issues, among the others, are worth to be mentioned.

The analysis of root branches of beech and oak stools drew the attention to the turnover of root system as well as stool resprouting of aerial part takes place after coppicing. It contributes a further understanding of stools' ability to regrow several times without any depletion of regeneration potential.

Growth dynamics in ageing coppice forests, proved that rotation set by yield tables was the right technical time as for harvestable fuelwood size but it occurred before the actual age of maximum wood production as in forest mensuration ruling principles. It widens the span of possible rotations.

Basic attributes of coppice system, i.e. assurance of natural regeneration, simple management, flexibility and resilience to disturbances, make again coppice – fifty years later – a system for the future complying with green economy issues among the other foreseeable sources, coppiced plantations on set-aside and short-rotation forestry. That is why looking back but ahead too, a consistent definition of coppice may be "a very ancient and modern system as well".

DE-EUTROPHICATION OF FOREST ECOSYSTEMS BY COPPICING?

EWALD, Jörg

Hochschule Weihenstephan-Triesdorf, Germany

Friday 10th April, 8:30 – 9:15

Nitrogen eutrophication due to land-use change and emissions from industry and agriculture is one of the strongest drivers of biodiversity loss in Central European ecosystems. Coppicing figures among the "degrading" uses that have created semi-open, oligotrophic habitats in historical cultural landscapes. But does it have the potential to counteract eutrophication under modern conditions?

In the absence of long-term experiments (de-)eutrophication studies rely on field measurements of nutrients in soil and biomass or on detecting responses of nutrient indicators in community composition. They investigate past abandonment retrospectively, track coppicing cycles or monitor effects of recent restoration.

Direct evidence of the depletion of soils and ecosystem budgets through coppicing is extremely sparse. Vegetation surveys, in which historically coppiced plots were relocated after decades of abandonment, provide the most conclusive, yet indirect evidence, which is often confounded by a negative inter-correlation of nutrients and light.

In many parts of Central Europe eutrophication coincides with the abandonment of coppicing and other degrading forest-uses. Their products were substituted by increasing use of fossil fuels and mineral fertilisers, the more proximal causes of eutrophication, which embodies the socio-economic transition from subsistence to overabundance. Chronosequences of coppice cycles suggest non-linear behaviour, with short pulses of nutrient release after cutting, followed by a transient niche for oligotrophic species grading into a species-poor thicket phase in which nutrients are locked in topsoil and tree biomass. In restoration experiments the conspicuous phase of N-release, sometimes accompanied by invasive species, casts doubt on the efficiency of coppicing.

The results of this review point out the need for joint ecosystem studies that combine monitoring of nutrients and organism responses in coppices over the whole management cycle. Under modern nutrient regimes, conservation-oriented coppicing may have to be combined with additional nutrient exports such as litter or topsoil removal at the expense of sustainable fuel production. Thus, even in the era of renewable energy, biodiversity-oriented coppicing is likely to remain an atypical management system requiring specific incentives.

COPPICING IN THE PAST – EXAMPLES OF PRACTICE, CONTEXT AND CONSEQUENCES

BÜRGI, Matthias

Swiss Federal Research Institute WSL, Switzerland

KEYWORDS: forest history, Switzerland, coppicing, stand structure, diversity

Friday 10th April, 9:15 – 10:00

Scientists and practitioners alike have clear ideas on what coppicing is and also quite distinct mental images how coppice stands look like. At the same time, the diversity of management practices and resulting stand structures which are related to coppicing, is enormous.

This situation offers the opportunity to address some issues related to the development of practices and the role of terminology therein, the institutional, legal and economic context of this development, and the ecological consequences. In this presentation I will discuss various form of diversities, from cultural diversity to biodiversity, at examples from coppice forests in the Swiss lowlands (Bürgi 1999a,b; Bader et al. 2015) and some factors increasing and reducing diversity will be determined.

Based on these considerations, I conclude that talking about coppice forests, always means talking about diversity: Diversity in terms and their meaning, diversity of traditions in uses and management, and not the least biodiversity – related and fostered by the various forms of coppice practices. Recently, the concept of biocultural diversity has been promoted to highlight the interconnectedness of diversity on all these different levels. Based on the material presented, I will propose a critical assessment of merits and limitations of this concept.

SHORT-ROTATION WILLOW COPPICE FOR BIOMASS PRODUCTION AND LAND RECLAMATION IN CANADA

MOSSELER, Alexander John; MAJOR, John

Natural Resources Canada, Canada

KEYWORDS: coppice

Friday 10th April, 14:00 – 14:30

A common garden and population genetics approach was used to test both genetic and site effects on biomass production traits in eight North American willows (*Salix*): including survival, coppice structure, colony-formation, and various adaptive traits on highly disturbed, infertile, coal mine spoil sites. Much of this work has been related to reclamation of former mine sites affected low pH and potential metal toxicities but several genotypes (clones) of *Salix discolor* and *S. eriocephala* have proven to be well adapted to such soils. However, *S. interior*, a widespread riparian willow that produces a multi-stemmed colony from root shoots that arise from a rapidly spreading shallow, horizontal root network, may be one of the most compelling and cost-effective means for producing short-rotation woody biomass plantations. Survival from dormant, rootless stem cuttings was above 95% in some clones of *S. eriocephala* and *S. interior* which produced 5-6 t/ha fresh biomass from 2-year-old coppices on infertile, shale rock overburden. Allometric relationships in coppice structure among stem basal diameter, stem length, number of coppice stems per plant, and biomass yield clearly reflected site quality differences and could be used as site quality indicators. Despite poor average rooting ability in non-riparian willows such as *S. bebbiana*, *S. discolor*, and *S. humilis*, some genotypes showed good survival and growth, and further selection for rooting ability, biomass yield, and other biomass quality traits is warranted.

Lectures – Abstracts

Silviculture and regeneration

THE EFFECT OF HARVESTING ON STUMP MORTALITY AND RE-SPROUTING IN AGED OAK COPPICE FORESTS

PYTTEL, Patrick; FISCHER, Ulrich; BAUHUS, Jürgen

Chair of Silviculture, Faculty of Environment and Natural Resources, University of Freiburg, Germany

KEYWORDS: coppice, oak, sprouting, regeneration, mortality

In Central Europe, traditional management of oak coppice forest was abandoned at the beginning of the last century, leaving large tracts of forest developing into aged coppice stands. Recently renewed interest in coppicing has developed in many European countries because of the increasing importance of fuel wood as a substitute for fossil fuels and the preservation of coppice forests as a historical landscape element and habitat with high nature conservation value. However, there are uncertainties about the re-sprouting ability of large and old oak stumps. In this study we determined the re-sprouting ability of sessile oak stumps 80 to 100 years after the last coppice cut. Stump mortality and re-sprouting intensity were analyzed in relation to three different harvesting methods, browsing intensity, vitality of parent trees and stump parameters. On average 16% of all sessile oak stools died within two vegetation periods after coppicing. Stump mortality was higher in unfenced areas compared to areas protected against browsing. Two vegetation periods after coppicing, numerous new stump sprouts were recorded. Growth of the new sprouts was mainly influenced by browsing. Our results indicate that the re-sprouting ability of 80-100 year old oak trees originating from former coppice management is still high and little influenced by harvesting methods. However, browsing must be controlled, as with any other form of forest regeneration, if coppicing is to be applied successfully.

IMPACT OF COMMERCIAL WILLOW SHORT ROTATION COPPICE PLANTATION ON WATER AND SOIL

DIMITRIOU, Ioannis[1]; MOLA-YUDEGO, Blas[1,2]

1: Swedish University of Agricultural Sciences SLU, Sweden
2: Norwegian Forest and Landscape Institute

KEYWORDS: willow, *salix*, bioenergy, short rotation coppice, ecosystem services, soil quality, water quality, soil carbon, cadmium, heavy metals

Short rotation coppice (SRC) with willow (*Salix* sp) for production of biomass for heat and/or electricity is expected to increase in the short-term in Europe and other parts of the world. SRC is usually planted in agricultural soils and this will have implications on various environmental issues related to water and soil due to the differences between annual and perennial systems in terms of management and physical traits. This paper will present results from experiments conducted in a large number of commercial SRC plantations compared to adjacent fields of common agricultural practices in Sweden. The results focus on differences between SRC and agriculture in i) groundwater quality in terms of nitrate-N and phosphate-P; ii) organic C and of trace elements in top and subsoil. The results will indicate differences in provided ecosystem services between land uses potentially competing in future landscapes (agriculture for food and/or fodder vs SRC for energy).

BEECH FORESTS IN CENTRAL APENNINES: ADAPTIVE MANAGEMENT FOR STRUCTURE AND FUNCTIONS IN TRANSITION

URBINATI, Carlo[1]; IORIO, Giorgio[2]; SILVIA, Agnoloni[3]; GARBARINO, Matteo[1]; VITALI, Alessandro[1]

1: Marche Polytechnic University, Ancona – Italy
2: Comunità Montana Valnerina, Norcia – Italy
3: Corpo Forestale dello Stato, Massa-Carrara – Italy

KEYWORDS: *Fagus sylvatica*, coppice, high forest conversion, age structure

We present an overview of our research on structure, functions and management of coppiced beech forest in central Apennines. In over 100 sample plots we analyzed structural and chronological attributes of stands, assessed previous structures and their dynamics. We used thousands of trees for multivariate, geostatisitical and dendroecological analyses. Beech forests in central Apennines were managed as multifunctional silvo-pastoral systems for production of timber, firewood, charcoal, NWP and for feeding cattle, calibrating the use according to site fertility and accessibility. Today this mosaic-like structure is disappearing for stand abandonment and abuse of coppice conversion to even-aged high forests. This is often requested by regional forest laws and regulations, Rural Development Plan, Natura 2000 guidelines causing a diffuse standardization of structural traits. Extensive timber production is unsustainable today in most of the Apennines forests, but evenaged conversion seems to be unsuited also for new forest functions such as biodiversity conservation and erosion control. The presence of target species such as *Taxus*, *Abies* or *Ilex*, is often limited to adult trees. Excessive canopy cover, strong competition with sprouting beech and ungulate browsing do not guarantee their regeneration. Small scale sylvicultural options, such as group or individual selective thinning or cuts, girdling of neighbor trees, should be introduced to enhance growth and reproduction of target species and stand structure and composition diversity. Unfortunately these treatments will be economically unsustainable unless forest management regulations and financing programs would be adapted to such general objectives.

GENERATIVE REGENERATION OF SESSILE OAK IN AN OVERAGED COPPICE FORESTS

DOBROVOLNÝ, Lumír; MARTINÍK, Antonín

Mendel University in Brno, Faculty of Forestry and Wood Technology

KEYWORDS: oak, generative regeneration, over-aged coppice stands

Over-aged oak coppice stands are typical forests in lowland part of Czech Rep. Keeping some proportion of generative regeneration is often required for the high-valuable timber production. The potential and limits of generative reproduction were analysed on the acidic (Moravsky Krumlov) and rich (Hady) soils under different stand structure/light levels: full canopy closure "C" (BA 30-40 m^2/ha; ISF about 10%) and middle opening "O" (BA 15-20 m^2/ha; ISF about 35%). Similar acorns production (between 64-72 acorns.m-2) on both sites and higher acorn's survival on rich site was observed. On the acidic site the potential of oak seedlings emergence was much higher; oak here occupied all area. With increase of light the density of seedlings decreased (C: 310,000; O: 68,000 pcs./ha) and the height growth (C: up to 20 cm; O: up to 400 cm) with age variability increased. In contrast to the rich site other species like hornbeam, field maple, ash, lime and shrubs were dominant and the density (C: 8,000; O: 12,000 pcs./ha) with the height growth (C: up to 20 cm; O: up to 130 cm) of oak seedlings here was much lower. The potential of generative regeneration of oak was limited by different competition according to the site and stand structure. To increase height growth of oaks the reduction of basal area up to 50% is recommended with species selection composition to achieve desired share of oak, especially on rich site.

SPORADIC TREE SPECIES MANAGEMENT FOR PRESERVING BIODIVERSITY AND INCREASING ECONOMIC STANDS VALUE: THE PPROSPOT EXPERIENCE

PELLERI, Francesco[1]; SANSONE, Dalila[1]; FABBIO, Gianfranco[1]; MORI, Paolo[2]

1: Consiglio per la Ricerca e la Sperimentazione in Agricoltura, Italy
2: Caompagnia delle Foreste, Italy

KEYWORDS: sporadic tree species, single tree silviculture, thinning, biodiversity, valuable timber

In the framework of the LIFE+ Program the PPROSPOT project was implemented in the Tuscany Region (Italy) with the main goals of protecting tree biodiversity and strengthening the multifunctional role of forest ecosystems in mountain and hilly areas. The focus of the project was preserving and enhancing sporadic species protected by the regional law. A few of these species are characterized by valuable timber and can give a further interesting income also within coppice systems.

According to Regional inventory managed coppices seem to be the most interesting type, as a matter of fact the frequency of these species are higher than in overgrown coppices and high forests. In this situation, the sporadic species, characterized by a weak competitive ability, can take an advantage from the periodical reduction of competition due to coppicing.

The project promotes a silvicultural approach, known as tree-oriented silviculture. This approach is based on interventions aimed at nursing the best crop trees (in the young stage) and implementing localized crown thinning to enhance their diameter growth. This permits to create better condition for their natural diffusion and to get suitable valuable timber sizes. Ninety hectares of demonstrative interventions, mainly concerning mixed oak deciduous coppices, were carried out and a new management approaches were proposed to integrate tree oriented silviculture and coppice system. Different combinations of thinning regimes have been practiced and crop trees reaction, monitored from the thinning time up to now, to determinate the effects on species growth, competition dynamics and effectiveness of the applied methods

SHRUB INTERFERENCE IN THE ESTABLISHMENT OF BEECH SEEDLINGS IN AN ABANDONED COPPICE FOREST

HARASAWA, Natsuho; KAMITANI, Tomohiko

Graduate School of Science and Technology, Niigata University

KEYWORDS: beech, seedling regeneration, seed-tree density, evergreen shrub

Coppice forests that had been used for charcoal and firewood production in central Japan until the 1960's can be divided into various types. Beech dominates firewood forests that have a long rotation cutting cycle (Kamitani 1993).

Though there is a high abundance of beech seedlings in the year following a mast year, evergreen shrubs prevent the establishment of these seedlings. This causes difficulty in the restoration of beech trees at high densities in the abandoned forest. We investigated the influence of beech seed-tree density and evergreen shrub cover on the occurrence and survival of beech seedlings in an old coppice stand.

The study was conducted in an even-aged beech coppice stand in Takigashira, central Japan. Twenty 1m^2-quadrats were established in six stands. The number of seedlings was counted monthly. The light intensity (rPPFD) was measured using quantum sensors and the evergreen shrub cover was quantified using image analysis.

There was no significant correlation between the number of fallen seeds and number of seedlings in spring following a mast year. In addition, there was no significant correlation between number and survival rate of seedlings in the first year. There was a significant correlation between seedling survival rate and light intensity in early spring. Evergreen shrub cover strongly influenced seedling survival.

In the former coppice forest, almost all shrubs had been cut at the same time as the trees, which resulted in successful beech seedling establishment under sufficient light conditions. We discuss the management practices needed for high-density beech forest stands.

Lectures – Abstracts

Ecology and biodiversity

CONVERSION OF *FAGUS SYLVATICA* COPPICES TO HIGH FORESTS: RESULTS FROM A THIRTY YEAR EXPERIMENT IN EASTERN ITALIAN PRE-ALPS

ALBERTI, Giorgio[1]; MARIOTTI, Barbara[2]; MALTONI, Alberto[2]; TANI, Andrea[2]; PIUSSI, Pietro[2]

1: University of Udine, Italy
2: University of Firenze, Italy

KEYWORDS: beech, conversion, long term experiment

Forests in North-East Italy are mainly dominated by pure beech stands traditionally managed as coppice. After World War II, a conversion program to high forests started in the Sixties of last century.

In this context, a long term experiment testing the effects on tree growth and stability of two different conversion criteria was implemented (thinning from below - Method A - and selective thinning - Method B). The conversions were applied to permanent plots in 1979-1980, with a thinning in 1997 and another in 2010. All trees were periodically measured in order to assess mortality, stability and growth. In 2011, a stem quality assessment as well as tree crown was performed. A new experiment, aimed at evaluating the possibility to adopt different types of regeneration cuts in order to create an irregular stand structure at landscape level and anticipate the regeneration, was started in 2011. The following treatments were tested: control; irregular cut; patch clear cuts on small areas; uniform seed cuts (within the shelterwood system). Results on tree growth response and stem quality will be presented for both conversion methods; a complete economic analysis for all regeneration cuts and results on seed production and regeneration will be also reported.

HISTORICAL LEGACY OF COPPICE SYSTEMS IN HERBACEOUS VEGETATION OF CENTRAL EUROPEAN FORESTS

HÉDL, Radim; CHUDOMELOVÁ, Markéta; KOLÁŘ, Jan; KOPECKÝ, Martin; MÜLLEROVÁ, Jana; SZABÓ, Péter

Institute of Botany, Czech Academy of Sciences

KEYWORDS: historical coppicing, vegetation diversity and composition, herbaceous forest vegetation, long-term legacy

This paper examines the long-term legacy of coppicing systems in current patterns in forest herbaceous vegetation. Historical management systems are often ignored in large-scale ecological studies. This can be due to lack of data, which is particularly true in case of coppicing. Once being the most widespread management system in the lowlands of central Europe, coppicing has been replaced by modern forestry management only recently. Our research quantifies the effects of coppicing on the diversity and compositional patterns of vegetation in the eastern part of the Czech Republic. Vegetation patterns in several thousand phytosociological relevés sampled over the 20th century are explained by spatially explicit MaxEnt modelling. Models include the distribution of coppicing in three time slices: the Late Middle Ages (14th–15th centuries), the Early Modern Period (18th century) and sub-recently (19th century). Data on atmospheric deposition of nitrogen and sulphur and data on geology and climate are also included. Our results suggest that the past coppicing management played a significant role in shaping of large-scale patterns in diversity and composition of forest herbaceous vegetation.

LOGGING IN THE CORE ZONE OF A NATIONAL PARK BENEFITS BIODIVERSITY. MULTI-TAXA SURVEY IN TEMPERATE OAK-DOMINATED FORESTS

ŠEBEK, Pavel[1,2]; BAČE, Radek[3]; BARTOŠ, Michael[2,4]; BENEŠ, Jiří[1]; CHLUMSKÁ, Zuzana[2,4]; DOLEŽAL, Jiří[2,4]; KOVÁŘ, Jakub[5]; MACHAČ, Ondřej[5]; MIKÁTOVÁ, Blanka[6]; PLÁTEK, Michal[1,2]; POLÁKOVÁ, Simona[1,7]; ŠKORPÍK, Martin[8]; STEJSKAL, Robert[8]; SVOBODA, Miroslav[3]; TRNKA, Filip[5]; VLAŠÍN, Mojmír[9]; ZAPLETAL, Michal[1,2]; ČÍŽEK, Lukáš[1,2]

1: Biology Centre ASCR, Czech Republic
2: University of South Bohemia, Czech Republic
3: Czech University of Life Sciences, Czech Republic
4: Institute of Botany ASCR, Czech Republic
5: Palacky University in Olomouc, Czech Republic
6: Nature Conservation Agency of the Czech Republic, Czech Republic
7: Beleco, Czech Republic
8: Podyji National Park Administration, Czech Republic
9: Veronika, Czech Republic

KEYWORDS: threatened species, conservation practice, open forest, forest steppe, traditional silviculture

We carried out a study in formerly coppiced oak-dominated forests left for spontaneous succession in the Podyji National Park (Czech Republic). Twelve experimental clearings with retention trees have been created in the closed-canopy forests of the park's core zone in order to support populations of light-demanding species. Six of these clearings were connected to forest edge and meadow, the other six clearings were isolated from open habitats. In the first season following the intervention, we sampled eight different model groups in the two types of clearings, and in four adjacent control habitats: closed-canopy forest, forest edge, open forest, and meadow, in order to observe colonization process. The openning of the canopy has led to increase in richness of butterflies, saproxylic beetles, reptiles and plants; it has decreased richness of moths and epigeic beetles, and had no effect on birds and spiders.

In most groups, the clearings hosted different species composition and threatened species than the closed forest and the forest edge, showing that these two cannot serve as a sufficient surrogate in conservation of open woodland biota. The isolated clearings were poorer than those connected to open habitats, and their assemblages contained larger share of species associated with closed forest. The partial cutting had a positive effect on richness and assemblages of most taxa and seems a valuable tool in conservation of temperate woodland biodiversity. It is also important to ensure the connection of the created gaps with the open habitats (forest edges, open forests) to facilitate the colonization processes.

FOREST STRUCTURE AND HERB SPECIES DIVERSITY IN LANDSCAPE WITH ACTIVE COPPICING

VOLAŘÍK, Daniel; ŠEBESTA, Jan; KOUTECKÝ, Tomáš; ŘEPKA, Radomír; DRESLEROVÁ, Jaromíra; ŠENFELDR, Martin; MATULA, Radim

Mendel University, Brno, Czech Republic

KEYWORDS: coppice, forest pasture, forest fires, species diversity

Coppicing was widely used in Europe for centuries but was abandoned in many regions in the first half of 20th century. Abandonment of this traditional forest management is supposed to be one of the causes of decreasing species diversity. We focused on south-west Romania, village Sfânta Elena where coppicing is still practiced. Besides coppicing, forest pasture and forest fires are important factors influencing forests of studied landscape. We hypothesised that various structural forest types could establish in such landscape and that coppice is not necessarily the most important one for maintaining herb species diversity in herb layer. We established 70 circular plots (18m diameter) where position and DBH of each stem (> 5cm) was measured using Field-Map technology. Locations of sample plots were selected using stratified random selection reflecting distance from the village, slope and aspect. Based on characteristics derived from Field-Map measurements, forests were classified into active coppices, abandoned coppices, high forests and shrubs. Herb layer was described using phytocoenological relevés. Species richness and Shannon index of diversity was calculated. Our results showed that herb species richness was highest in shrubs and herb species diversity was lowest in high forest compare to other types. Moreover within all structural types we observed similar trend of decreasing species diversity with increasing distance from the village and with increasing forest canopy cover. We conclude that several driving forces – coppicing, forest pasture, forest fires – are important for herb species diversity and richness mainly due to steadily reduced forest canopy cover.

LEGACIES OF PAST COPPICING ON THE STRUCTURE AND VEGETATION DIVERSITY OF BEECH FORESTS IN CENTRAL APENNINES, ITALY

GARBARINO, Matteo; ALLEGREZZA, Marina; CIUCCI, Vanessa; OTTAVIANI, Cecilia; RENZAGLIA, Francesco; TESEI, Giulio; VITALI, Alessandro; URBINATI, Carlo

Università Politecnica delle Marche, Italy

KEYWORDS: Traditional coppice, biodiversity, central Apennines, bioindicators, forest structure

In previously coppiced forests, the structural changes caused by management are a primary drivers of plant biodiversity. However most of the Apennines beech forests are a very important habitat for biodiversity conservation according to the EU (9210* “Apennine beech forest with *Taxus* and *Ilex*”).

In our study, we assessed the influence of forest structure and environmental variables on the species composition and diversity of coppiced beech forests in central Apennines.

We mapped 73 temporary circular plots in selected coppices, located between 800 and 1700 m a.s.l., of Marche and Umbria regions. Spatial and chronological forest structure, main site physiographic variables and floristic composition (using Braun-Blanquet abundance-dominance scale) were analyzed in each plot. Multivariate statistical analyses were used to describe relationships between vegetation composition, forest structure and environmental variables.

We observed that marginal and less productive sites located on steeper slopes were characterized by a higher accumulation of deadwood. Older stands expressed the highest values of structural diversity with bigger and higher trees. At lower elevation, on very productive sites (high basal area) we observed the denser and more heavily coppiced stands.

We found different beech forest zonation along elevation gradients and that geomorphology and altitude are main abiotic ecological factors to discriminate, also statistically, the floristic composition of macrothermal and microthermal beech forests. We identified groups of plant species, used as bioindicators to characterize the different forest types in terms of composition, structure and development dynamics. This was particularly useful in recent secondary forests invading abandoned prairie ecotones.

STRUCTURE, DIVERSITY, PRODUCTIVITY AND MANAGEMENT OF COPPICED WOODLAND IN BOHEMIAN KARST – CASE STUDY

ČERNÝ, Tomáš; KARLÍK, Petr; ŠÁLEK, Lubomír; JELENECKÁ, Alžběta; JELENOVÁ, Lenka

Faculty of Forestry and Wood Sciences, Czech University of Life Sciences, Czech Republic

KEYWORDS: thermophilous woodland, coppices with standards, forest structure, monitoring, management

Coppice woodlands are characterized by short rotation harvesting – 30–60 years with subsequent vegetative regeneration – and they have a long tradition in the temperate lowland regions of Europe (hundreds or even thousand years of historical management). Many of these multi-purposed forests (especially those situated in sloped terrains) are recently abandoned. This process affects habitat conditions (especially light availability) in the time scale of decades, with strong impact on biotic alterations, changing finally biodiversity and potential productivity. We have started to do an integrated exploration of herb-rich oak-hornbeam woodland on limestone coppiced in the past, situated in the western part of the Bohemian Karst, Central Bohemia. The main aim of our project is to study the direct effect of coppicing on biodiversity, species interactions and tree regeneration. For all trees within the research plot we recorded spatial position (using laser measurement by means of FieldMap technology) and number of parameters such as species identity, DBH and growing form (individual stems versus multistemmed trees – stools).

We measure changes within the herb layer (species presence/absence, species abundancies, biomass production) as influenced by main resources availability (soil nutrients, light).

During the management intervention (felling) we will register indicators like calculation of working expences (e.g. cutting, delimbing, forwarding, skidding), amount of harvested wood and its quality and financial gains from products (e.g. round timber, stowed firewood, cleft firewood) in order to study how far such a management method is cost-effective in recent market conditions.

SITE PREFERENCES OF ENDANGERED SPECIES IN A FORMER COPPICE OF HIGH CONSERVATION VALUE

ROLEČEK, Jan[1,2]; VILD, Ondřej[1,2]; SLADKÝ, Jiří[3]; ŘEPKA, Radomír[4]

1: Department of Vegetation Ecology, Institute of Botany, Czech Academy of Sciences, Lidická 25/27, Brno, 602 00, Czech Republic;
2: Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, Brno, 611 37, Czech Republic
3: Cihlářská 18, 695 03, Hodonín
4: Department of Forest Botany, Dendrology and Geobiocoenology, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, Brno, 613 00, Czech Republic

KEYWORDS: habitat requirements, threatened species, traditional management, oak forest, plant diversity

Coppicing is a historical form of management that has been abandoned since the 19th century in the Czech Republic. Transformation of coppices to high forests brought fundamental changes in site conditions and retreat of many species. Our study focused on the best preserved remnant of formerly coppiced subcontinental oak forest in the country – Dúbrava Wood near Hodonín. To improve our understanding of ecology of endangered species and facilitate establishing effective conservation measures, we studied their site preferences here. Specifically, we mapped the occurrence of all critically and strongly endangered species. Then we compared vegetation composition and site conditions between plots with the largest populations of endangered species and plots randomly distributed across all major forest habitats in the wood. Our analyses show that the endangered species have highly uneven distribution along several environmental gradients. They are concentrated in well sunlit forest sites with soils of high pH and K content. The herbaceous vegetation in such sites is significantly richer in species and attains higher cover. Species characteristic for subcontinental oak forests are best indicators of sites with endangered species, while some broadly-distributed shade-tolerant and nutrient-demanding forest species avoid them. Such sites belong to most threatened by successional changes (particularly spread of *Tilia* and *Carpinus*), therefore we recommend conservation measures controlling these species such as selective cutting or grazing. As there are some endangered species that do not follow this general trend, a mosaic of different habitats should be maintained within the forest to protect different components of its unique biodiversity.

ANALYZING THE SPATIAL STRUCTURE OF PERSIAN OAK COPPICE STANDS VIA NEAREST NEIGHBOR SUMMARY STATISTICS IN ZAGROS WOODLANDS

ERFANIFARD, Yousef; KARIMINEJAD, Narges

Shiraz University, Islamic Republic of

KEYWORDS: Spatial pattern, Persian oak coppice tree, Zagros, Nearest neighbor summary statistic

One of the main purposes of spatial distribution analysis of trees in natural stands is to reveal information on intra- and inter-specific interactions and their relationships with environment. We investigated the spatial pattern of Persian oak (*Quercus brantii* var. *persica*) trees in a coppice stand in Zagros woodlands, Iran, using nearest neighbor summary statistics to assess their inter-specific interactions in these woodlands. All trees were completely stem-mapped in a 300 m × 300 m plot purely covered with Persian oaks by azimuth and distance technique. Five nearest neighbor summary statistics (i.e., nearest neighbor distribution function, D(r); spherical contact distribution function, Hs(r); J-function, J(r); Getis-Franklin neighborhood density function; and Clark-Evan aggregation index) were applied to analyze the spatial distribution of the trees. The Kolmogorov-Smirnov goodness-of-fit test showed that the observed spatial pattern of 1113 Persian oak coppice trees significantly followed a homogeneous Poisson process null model in the study region. The results of D(r), Hs(r), and J(r) showed that Persian oak coppice trees had competitive interactions up to 8 m from each other (α=0.05). Getis-Franklin neighborhood density function presented the higher density of trees in the center of the plot, while Clark-Evan aggregation index expressed the mean distance to nearest neighbor of 5.8 m and significant dispersion of Persian oak coppice trees indicating their competitive interactions. It was concluded that Persian oak coppice trees competed with each other for environmental resources up to 8 m in the study region and they had no interactions with each other after this spatial scale.

COPPICE ROTATION ON BEECH FORESTS: SOME EFFECT ON PLANT SPECIES DIVERSITY

CANULLO, Roberto; CERVELLINI, Marco; SIMONETTI, Enrico; CAMPETELLA, Giandiego

University of Camerino, Italy

KEYWORDS: beta diversity, forest regeneration, upland, Central Apennine, beech forest

Beech forest coppice with-standards systems in the Marches Region (Central Italy) are characterized by small units (<1ha), recently (≈1930) deployed to coppicing, with an increasing abandonment since the 60's, and its lately revival for biofuel.

Evidences show that a mosaic of exploited - non exploited patches could maintain a good forest species pool (Garadnai et al. 2010).

Structural and plant species surveys were performed on 80 plots (20x20 m) by a stratified design (age since last coppicing, substrate and elevation); 57 plots were re-sampled in 2011, and structured interviews to cutters conducted.

We set age groups: post logged (1-16 years), recovering (17-31 years), old (32-95 years), and classified species in Social Behaviour Types: SBT1 beech specialist, SBT2 forest generalist, and SBT3 open habitat (Bartha et al. 2008; Canullo et al. 2011).

Results.

SBT1 increase along the temporal gradient, SBT2 is almost constant, SBT3 strongly reduced.

Community changes occurred between 2006- 2011: differences in the understory species composition are driven by tree canopy cover and, secondarily, slope and aspect.

Cutters' decisions are not based on the canopy cover: productivity thresholds are derived from age, height, diameter (indirectly indicating canopy closure).

Disturbance affects a stand after it has consolidated its sub-optimal forest habitat conditions for SBT1 species: tree canopy cover stabilizes approximately 10 years before users usually decide cutting (24-28 years).

Stands of age between 16 and 24-28 years probably develop crucial habitats for the survival and reproduction of forest generalist and beech specialist species, even during periods or within patches of active coppicing.

SUCCESSFUL SPROUTING IN CORRELATION TO THE HEALTH PARAMETERS ON THE EXAMPLE OF GREY ALDERS (*ALNUS INCANA* (L.) MOENCH)

MÁJEK, Tomáš; CECH, Thomas

Mendel University, Brno, Czech Republic

KEYWORDS: *Alnus incana*, coppice, Grey alder, dieback, Austria

In Austria, Grey alders (*Alnus incana* (L.) Moench) are currently suffering from a strong dieback of unclear origin. On two plots of declining Grey alders along the streams Paalbach and Turrach of the Mur river system in Styria, coppicing trials were performed to prove the regeneration ability of diseased trees. Both sites were selected as typical representatives of the current situation in the Murtal area where heavy dieback of the trees can be observed. On both sites all the selected trees were approximately of the same age, chosen in the range from absolutely healthy to almost dead in a total number of 30 each. Selected trees were cut in spring 2013 and the stumps were numbered. Before cutting, several parameters were estimated on the selected trees: epicormic shoots, tarry spots, necroses, abnormal fructification, dieback, stem cracks, defoliation, wood insects, wood destroying fungi, leaves reduced in size, presence of rot in the stump, yellow leaves and damage to the roots. All these parameters were assessed by numbers from 0 to 2 according to the intensity of the parameters.

In summer of 2014, the number of living stumps with new coppices was counted. The results revealed a correlation between the health characteristics of the coppiced trees and a successful sprouting of the stump. In addition, it seems clear that some health parameters of the coppiced trees are more important for the process than others.

COPPICE MANAGEMENT AND NUTRITION

PIUSSI, Pietro

Uiversità di Firenzei, Via del Ronco 11, 50125 Firenze, Italy

KEYWORDS: nutrition, fodder, pollards, grazing, litter

Coppices have always been a source of food for humans, directly, through seeds, fruits and game, or indirectly through seed and fodder utilized by domestic animals. Different coppicing methods originate shoots from stool, pollards or shredded trees; they combine wood and food production and some of them are still in use, but nowadays in Italy coppice stands are managed only on stools. These methods have been applied also on isolated trees. Nourishment was obtained from coppice in different ways:
1. Fodder provided by leaves obtained by shredding shoots or at the time of final cutting,
2. Seed produced by oaks or beech standards (maiden trees)
3. Agricultural crops grown on coppice soil for a 2-3 years period after coppicing
4. Leaves and acorns provided from pollard stands devoted only to these products
5. Dead leaves used as litter for animals and afterwards emploied as manure
6. Grasses and herbs exploited through grazing or collected to produce hay
7. Pollard stands grown specifically for practicing hunt of small birds with nets or birdlime (mistletoe).

The prolonged use of coppices for these kind of products has presumably caused a selection in favour of species and individual trees whose seed production was more abundant or more tasty. Species (usually shrubs) avoided by grazing animals because thorny or less appetizing or poisonous spread over wider areas. The soil has been depleted of nutrients, compacted by animals hoofs and eroded. Where soil was tilled, stones have been collected and piled in heaps.

Abstracts

Ecophysiology and tree ecology

RESPROUTING ABILITY AND SPROUT GROWTH DYNAMICS IN TEMPERATE TREES

MATULA, Radim; ŠRÁMEK, Martin

Mendel University in Brno, Czech Republic

KEYWORDS: Resprouting, temperate trees, competition, allometric equation, woody biomass, carbon stock

Resprouting trees often form important part of woody vegetation from temperate zone to tropics but the main processes that drive resprouting ability and sprout growth are still little known. Understanding of resprouting is also a key for successful coppice restoration and management optimization. To address this gap, we have followed individual development of approximately 5000 spatially located trees one year before and six years after their harvest. This long-term study has been done in two experimental plots in the south-east of the Czech Republic. For this purpose, we developed reliable method for measuring, biomass and carbon estimation in multi-sprout trees which were previously lacking. Our results showed that, apart from species identity, pre-harvest above-ground as well as below-ground competitions play the most important role in resprouting success of harvested trees, whereas pre-harvest tree size and sprout competition are the main drivers of sprout growth dynamics. Our results and the models on which these results are based may be utilized for coppice management. Because resprouting ability is almost universally driven by the level of resource storage in individual plants, our results may be applied in a variety of terrestrial ecosystems with woody vegetation.

WHAT DO WE KNOW ABOUT OAK COPPICE ROOTS?

TROCHTA, Jan; PÁLKOVÁ, Marcela; VRŠKA, Tomáš; KRÁL, Kamil

The Silva Tarouca Research Institute for Landscape and Ornamental Gardening

KEYWORDS: root biomass volume, polycormon structure, terrestrial laser scanning, coppice, polycormon age

Although the old oak coppice stands form structure of polycormons, the connection among individual stems stays unclear and was poorly studied so far. For our study we selected a polycormon in Lipina Forest, Podyjí National Park, Czech Republic. The polycormon is recently composed of 7 stems with an average distance of 2.13 m. Detailed mapping required great amount of digging and cleaning the roots from soil using advanced method of air-spade supersonic nozzle. After exposition of roots and bedrock the polycormon was scanned by terrestrial laser scanning to capture all details, and processed in computer into detailed 3D model of root system and stems. Resulting intimate 3D model of the polycormon allows to estimate its history and spreading in soil from the first root and follow the main roots leading to the last generation of stems.

From the 3D model of the polycormon we also calculated the volume of woody biomass. Volume of the excavated part of the root system is about 1.01 m3 with surface area of course roots of 27.36 m^2. The volume of total aboveground woody biomass of stems is 2.11 m3.

According to dendrochronological coring the estimated age of the polocormon is about 825 years (SE ± 145 years). Some roots were selected and cut in a manner to estimate wood density inside of root. The density is very variable depending on root shape and on distance from the first root.

TRANSPIRATION OF SESSILE OAK SEEDLINGS AND SPROUTS IN RELATION TO MICROCLIMATIC CONDITIONS

PIETRAS, Justyna[1,2]; STOJANOVIĆ, Marko[2]; POKORNÝ, Radek[1,2]

1: Global Change Research Centre, Czech Academy of Sciences
2: Department of Silviculture, Faculty of Forestry and Wood Technology, Mendel University in Brno

KEYWORDS: transpiration, coppice, sessile oak, sprouts, seedlings

Transpiration of sprouts and seedlings of young sessile oaks *Quercus petraea* (Matt.) Liebl. in coppice forest stand was evaluated according to different microclimatic conditions. Plant transpiration (T) was derived from sap flow measurements using the trunk heat balance method (THB). The sap flow (Q) of four seedlings and four stump sprouts was measured during the growing season in 2014 and analysed together with climatic and biometric data. Values were calculated with respect to the plant cross sectional area (CSA) – at a height of 10 cm – and to the plant leaf area (LA).

The CSA was weakly correlated with the LA and Q in both sprouts and seedlings. Sap flow was linearly correlated with LA. The mean daily sprout sap flow with respect to the CSA was significantly higher ($\alpha = 0.05$) than that of seedlings. The differences in transpiration, calculated as Q divided by LA, occurred during a drought period when seedlings transpired significantly less than sprouts. Our results support the hypothesis, that sprouts have access to a larger water pool using the old stump root system and withdraw water during drought. Moreover, sprouts seem to be less susceptible to unfavourable climatic conditions than seedlings of a similar age. Coppice management would therefore be advantageous on sites with frequent drought periods.

YOUNG COPPICE AND STANDARD SESSILE OAK RESPONSE UNDER DIFFERENT LIGHT CONDITIONS

STOJANOVIĆ, Marko[1]; ČATER, Matjaž[1,2]; DOBROVOLNÝ, Lumir[1]; POKORNÝ, Radek[1,3]

1: Department of Silviculture, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemedelska 3, 613 00 Brno, Czech Republic
2: Slovenian Forestry Institute, Večna pot 2, 1000 Ljubljana, Slovenia
3: Global Change Research Centre, Czech Academy of Sciences, Belidla 4a, 603 00 Brno, Czech Republic

KEYWORDS: coppice, standards, drought response, young trees, quantum yield

In coppice and standard sessile oak stands of comparable age (100 years), growth and light utilization efficiency (quantum yield) of young oaks was compared in mature stand of different density; under closed canopy conditions (indirect site factor (ISF) below 20%, max density), on the forest edge, (ISF between 20-35%, med. density), and in the open, without mature canopy cover (ISF above 35%, min. density).

Assimilation response was compared in every forest complex and light category at 0, 100, 250, 600, 1200 and 1800umol/m^{2}s at constant temperature (200C), CO^2 (350 mmol/l), constant relative air humidity and gas flow in 6-8 young oaks of every light category in optimal and drought stress conditions. Quantum yield, height, stem diameter and number of young oaks was evaluated for every light category and compared with corresponding mature stand density.

With increasing light, the number of young oaks in standards decreased, while in coppiced forest it increased. In optimal conditions the quantum yield in standards was highest under mature canopy, while in coppices maximum was shifted toward the edge light conditions.

During severe drought the drop in efficiency of standards was most evident in the open light category, while in the categories of coppiced oaks no differences in efficiency were confirmed between optimal and drought stress, proving the advantage of young coppices over standards. Optimal density of mature stand was provided and discussed for coppice and standard type of forest stand according to the measured response of young trees.

DIFFERENT HARVESTING INTENSITY AND SOIL CO^2 EFFLUX IN SESSILE OAK COPPICE FORESTS

DAŘENOVÁ, Eva[1]; ČATER, Matjaž[2,3]; PAVELKA, Marián[1]

1: Global Change Research Centre CAS, Czech Republic
2: Slovenian Forestry Institute, Večna pot 2, SI-1000 Ljubljana, Slovenia
3: Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic

KEYWORDS: respiration, soil moisture, temperature, coppice, drought

Soil CO^2 efflux accounts for about 45-80 % of total ecosystem respiration and, therefore, is an important part of the ecosystem carbon cycle. Soil CO^2 efflux has been poorly addressed in coppice forests, the ancient way of forest management.

In our study, the measurements of soil CO^2 efflux, soil temperature and soil moisture were provided in Sessile oak stands with different harvesting intensity (control-0%, V1-75%, V2-80%, V3-85% and V4-100% intensity) during the fifth and sixth year after the harvesting.

Soil CO^2 efflux ranged between 2-8 µmol m^{-2} s^{-1} and indicated an increasing pattern with increasing harvesting intensity. The slope of the pattern within measurement period declined from the fifth to the sixth year after harvesting, indicating gradual recovery of soil carbon dynamics of the coppiced stand to the equilibrium state as before harvesting.

Temperature sensitivity of soil CO^2 efflux ranged between 2.1-2.8 with the lowest values measured in the control stand. Soil CO^2 efflux in the control stand was more sensitive to changes in soil moisture than on the harvested plots.

By our calculation 6.2 tC ha^{-1} was released from the control stand and 6.2-6.8 tC ha^{-1} from the harvested stands during the sixth year after harvesting. If the mean temperature increased by 1 °C, the amount of the released soil carbon would increase by 7.7 % in the control stand and by 9.0-10.8 % in the harvested stands respectively, depending on the harvesting intensity.

QUERCUS PYRENAICA COPPICES II: DEGRADATION TAKES ROOTS ON ITS HISTORICAL MANAGEMENT

SALOMÓN, Roberto[1]; VALBUENA-CARBAÑA, María[1]; RODRÍGUEZ-CALCERRADA, Jesús[1]; GONZÁLEZ-DONCEL, Inés[2]; IGLESIAS, Manuel[1]; ZAFRA, Elena[1]; MIRANDA, Jose Carlos[1]; MORALES, Cesar[1]; LÓPEZ, Rosana[1]; G.GORDALIZA, Guillermo[1]; RODRÍGUEZ-GARCÍA, Aida[1]; GUZMÁN, Paula[1]; OTERO, Cesar[1]; OLEKSYN, Jacek[3]; ZYTKOWIAK, Roma[3]; GIL, Luis[1]

1: Forest Genetics and Ecophysiology Research Group, Technical University of Madrid, Spain
2: Department of Forest Management and Economy, Technical University of Madrid, Spain
3: Polish Academy of Sciences, Institute of Dendrology, Kornik, Poland

KEYWORDS: *Quercus pyrenaica*, root biomass, root/shoot, carbohydrates

Stem top drying, low production and scarce acorn yield are commonly observed in *Quercus pyrenaica* stands in the Iberian Peninsula. A hypothetical root/shoot imbalance provoked by centuries of coppicing is pointed as the cause of this degradation state. Stem genotyping was performed to elucidate inconspicuous clonal structure and two clones of contrasting sizes – 55 and 6 m^2 – were harvested and excavated to measure root/shoot ratios of biomass and total non-structural carbohydrates (TNC) concentrations. Biomass R/S ratios were 1.05 and 0.45 – even higher if uniquely living biomass is accounted- for the large and the small clones, respectively. During bud-swelling, the large clone registered higher TNC in roots than the small clone, whereas stem and twig TNC showed no differences. After the growing period, stem and twigs TNC were higher in the small clone whereas there was no difference in root TNC. Remarkably, the large clone composed of eight stems and more than 50 old stumps was inter-connected by more than 150 living root grafts and parental roots. Moreover, radiocarbon dating showed that root system in the large clone was at least 500-600 years old. Results suggest that the larger clonal size the greater R/S ratio, due to massive root system development. This imbalance determines carbon allocation patterns and physiological constraints for stem performance. Actually, R/S imbalance might lead to limited stem growth and larger carbohydrates consumption occurring in root respiration processes, as previously observed in the same stand.

HYDRIC FUNCTION OF COPPICE FORESTS - THE EFFECT OF COPPICE FOREST ON SEASONAL DYNAMICS IN SOIL MOISTURE

KUPEC, Petr; DEUTSCHER, Jan

Mendel University, Brno, Czech Republic

KEYWORDS: coppice, hydric forest functions, seasonal dynamics in soil moisture, TFE MF Krtiny

On a permanent experimental site with low-forest in the area of TFE MF Křtiny, Czech Republic, the hydric function of coppice forests is studied by evaluating the effect of low-forest on seasonal dynamics in soil moisture. In 2010, cuttings of different intensity have been done on the site in the then native high-forest with the intention to initialize different models of low-forest. The experimental site is originally a homogenous oak forest on a mesotrophic site.

The soil moisture is measured in fortnight intervals in a net of sampling nests so that the data from readings performed during one day resemble areal measurement. The sampling nests are situated in identical soil conditions (soil type) and in relatively close terrain conditions (slope, exposition). The determining parameter for soil moisture is then the type of low-forest. The sampling nests are situated within three types of low-forest according to the intensity of the initial cutting. A part of the experiment is a study site in the native forest used as a reference.

Recently, data on soil moisture are available from the years 2013 and 2014, from spring to autumn. The goal of this contribution is to present the evaluation of soil moisture dynamics in relevance to the different intensity of the initial cutting as a model of different types of initial stages of low-forest.

Lectures – Abstracts

Socio-economics

INTEGRATING FOREST MANAGEMENT INTO CONSERVATION OBJECTIVES: COPPICE MANAGEMENT AND FOREST HABITATS IN NATURA 2000 AND EMERALD NETWORK SITES

MAIROTA, Paola[1]; SUCHOMEL, Christian[2]; CONEDERA, Marco[3]; VERHEYEN, Kris[4]; HEINSOO, Katrin[5]; BUCKELY, Peter[6]

1: University of Bari "Aldo Moro", Italy
2: Chair of Landscape Management, University of Freiburg
3: Research Unit Community Ecology, Swiss Federal Research Institute WSL
4: Forest & Nature Lab, Ghent University
5: Institute of Agricultural and Environmental Sciences Estonian University of Life Sciences
6: Peter Buckley Associates

KEYWORDS: Habitats Directive, Bern Convention, forest habitat types, coppice system

Most forest habitats, as defined and listed for their nature conservation importance in the Habitats Directive of the European Union and in the Bern Convention, are the result of long lasting human intervention, including coppice system. The continuation of this regime, that is of traditional management systems, is recognized as absolutely essential to habitat conservation. Within the framework of the EU COST Action FP1301 EuroCoppice, this contribution is the first attempt to explore the scope for and the attitudes towards coppice system in Natura 2000 and Emerald network sites of a selection of administrative regions (one for each of a group of countries (Italy, Germany, Belgium, Great Britain, Estonia and Switzerland). A general list of forest habitat types for which coppice is biologically possible has been compiled at the continent level and populated with the sites where such habitats are present at the national and regional levels. At the regional level a critical scrutiny of existing sites' management plans and/or other statutory, administrative or contractual measures and/or forest management provisions is ongoing for each site with forest habitat types potentially under coppice within the region. Preliminary results show that approaches for the integration of coppice management into conservation differ between nature protection authorities. We illustrate this disparity with some contrasting case studies and discuss the possible causes of such differences (modes for transferring legally/non legally binding prescriptions from nature protection directives/conventions into national legislation, national/regional reference frameworks of technical measures/silvicultural models for forest habitats).

ECONOMIC FEASIBILITY OF GROWING SHORT-ROTATION COPPICED BIRCH ON CUTAWAY PEATLANDS FOR BIOENERGY

JYLHÄ, Paula; HYTÖNEN, Jyrki; AHTIKOSKI, Anssi

Finnish Forest Research Institute, Finland

KEYWORDS: downy birch, coppice, economy, bare land value

By 2020, about 44,000 ha a^{-1} of peat production sites will be released to other uses in Finland. Within this time span, the production of forest chips is to be increased by more than 50% up to 13.5 million m3, which implies rising production costs and call for developing novel, cost-efficient production systems. We evaluated the economic feasibility of growing short-rotation downy birch (*Betula pubescens* Ehr.) energy biomass on cutaway peatlands. The study is based on data measured from six naturally afforested, 15–26 years old downy birch stands located in northern Finland. In the financial analysis covering infinite number of rotations, afforestation by natural or broadcast seeding was assumed, and the stands were regenerated by coppicing after the first, second, and third rotations. Mean annual biomass production in the measured stands exceeded 3 t DM ha-1. The bare land value was positive even with a five per cent discount rate in all but the youngest, 15-year-old stand. With an interest rate of three per cent, for example, the break-even stumpage price for energy wood implied an economic surplus to be reached without subsidies in five stands out of six. The unit price of energy (when bare land value equals 0) for the majority of the stands was below the assumed price level of 21 € MWh-1, indicating long-term financial profitability associated with the production. The profitability of biomass production is strongly influenced by the cost of harvesting, which is among the most important sources of uncertainty in our calculations.

TRADITIONAL COPPICE IN SOUTH EAST ENGLAND: THE IMPORTANCE OF WORKFORCE ENGAGEMENT FOR DEVELOPMENT

BARTLETT, Debbie

University of Greenwich, United Kingdom

KEYWORDS: coppice, workforce, history, development

This paper describes research into the historic importance of the coppice industry, now largely restricted to south east England and the relevance of this to current rural development policy. The economic and social contexts have altered significantly over time with product substitution and changing consumer aspirations, and particularly the availability of alternative fuel sources. Over the last fifty years the 'value' attached to coppiced woodlands has shifted away from resource exploitation and towards a greater appreciation of them for wildlife, recreation, amenity and cultural heritage. This has increased wider public awareness of and appreciation for coppicing as a management technique and, consequently rising concern over the reduction in area managed. This was assumed to be due market failure but attempts to reverse this by creating new outlets failed. The reason for this has been explored by investigating the history of the industry and engaging directly with the workforce, both individually and in focus groups. Coppice workers were found to be more numerous, active and enterprising than previously thought and many were found to be working in family groups servicing traditional markets. They were unaware of concerns about decline in the area coppiced or initiatives to address it. Issues currently affecting their businesses included housing costs, rural crime, harvesting restrictions, loss of yards and training needs. It is concluded that Government policies to promote woodfuel are not likely to succeed without active engagement with the workforce to understand their perspectives and enabling them to participate in policy decisions is recommended.

How a political compromise from 1721 led to the conservation of coppice woodlands

Mölder, Andreas

Northwest German Forest Research Station, Germany

Keywords: coppice woodlands, forest ownership, historical ecology, nature conservation, socioeconomic development

The structure of forest ownership and land tenure is an often underestimated factor in forest studies, but it is crucial for the development, structure, and tree species composition of woodlands. It can be assumed that, in regions with both state-owned forests and smaller private forests, the latter contain more relict species bound to habitats shaped by historical woodland management practices such as coppicing. But which kind of political decisions in the past led to the land tenure structure which is obviously so important for biodiversity patterns and habitat conditions?

To answer these question, I have conducted a case study in the Osnabrück region (northwest Germany), a very suitable study area due to a mixture of smaller private and larger state-owned forests. The Osnabrück region is famous for coppices dominated by *Fagus sylvatica*, which are regarded as very valuable habitats.

I found that a political decree from 1721, which was merely a compromise, was the base for the present-day distribution of coppice woodlands in the Osnabrück region. This decree ruled that the common woodlands should be privatized in a relatively fair-minded way. As a result, a huge amount of small private forest parcels was created. Mainly due to the low economic importance of these forest patches, coppice structures persisted until today. Consequently, a compromise made nearly 300 years ago resulted in the conservation of valuable coppice habitats worthy of protection. However, these stands are overaged and appropriate conservation management strategies are needed.

Ecological diversification of intensively managed agricultural portfolios with short rotation woody crops is economically profitable – An application of the Modern Portfolio Theory

Hauk, Sebastian

University of Applied Sciences Weihenstephan-Triesdorf, Germany

Keywords: profitability; diversification; land-use optimization; uncertainty;

Compared with most common bioenergy plants, short rotation woody crops (SRWC) provide higher environmental benefits, but are not widespread in intensive cropping systems because they are thought to be less economically viable. However, most recent economic evaluations of SRWC have been based mainly on mutually exclusive comparisons of alternative investments and have neglected both uncertainties of cash flows and diversification effects. To address these effects, we apply the Modern Portfolio Theory to evaluate the economic performance of SRWC at the farm level in medium-to-high-yielding regions in Bavaria (Germany). In mutually exclusive SRWC-crop comparisons, the gross margins of SRWC were competitive with most alternative crops, and showed less variation. Therefore, the inclusion of SRWC into existing farm production plans can improve overall profitability while lowering risk. Thus, diversifying cash crop rotations with SRWC is an effective risk-management instrument for land-use decision makers that can also provide environmental benefits.

STRUCTURE, UTILIZATION AND MOTIVATION OF MANAGEMENT OF PRIVATE OWNED COPPICE FORESTS – A CASE STUDY FROM SOUTH WEST GERMANY

SUCHOMEL, Christian; JOTZ, Sarah

University of Freiburg, Germany

KEYWORDS: private ownership, motivation of utilization, management of private forests

The aim of the study was to get informations about the private forest ownership situation in coppice forests. The focus was on the typical structure of the private coppice forests, utilization of the coppice, kind of silvicultural management system, amount of harvesting products, motivation of utilization and - in case if they are not utilize – conditions for a future utilization. Rhineland Palatinate was chosen as a study area, a federal state with one of the highest percentages of coppice/aged coppice in Germany.

With a questionnaire 812 people who own coppice or aged coppice forests were asked about their forests. 277 (37.7 %) people answered the questionnaire by mail or online.

85 % of the asked people have forests smaller than 5 hectares. Two third of the forest owners live very close (< 5 km) to their forests. The answers to questions about utilization show that most of the forest owners did not made any harvesting or tending operations during the last ten years. The most mentioned reasons for that are “not needed” and “too expensive”, “physically not fit enough” and “no time”.

The forest owners have been asked what the “like” within their forests. The most forest owners answered that they like the possibility to get firewood. The second most answer was Biodiversity.

Traditional management (small clear cuts) were just done by a very few people.

With the knowledge that most of the owners are not utilizing their coppice forests information campaigns or funding programs could be initiated.

OPERATIONAL SHORT ROTATION WOODY CROP PLANTATIONS: MANUAL OR MECHANISED HARVESTING?

VANBEVEREN, Stefan[1]; SCHWEIER, Janine[2]; BERHONGARAY, Gonzalo[1]; CEULEMANS, Reinhart[1]

1: University of Antwerp, Belgium
2: Albert-Ludwigs-University of Freiburg, Germany

KEYWORDS: POPFULL, wood chips, poplar, harvesting efficiency, motor-manual harvesting

Harvesting is the most expensive, but the least investigated process in the cultivation of short rotation woody crops (SRWC). To get a better idea of the harvesting process (in terms of its performance, productivity, cost, soil compaction, cutting height and quality as well as biomass losses), we closely monitored the second harvest of a SRWC culture in Flanders (Belgium). We compared our results to the harvests of other, small European parcels. The trees at our site were harvested with both a manual and a mechanised (Stemster harvester) cut-and-store system, while the cut-and-chip system was analysed from an extensive literature survey. The production cost (to the edge of the field) at our site reached 426 (manual) and 94 (mechanised) € t^{-1}, while the average values found in the literature are respectively 104 and 78 € t^{-1}, versus 17 € t^{-1} for the cut-and-chip harvesting system. The productivity at our site reached 14 (manual) and 22 (mechanised) oven-dry tonnes per scheduled machine hour, while the average values found in the literature are respectively 15 and 23 t h^{-1}. Based on the good performance (ha h^{-1}) and productivity (t h^{-1}) of the cut-and-chip system as well as its lower costs, this harvesting system is recommended for operational SRWC.

PAST, PRESENT AND FUTURE OF THE COPPICE SILVICULTURAL SYSTEM IN THE ITALIAN NORTH-WEST

MOTTA, Renzo[1]; BERRETTI, Roberta[1]; MELONI, Fabio[1]; NOSENZO, Antonio[1]; TERZUOLO, Pier Giorgio[2]; VACCHIANO, Giorgio[1]

1: Univ. of Turin, Dep. DISAFA, Italy
2: IPLA, Turin, Italy

KEYWORDS: silviculture, high forest, coppice, coppice with standard, conversion, fallow lands

The coppice management system is still widespread in northern Italy. In the past most of the broadleaves were coppiced with short rotations due to the high request of firewood and charcoal. Over the last decades local and global dramatic socio-economic changes have produced a decline in overall firewood exploitation, a lenghtening of the rotations and a generalized abandonment of marginal coppice stands. The only way to contrast this trend has been, in the last decades, a systematic conversion from coppice to high forest. Due to the fact that most of the conversion silvicultural treatments are costly and that the entire conversion process requires many decades this policy is not sustainable yet. The Piedmont region, taking into account the current dynamics, the expectations of the stakeholders and the supply of the ecosystem services has introduced new rules for the coppice silvicultural system allowing also the coexistence between gamic and agamic regeneration in the same stand. Current coppice and mixed regeneration stand silvicultural situation and future perspectives are presented and discussed.

SURVEY OF MANAGEMENT OF PRIVATE OWNED COPPICE FORESTS IN LATVIA

LAZDINA, Dagnija; DONIS, Janis; LAZDINS, Andis

Latvian State Forest Researche Institute "Silava", Latvia

KEYWORDS: Private forest owners, coppice forests, management

Results are obtained within the scope of the project "Monitoring of private forest management and forest ownership consolidation and cooperation process". In overall, 1,124 of 111,836 forest owners are surveyed. Most of them are representing small forest estates of up to 50 ha (84%), which is similar to the forest ownership in the country - 97% are holdings with total area up to 50 ha). Almost half of the owners (58%) deal with coppice forestry, which is more popular in a group of forest owners having more than 50 ha of forest, 70% of them managing some of their properties as coppice forest. Tree species represented in coppice forests are birch (71%), aspen (60%), grey alder (51%), black alder (12 %), willows (9 %), other species (7%) and 3% with no answered. Willows and grey alder are more often mentioned by small size forest properties owner's group. Half of the owners additionally to deciduous trees coppice are planting some coniferous species. The most common rotation period of coppice forest is 40 years – 30% of responses (age of final felling for aspen is 40 years); 29% of respondents preferring to harvest before stand reaches 15 years age, which is legal for grey alder stands and plantation forests; only 8 % of respondents answered that longer than 40 years rotation is used. No responses on rotation length was received from 34% of respondents. Only 9% of respondents are considering the possibility to establish short rotation coppice (SRC); 24 % are not decided.

Lectures – Abstracts

Production

POTENTIAL USE OF TREE AND STAND EMPIRICAL GROWTH MODELS FOR COPPICE GROWTH MODELLING

KNEIFL, Michal; KADAVÝ, Jan; KNOTT, Robert; ADAMEC, Zdeněk; DRÁPELA, Karel

Mendel University in Brno, Czech Republic

KEYWORDS: dendrometric values, structural values, stool, yield tables, coppice forest, simulation

There has been renewed interest in coppices in the last few decades. This has been determined by increasing demand for fuel wood and attempts to enhance biodiversity of managed forests. Except from various coppice yield tables for some European countries, there is currently no ready-to-use coppice growth model for coppices presently. The goal of this paper is to analyze potential applicability of existing empirical models (or their components) for coppice growth modeling. We selected a set of existing models for short rotation coppices, short rotation forestry including coppices and models for even-aged generative - origin forests. We assessed whether existing model can handle structural and biometric variables specific for coppices. We found that within-stool competition, mortality and morphologic variability were the variables conditioning the applicability of a model. Our survey revealed that there currently is not an applicable empirical growth model that would be able to simulate complex structure of a coppice. On the other hand, some components of existing models (e.g. resprouting probability models and diameter increment models) are potentially useful to model particular variables important for coppice structure and growth description. These components could become a part of a future coppice empirical growth model construction. As the demand for active coppice management grows in Europe, an effective decision support tool will be necessary.

COPPICING ABILITY AND BIOMASS PRODUCTION OF DOWNY BIRCH (*BETULA PUBESCENS* EHRH.) – 4-YEAR RESULTS

HYTÖNEN, Jyrki

Finnish Forest Research Institute, Finland

KEYWORDS: coppicing, stump diameter, downy birch, biomass production

Native downy birch is a primary successional tree species colonising open areas thriving also on peatlands. The use of bioenergy in energy generation in Finland is to be increased considerably. The possibility of using short-rotation coppice management in natural dense downy birch stands on cutaway peatlands was studied. Permanent sample plots were established in six 10–26 years old downy birch stands located close to Oulu, northern Finland. The stand biomass was measured and trees were clear-cut in spring 2011 and trees were transported to roadside. Diameter and height of the stumps were measured. The number and height of sprouts were measured annually, as well as sample trees were taken for constructing biomass equations. Sprouting ability of birches decreased with increase of age and stump diameter of the mother trees. However, larger stumps produced more spouts than smaller and younger stumps did. When the mother stands had been young when clear-cut 10% of the stumps died, while in older stands 20% of the stumps did not produce any sprouts. During the first three years biomass production correlated with the number of shoots, being 12 t/ha in the stands clear-cut at the age of 10 years and 1 t/ha in the stands, which were cut at the age of 24 years. In the youngest stand there were initially over 350,000 birch spouts the number decreased due to self-thinning to 136,000 in three growing seasons. After three years, highest shoot mortality was found in the youngest and densest stands.

ROTATION-END COMPARISONS FOR *EUCALYPTUS* REGENERATION REGIMES (COPPICE VERSUS REPLANT) ON FOUR CONTRASTING SITES, SOUTH AFRICA

LITTLE, Keith MacMillan

Nelson Mandela Metropolitan University, South Africa

KEYWORDS: *Eucalyptus*, coppice, tree improvement, productivity, regeneration costs

With the focus on maximising timber yield on a sustainable basis from a static land base, rather than on a reduction in costs alone, the question of whether to replant or coppice has become increasingly important. Although past research has compared coppice growth and limited wood properties with genetically similar planted material, this data was collected over successive rotations and as such a direct comparison could not be made. Four trials were established in 1999/2000 in South Africa with either *E. grandis* x *E. camaldulensis*, *E. grandis* x *E. urophylla*, *E. macarthurii* or *E. nitens*. Within these trials, genetically similar trees and coppice were compared over the same rotation and on the same site. For *E. nitens* and *E. macarthurii*, improved material were also compared to the genetically similar, albeit unimproved coppice. As the regeneration regimes were tested under identical site and climatic conditions, a direct comparison could be made between the two. In addition to the above, plots within the commercially managed stands in which the trials were located were demarcated, the coppice measured, and trial data compared with commercial operations. Rotation-end data included stocking, merchantable volume, timber/pulp yield, and costs/profits. Growth and productivity responses were site and/or species specific, with stocking the main factor determining treatment ranking within each trial. Regeneration via coppicing was cheaper, and although the harvesting costs associated with felling coppiced stands was higher, the IRR (calculated at 6% over 2 consecutive rotations) was generally highest for coppice.

ANALYSIS OF ECOLOGICAL BEHAVIOUR AND MANAGEMENT TOOLS FOR CHESTNUT COPPICE STANDS IN NORTHWEST SPAIN

MENÉNDEZ-MIGUÉLEZ, María[1]; ÁLVAREZ-ÁLVAREZ, Pedro[2]; MAJADA, Juan[1]; CANGA Elena[1]

1: Forest and Wood Technology Research Centre (CETEMAS), Spain
2: Research Group in Atlantic Forests (GIS-Forest). Department of Organisms and Systems Biology, University of Oviedo, Escuela Politécnica de Mieres (E.P.M.), Spain

KEYWORDS: chestnut coppice, site index, CHAID procedure, stand density management diagrams, biomass, carbon pools

The knowledge of productive capacity and ecological behaviour of *Castanea sativa* Mill. coppice stands is the starting point in predicting forest growth and the subsequent management decision, especially in areas where timber production is the primary objective. The importance of chestnut coppice stands in northwest Spain joined with the practically non-existent studies of its growth and yield, make necessary the development of some tool to facilitate forest management.

The feasibility of using environmental factors, including edaphic, physiographic and climatic variables as indicators of productivity described by site index was evaluated. Stand density management diagrams, which are average stand-level models which graphically illustrate the relationships between yield, density and mortality throughout all stages of the stand, were also developed as useful management tools for stakeholders and Public Administrations.

The key factors affecting site productivity were evaluated according to two different statistical analyses: the CHAID procedure and parametric regression techniques. Results obtained revealed that the best site qualities correspond to plots with less summer precipitation and lower mean annual temperatures.

The relative spacing index (staggered distribution) was used to characterize the growing stocks for the stand density management diagrams. The diagram provides information about quadratic mean diameter, stand above-ground biomass, stand stem biomass and stand carbon pools.

The results and basic tools obtained in this study provide further information about the ecology of the species in northwest Spain and mean the baseline for future studies of different management regimes to improve the knowledge of chestnut coppice stands.

QUERCUS PYRENAICA COPPICES I: SCARCE ACORN YIELD IS NOT RELATED TO CLONAL SIZE

VALBUENA-CARABAÑA, María; ZAFRA, Elena; SALOMÓN, Roberto; GIL, Luis

Forest Genetics and Ecophysiology Research Group, E.T.S. Forestry Engineering, Technical University of Madrid, Spain

KEYWORDS: *Quercus pyrenaica*, clonal structure, seed production, unique genotype, vegetative regeneration

Quercus pyrenaica Willd. is a western Mediterranean/Atlantic species which current core of distribution is the Iberian Peninsula. The species has the specific ability to regenerate profusely from the entire root system after above-ground biomass removal by ecological disturbances. Its regenerative capacity was made use of in traditionally managed coppices, maintained along centuries mainly for charcoal, but also for firewood and woody pasture production. After the abandonment of coppicing in the 70's, jointly to the derived ecological, economical and social problems, these woodlands present marked levels of degradation, evidenced by low wood and acorn production. Especially, lack of fructification is one of the major hinders for woodland preservation, and its avoidance is one of the pursued aims of the most recommended alternative management. Sadly, the few experimental attempts to high forest conversion by thinning were not successful in this sense. Our former genetic analyses performed in several abandoned coppices showed surprising high levels of genetic diversity, helping to infer that despite coppicing promotes vegetative reproduction, trees acting as seed sources and seedling establishment had to be historically common. We have recorded acorn production of 20 trees (10 bearing unique genotypes and 10 belonging to clonal clumps) in an open parkland during three years. Results showed high inter-individual and inter-annual variability. The absence of a differentiation pattern hinders to explain neither the generalized lack of fructification in coppice stands of the species nor the existence of a trade-off independent of resources availability between sexual and asexual reproduction.

ALLOMETRIC BIOMASS EQUATIONS AT THREE COMPONENTS OF COPPICE ORIGINATED OAK FOREST IN STRANDJAS OF TURKEY

ÖZDEMIR, Emrah[1]; YILMAZ, Ersel[1]; MAKINECI, Ender[1]; KUMBASLI, Meric[2]; KETEN, Akif[2]; BESKARDES, Vedat[1]; ZENGIN, Hayati[2]; CINAR YILMAZ, Hatice[1]; CALISKAN, Servet[1]

1: Faculty of Forestry, Istanbul University, Turkey
2: Faculty of Forestry, Duzce University, Turkey

KEYWORDS: Regression Model, *Quercus*, Statistics, DBH Classes

This study was carried out coppice originated oak forests including various stand types and structures located in Strandjas of Turkey. Data were obtained from harvesting and weighing a total of 269 sample trees on total 192 sample plots that their size of 20 m *20 m to construct biomass equations. Biomass equations for estimating biomass values of the different tree components such as foliage, branch, bark, stem as well as total above - ground can be developed. These equations as regression models are based on the allometric relationships between biomass values which belong to tree components and tree variables such as diameter at breast height and total tree height that's why two basic model were developed to estimate biomass values of tree components in this study. In Model1 (W=a*DBHb), diameter at breast height was single predictor, in Model2 (W=a*(DBH2*H)b), diameter at breast height and total height were used with together as predictor. These two basic models were constructed for estimating biomass values of tree components such as foliage, branch, bark, stem as well as total above - ground for 1. dbh class (0- 8 cm), 2. dbh class (8 -20 cm), 3. dbh class (20-36cm) and 4. all dbh class (0-36 cm) separately. Eventually, A total of 40 biomass regression models (equations), which contain 2 basic models*4 dbh class*5 tree components, were obtained and calculated statistics of these models were also discussed in this study. All of the models showed a statistical significance.

Lectures – Abstracts

History and dendrochronology

COPPICE WOODLAND SINCE THE MIDDLE AGES: SPATIAL MODELLING BASED ON ARCHIVAL SOURCES

SZABÓ, Péter; MÜLLEROVÁ, Jana; SUCHÁNKOVÁ, Silvie; KOTAČKA, Martin

Institute of Botany, Czech Academy of Sciences, Czech Republic

KEYWORDS: spatial modelling, historical ecology, archival sources

Coppice woods have been present in Europe since prehistory. From approximately the Middle Ages onwards, archival as well as archaeological data are available to study the history of coppicing. Existing detailed studies of individual sites provide a wealth of knowledge on the methods of coppicing, and at such sites the long-term effects of coppicing on vegetation structure and composition were also examined. However, little is known about the distribution and extent of coppicing at the landscape scale in the deeper past, and forming a coherent picture of the spatial extent rather than the management details of coppicing in larger regions remains a challenge. In this presentation we will use three archival datasets, current environmental data and the MaxEnt software to model changes in coppice distribution from the 14th through the 19th century in Moravia (eastern Czech Republic, ca. 22,300 km^2). The medieval model will be based on an extensive collection of charter evidence and the interpretation of a Latin term. Models for the 18th and 19th centuries will come from tax survey data. We will examine whether there were significant changes in coppice distribution in the study period and what may have caused such changes, with special attention to regional population dynamics.

500 YEARS OF COPPICE-WITH-STANDARDS MANAGEMENT IN FLANDERS (BELGIUM): THE CASE OF MEERDAAL FOREST

VANDEKERKHOVE, Kris

INBO, Belgium

KEYWORDS: coppice-with-standards; basal area

For centuries, coppice and coppice-with-standards were the main forest management systems in Flanders. High population densities and low forest cover resulted in a very high demand for wood, especially firewood, so strict regulations and management regimes were needed to prevent overexploitation. We illustrate this with one well documented case of Meerdaal Forest, with reference to other sites in Flanders.

The forest of Meerdaal is a woodland 30 km east of Brussels. For centuries its high quality timber oak stands were managed as coppice with standards, with a relatively high share of standard trees. Using historical archives and maps we reconstruct how this coppice-with-standard management was developed and optimised over a period of 500 years. Changes in cutting cycles and configurations are analysed, but also how this management was combined with other sources of income like grazing and acorn picking.

Over the last century, the coppice with standards system was abandoned and the oak stands were gradually transformed to high forest, resulting in a loss of some light-demanding species like butterflies. For natural and cultural history reasons, a restoration programme has been initiated on a limited area of 20 ha over the last years. Some preliminary results of this project are also given.

THE RISE AND FALL OF COPPICING – HISTORICAL PROCESSES AND CONSEQUENCES FOR NATURE CONSERVATION

MÜLLEROVÁ, Jana[1]; SZABÓ, Péter[1]; HÉDL, Radim[1]; DÖRNER, Petr[1]; VEVERKOVÁ, Alina[2]

1: Institute of Botany AS CR, Czech Republic
2: Nature Conservation Agency of the Czech Republic

KEYWORDS: conservation, forest management, history, forest composition, vegetation diversity

European broad-leaved forests have been shaped by humans for millennia. Historical management practices were related to both environmental and socio-economic conditions. In order to reconstruct long-term spatio-temporal dynamics in forest management and to investigate changes in both woody and herbaceous species composition in the Pálava and Czech Karst Protected Landscape Areas, we analyzed forest archival sources spanning the past seven centuries and repeated vegetation plot surveys from 1950s. Forests in both study areas were coppiced for centuries, with the coppice cycle lengthened from 7 to 30 years (14th to 19th century) and a fluctuating density of standards. Coppicing provided variety of structural, disturbance and microclimatic conditions for both tree and understorey vegetation. The gradual process of abandonment started already in the second half of the 19th century and after WWII (1950s), the coppicing was ceased completely. Poorly accessible upper slopes and low productive sites were abandoned earlier. After the abandonment, succession towards mature close forests ensued. The results suggest decrease in light demanding and increase in nitrophilous species, which was partly reflected in decline of threatened species. Biotic homogenization of forest vegetation was common, although species richness did not show universal trends. The ecological processes were similar in both regions despite their geographical distinction and historical and environmental differences. To stop the process of biodiversity loss and support the goals of nature conservation, the re-establishment of coppice management is proposed. For the successful restoration the detailed knowledge of management history and the driving forces of historical forest changes is indispensable.

WHY COPPICES WEREN'T A COMMON PRACTICE IN OAK-ELM-ASH FORESTS OF THE BEREG PLAIN?

DEMETER, László[1]; FERENC, Horváth[2]; BIRÓ, Marianna[2]; VARGA, Anna[2]; MOLNÁR, Zsolt[2]

1: University of Pécs, Hungary
2: Institute of Ecology and Botany, Hungary

KEYWORDS: driving force, traditional forest use, coppice, Bereg Plain

Coppice management systems have a long tradition in Europe. Nevertheless, it was not a common management practice in floodplain forests of the Bereg Plain (Upper-Tisza region). We aimed to address the following questions: what kind of traditional management practices were practiced in the past?; what were the driving forces of forest uses?; why coppice was not widespread in the region? Past practices and driving forces were reconstructed by using written sources and 23 oral history interviews with local foresters, hunters, fishers, forest workers and shepherds in 6 settlements. In the XIXth century, coppice forests comprised small areas (some 10 ha) and were restricted to hill slopes and alder marshes. Smallholder selective logging, pannage and forest grazing, hunting, fishing, mowing, gathering were the most important traditional forest uses. Among the driving forces, demand for firewood, barrel stave and railway sleepers, wood pastures of high quality, hay and acorn were especially important. Data show that cutting living oak trees was forbidden and strictly punished in the XVIIIth century. Locals could cut firewood and timber construction with the permission of local authority till 1945. The base of the pig keeping was pannage until the end of the XIXth century. Demand for stave, sleeper and high quality timber drove forest management till the 1950s. Demand for acorns and high forests were the crucial drivers that didn't allow coppices to be widespread in hardwood floodplain forests of the Bereg Plain.

COPPICING HISTORY AND RESTORATION FOR BIODIVERSITY CONSERVATION IN THE PODYJI NATIONAL PARK

VRŠKA, Tomáš; PÁLKOVÁ, Marcela; ADAM, Dušan

Silva Tarouca Research Institute, Department of forest Ecology, Brno, Czech Republic

KEYWORDS: Coppicing history and restoration for biodiversity conservation in the Podyji National Park

The history of coppicing and actual state of former coppice stands in the Podyji National Park (PNP) were investigated. We analysed 34 old forestry and military maps since 1764 to 1986 and the available forest management plans. Actual state of former coppice forests was evaluated in the field according to qualitative classification based on the influence of historical management (type, duration, cutting cycle or intensity), natural site conditions and stand characteristics (tree species composition, stand structure and texture). Coppices were classified into three types: i) ancient coppices, ii) protection forests of coppice origin, and iii) extensive coppices with a short history of coppice management. The surviving fragments of coppice woods in the PNP cover a total area of 1542 ha, of which 519 ha are in the most valuable ancient coppice category (i), 495 ha are protection forests of coppice origin (ii), and 528 ha are extensive coppices (iii). Ancient coppices survive mostly in the south-eastern half of the territory on xerothermic, nutrient poor sites. In the north-western part of the PNP there are fewer coppice woods and these mostly belong to type "iii", rarely to type "ii". We recommend to the PNP authorities: i) the set of priority stands for the restoration of coppicing, and ii) modification of the border between the target core zone (unmanaged) and buffer zone (special-purpose management for biodiversity conservation) in the next management plan.

FOREST MANAGEMENT HISTORY AND ITS ENVIRONMENTAL IMPACTS IN SW SLOVAKIA (CASE STUDIES)

FEHER, Alexander

Slovak University of Agriculture in Nitra, Slovak Republic

KEYWORDS: biodiversity, coppice, woodland history, Slovakia

The paper is focused on the history of forest management in the Nitra region. It is consisted of four parts: an overview of history of woodlands in SW Slovakia, analysis of more then 700 forest/wood/woodland names from the 11th-20th cent. (interpretation of possible management strategies and species composition of forests, considering the traditional ecological knowledge and ethnobotany), comparison of biodiversity of four coppice forests near Nitra with different history (combinations of types and intensities of use, changes in size and various levels of degradation), effects of short rotation coppice on local biodiversity (ecological and socio-economical analysis of biodiversity, multivar. analysis of changes).

MANAGEMENT OF COPPICE FORESTS IN ROMANIA – A HISTORICAL APPROACH

NICOLESCU, Valeriu-Noroce[1]; HERNEA, Cornelia[2]

1: Faculty of Silviculture and Forest Engineering, University „Transylvania" of Brasov, Romania

2: Banat's University of Agricultural Sciences and Veterinary Medicine, Timisoara, Romania

KEYWORDS: low coppice, high coppice, coppice-with-standards, Romania, history

Broad-leaved forests throughout Europe have been regenerated by vegetative ways since thousands of years ago. This is also the case of Romania, where coppice forests have been managed since the old times in various ways such as:

a. Low (simple) coppices: the system was used on a very large scale (over 1.1 million ha = 30.2 per cent of managed forests of Romania) until 1948, its share declining down to 4-5 per cent owing to their conversion towards high forests. Currently this system is performed only in black locust, alder as well as native willow and poplar stands, with rotations of maximum 30-35 years depending on yield class and forest function.

b. High coppices (pollarding): in the past it was used in highly grazed forest areas but especially in floodplain willow forests, located along the Danube River and in the Danube Delta. The height of high stump ranged between (1) 2 and 3 m and rotations up to 10 years were the most common. Currently the system is used solely in the floodplain forests of white willow, with rotations ranging between 15 and 30 years (production functions) and 20 to 35 years (protection functions) in stands designated to saw timber production.

c. Coppice-with-standards: it was used (since 1843) in its simplest form (with only two cohorts of initially 56, then 80 or even 100-140 standards per ha) until 1948, when its application was forbidden and all former coppice-with-standards stands were converted towards high forests.

THINNING EFFECTS ON SOIL AND MICROBIAL RESPIRATION OF FOREST FLOOR AND SOIL IN EUROPEAN HORNBEAM (*CARPINUS BETULUS* L.) FOREST IN ISTANBUL-TURKEY

AKBURAK, Serdar; MAKINECI, Ender

Istanbul University, Faculty of Forestry, Turkey

KEYWORDS: C/N, CO^2, fine root, forest floor, ground cover

In this study, the effects of thinning on soil respiration and microbial respiration in a European hornbeam (*Carpinus betulus* L.) stand were examined over two years (2010 – 2012). Thinning reduced tree density by 50% of the basal area. Research was focused on the main factors (soil temperature (TS), soil moisture (MS), soil carbon (C), soil nitrogen (N), soil pH, ground cover biomass (GC), forest floor mass (FF), carbon (FFC) and nitrogen in forest floor (FFN) and fine root biomass (FRB)) which are effective on the soil respiration (RS) and microbial respiration in forest floor (RFFM) and soil (RSM). RS was measured bi-monthly with the soda-lime method, and incubation method was applied to measure RSM and RFFM separately. Results were evaluated yearly and over two years research period.

Annual mean RS was not significantly higher in thinned plots (1.76 g C/m^{-2} d^{-1}) than in control (1.72 g C m^{-2} d^{-1}). During the two year research period, RS was higher in thinned plots and it was linear correlations with GC, Ts and FRB.

RSM was not significantly different between thinned and control plots over two year research period. However, RFFM ratio have significantly higher in control plots both annully and over two year research period. RSM was linear correlation with soil nitrogen content and soil pH, while RFFM was linear correlations with C concentration and the C/N ratio of forest floor in thinned plots.

PROBABILITY DISTRIBUTION FUNCTIONS FOR DIAMETER CLASSES IN PERSIAN OAK STANDS, SOUTHERN ZAGROS IRAN

ALVANINEJAD, Sohrab[1]; FEGHAHATI, Reza[2]; MIRZAEI, Mohammad Reza[1]

1: Assistant Prof. Dept. of forestry Faculty of agriculture, and Institute of natural resources and environmental, Yasouj University. Yasouj, I.R. of Iran
2: Forestry Graduated student, Yasouj University. Yasouj, I.R. of Iran

KEYWORDS: Persian Oak, Statistical Distribution, Diameter Distribution, Zagros Forests, Kohgilouye and Boyerahmad Province.

Preparation of distribution diagram of trees in diameter classes for access to knowledge about stand condition can be an effective step in forest management. Furthermore, using of common statistical distribution is designed to assist forest management to predict the distribution of trees in diameter classes, study of current status and future forest stands and description of stand structure. Thus, the aim of this study was to evaluate the statistical distributions, and to obtain an appropriate model for the distribution of natural Persian Oak (*Quercus brantii* Lindl.) stands in diameter classes. For this purpose, a natural stand of Persian Oak in 48 hectares in Margoon region located in Zagros forests, southern of Iran were selected and investigated with 100% inventory method. The models were fitted to diameter observations for 3595 of Persian Oak trees. In this research, were used of statistical distribution such as Gama, Log-Normal, Normal, Weibull, Beta and Jounson SB. The results of Chi-Square test, Kolomogrov-Smirnov and Anderson-Darling tests showed that, Gama, Log-Normal, Normal and Weibull statistical distribution models can not explain the distribution of tree diameter, and two Beta and Jonson SB probability distributions were more suitable for this purpose. According to scatter plot of diameter classes that were determined to be less conducive, the stand was an irregular and uneven aged and distribution of young and middle-aged trees were higher in diameter classes.

RELATIONSHIPS OF INCREMENT AND GROWTH IN OAK COPPICE FOREST OF NORTHWESTERN TURKEY

AYLAK OZDEMIR, Gafura

Faculty Of Forestry Istanbul University, Turkey

KEYWORDS: Yield Table, Stand Density, Site Class, Standing Volume, Mean Annual Volume Increment

Turkey has significant oak ecosystems in terms of species diversity, space occupied and distribution of various habitat. A large part of coppice originated oak forest belonging to different ages, species composition and stand structure is spread in the Northwestern Turkey named Thrace. Stand volume and volume elements are calculated depending on site index and age and stand density is kept constant at normal density in normal yield tables. Stand volume and volume elements are calculated depending on site index, age and stand density in variable-density yield tables. In this study relationships of increment and growth in coppice-originated oak forest are investigated comparative with the aid of stand volume elements of normal yield table formed by Eraslan and Evcimen (1967) and variable-density yield table formed by Aylak Özdemir (2013) for this region. Standing volume and mean annual volume increment are the most important variables in yield tables. For this reason, standing volume of coppice – originated oak forests in good site class, 20-150 ages is ranged between 46.4 m3 and 505.8 m3 according to normal yield table and is ranged between 86 m3/ha and 595 m3/ha at average stand density according to variable-density yield table. The mean annual volume increment of coppice – originated oak forests in good site class, 20-150 ages is ranged between 2.3 m3/year and 3.8 m3/year according to normal yield table and is ranged between 4.0 m3/year and 7.7 m3/year at average stand density according to variable-density yield table.

BIOMASS AND CARBON ACCUMULATION IN YOUNG BLACK LOCUST (*ROBINIA PSEUDOACACIA* L.) COPPICES ON DEGRADED LANDS FROM SW ROMANIA

CIUVAT, Alexandru Liviu[1,2]; BLUJDEA, Viorel[2]; DUTCA, Ioan[1]; DINU, Cristiana[2]

1: Transilvania University of Brasov, Romania, Romania
2: Forest Research and Management Institute Bucharest, Romania

KEYWORDS: black locust, biomass equations, carbon

In the past decades the S-V part of Romania (southern Oltenia region) was subject to an aridization process mainly because of its very low percentage of forests combined with increasingly felt negative impact of global climatic changes (e.g. drought, high temperatures). These phenomena generated degraded lands (especially by sand deflation) that have a devastating effect on the environmental and social conditions in southern Oltenia. The only species that proved capable to reclaim not only the sandy soils but also different types of degraded lands (e.g. eroded slopes, sterile dumps) is black locust (*Robinia pseudoacacia* L.) and it's been used by foresters in this purpose since 1885.

Currently black locust occupies about 5% of Romania's forests (250000 ha) and play an important role in mitigating the negative impact of global climate changes by CO^2 sequestration, and protection of soil and water resources.

On the other hand, Romania, as a country which ratified the Kyoto Protocol, accounts for LULUCF activities to demonstrate compliance with its emission reduction target. For this purpose it conducts a National Greenhouse Gas Inventory, and implements GHG emissions reductions and carbon sequestration activities.

The aim of this paper was to provide specific biomass equations for young black locust trees (1- 4 years old) from coppices established mainly on degraded lands. Such equations are very important considering the general lack of allometric data for young/small trees, required for the national reports on GHG removal in the case of degraded agricultural land afforestation, especially in South - Eastern Europe.

SURFACE FUEL LOAD IN COPPICE WITH STANDARDS FORESTS BEFORE AND AFTER HARVESTING IN TUSCANY, ITALY

ČORBIĆ, Vladimir[1]; NERI, Francesco[2]; KLVAČ, Radomír[1]; MARCHI, Enrico[2]; PAPIĆ, Slavica

1: Mendel University in Brno, Czech Republic
2: University of Florence, Italy

KEYWORDS: Coppice with standards, Oak, Harvest, Logging residue, Surface fuel load

Fire severity as well as intensity and rate of spread are under a big influence of surface fuel load and its characteristics. Forest harvesting may clearly affect the post-harvest fuel load. The aim of this study was to investigate how Cut to length harvesting in coppice may affect fuel load over time. The fuel load in harvested stands that have been harvested during the last 3 harvesting seasons was analysed. Also one unharvested stand (to be harvested next year) was taken as a control. The research was conducted in Rincine forest district, northeast of Florence in Tuscany, Italy. All surface fuels were collected in sampling plots, oven dried and classified into time lag classes. On the base of the data it seem that no significant changes were recorded among treatments in the load of 1h time lag class, while in the 10h time lag class the fuel load was higher in the harvested areas in comparison with the control. Moreover, in the same class, fuel load decreases in the harvested areas over time. Also the fuel load in the 100 h time lag class was higher in the harvested areas in comparison with the unharvested one, but no regularities could be observed among the harvested areas. The 1000h time lag class fuel was recorded in only one treatment. This is easily explained because during harvesting logs with diameter higher than 5-7 cm are usually extracted as firewood. Besides that, the quantity of grasses increased with the age of harvests.

FESTUCA AMETHYSTINA AS A RELICT SPECIES OF SOUTH MORAVIAN COPPICE

FEDOROVÁ, Barbora

Mendel University in Brno, Czech Republic

KEYWORDS: *Festuca amethystina*, southeast Moravia, National natural sight Hodonínská Doubrava, South Moravian coppice, subcontinental oak forests on sand soils, morphological characters

Festuca amethystina has been studied in the South Moravian coppice in the forest Hodonín Doubrava in the Czech Republic. Doubrava is probably the best preserved vegetation of endemic Pannonian subcontinental oak forests on sand soils of association *Carici fritschii-Quercetum roboris* in Central Europe. *Festuca amethystina* is critically endangered and it is an important phytogeographical perialpine species.

The aim of this thesis was to obtain initial data about the biology and variability of morphological characters of *Festuca amethystina*. The collected data focused on the size of micropopulations and demographic and morphometric characteristics of the species, i.e. diameter of clumps, length and number of stems, panicle length, number of spikelets and number of caryopsis.

In Hodonín Doubrava was found 10 microlocations, it means 10 micropopulations of *Festuca amethystina* subsp. *amethystina*. The total number of plants which was found in Hodonín Doubrava is 1 375. In all microlocations the most represented age category is the category of middle-aged clumps. Important result is that the diameter of clumps is connected with demographic characteristics of micropopulations. This is useful for protection of the species and locations. Another important result is that old clumps can be divided into several smaller clumps. It is a way how the species prolongs its life cycle.

The most significant threats in the studied area include: expansive spread of small-leaved linden, clear-cuts, drying and high numbers of game, especially of wild boar. Proper management should be used for the protection and conservation of this species and further studies are required.

THE INFLUENCE OF THINNING INTENSITY ON GROWTH OF A TEAK (*TECTONA GRANDIS* L. F) COPPICE

HANINEC, Peter[1]; NOVOSADOVÁ, Kateřina[1,2]

1: Mendel University in Brno
2: Global Change Research Centre, Czech Academy of Sciences, Czech Republic

KEYWORDS: coppice, *Tectona grandis*, leaf area index, biomass, thinning

Teak (*Tectona grandis* L. f) wood is one of the oldest commercial goods in the world. Teak is a predominantly sub-tropical or tropical tree. Teak stands may be established in generative or vegetative form. Vegetative form is a result of thinning or harvesting, when new sprouts from stumps may form new stands. The aim of this experiment was to find out the influence of thinning intensity and stand age on the sprouting ability and biomass production of teak trees.

This experiment was carried out in the plantation La Reserva (Nicaragua, 11° 49´ 02´´ N, 86° 13´ 10´´ W). All measurements were conducted in young teak stands, which were planted in 2006 – 2008. These stands were established with a spacing of 1x1 m. Thinning was performed in February 2014. Thinning intensities were:

1. Light thinning; removal of 25 % of the original trees

2. Moderate thinning; removal of 50 % of the original trees

3. Heavy thinning; removal of 75 % of the original trees

The stumps were left in the soil. Stump sprouts were measured one growing season after thinning. Several sprout characteristics were measured and estimated, such as: number of sprouts, their lengths and biomass and their orientations, number of leaves (on each sprout), their lengths, biomass and projected area. The results may contribute to determining the most suitable time for thinning operations and intensity in order to carry out successful vegetative regeneration.

WASTE UTILIZATION IN COPPICE FOREST AS AN ENVIRONMENTAL SERVICE

HEINSOO, Katrin

Estonian University of Life Sciences, Estonia

KEYWORDS: environmental service, fertilisation, management, sustainability, yield

From ecological perspective the coppice forest ecosystems can be described as areas with periodical elimination of biomass including beside carbon also other chemical elements. Hence sustainable soil management in the region is possible only if additional macroelements are provided to the area. Moreover, increased availability of nutrients in the soil promotes wood production during the next harvest cycle.

Instead of mineral fertilisers it is possible to use also other nutrient resources if they do not contain any toxic elements or pathogens.

Co-products of some human activities like domestic wastewater, sewage sludge from households or digestate from biogas production are excellent resources for fertilisation of non-food products like coppice. On the other hand promoted incorporation of these materials to the nutrient cycle and advanced utilisation of these substrates in coppice forest may be an important environmental service of coppice forestry in the region.

COMPARISON OF ASSIMILATION PARAMETERS OF COPPICED AND NON-COPPICED SESSILE OAK

HOLIŠOVÁ, Petra; PIETRAS, Justyna; DAŘENOVÁ, Eva; NOVOSADOVÁ, Kateřina; POKORNÝ, Radek

Global Change Research Centre, Czech Republic

KEYWORDS: coppice, drought, photosynthesis, sprout, wilding

Coppice forestry is an alternative to high forest aimed mainly at production of firewood with a short rotation period. A new interest in this silvicultural system has arisen with the demand for renewable resources of energy. Sprouts are at an advantage as compared to plants of seed origin, because they can use an existing root system. This advantage could induce changes at the level of photosynthetic apparatus especially in young plants. An answer to this thesis is in this study.

We compared photosynthetic ability of young sprouts, young wildings and mature trees of sessile oak (*Quercus petraea* (Matt.) Liebl.) growing in forest stand in the southeast of the Czech Republic. The site was established at the turn of 2008/ 2009 in 73 years old oak forest by felling with 83 % intensity. Based on the gas-exchange measurement techniques, we determined basic photosynthetic characteristics and transpiration rate at the leaf level. Data from non-limiting condition were compared with data measured under soil moisture limiting condition.

Measured parameters were not different between sprouts, wildings and old trees in the non-limiting condition. But during drought, sprouts had the highest photosynthetic capacity and transpiration due to ability to maintain higher stomatal conductance than wildings and old trees. It suggests better drought tolerance of sprouts compared with wildings.

COPPICE FOREST MANAGEMENT SYSTEMS IN THE NATURAL OAK FORESTS OF IRAN

HOSSEINI, Seyed Mohammad; SKOUPY, Alois

Czech Life Sciences University Prague, Czech Republic

KEYWORDS: Zagros Forests, Coppice forests, Forestry management, Regeneration and Oak

The coppice forests of Iran know as Zagros Forests, are located on the Zagros Mountains which covers the west side of the country parallel to the western border and therefore are under the direct impact of the sub-humid climate from Black Sea and the Mediterranean Sea in the form of precipitation and thus creates a suitable condition for forestation. These forests were denser and much vaster in the past and now the remaining forest is a protected area about 6 million ha. The main tree species in this region is Oak as: *Quercus infecturia*, *Q.libani* and *Q. rantii* in addition to other trees and shrubs species like *Acer persicum*, *Pistacia khinguk*, *Celtis caucasica* etc. It is an undeniable fact that the Zagros forests contribute to soil conservation as well as approximately 45% of the water supply in Iran and also contribute to the development of the economy in the country. Forestry management and sylvicultural methods in this forest are under the coppice forest management systems which are different based on social-economic situations, topography and soil contentions, forest stands and natural regenerations.

In this paper, coppice forest management methods in the Zagros Forests of Iran during last 30 years will be discussed.

GROWTH RESPONSES OF SORBUS TORMINALIS WITHIN A COPPICE WITH STANDARDS AND HIGH FOREST

HURT, Václav[1]; MAY, Jan[1]; SOUČEK, Jiří[2]

1: Mendel University in Brno, Czech Republic
2: Forestry and Game Management Research Institute (FGMRI) at Jiloviste-Strnady (Prague)

KEYWORDS: Wild Service tree, Noble hardwood tree species, diameter increment, transformation, coppice with standards.

This paper introduces the growth response of *Sorbus torminalis* in two different forest structures – a coppice with standards in a nature reserve and a high forest. The two populations that were investigated are located in the Moravian Karst (Hády) and the Orlické Mountains (Halín). The Hády site comprised a coppice with standards which was compared with the neighbouring high forest in a national nature reserve and a more distant high forest at the Halín site. The variability of the growth response data indicates that it is necessary to conduct measurements on a longer-term basis - beginning two or more

years prior to felling till at least two years after (because this is the minimum period for which there is no growth response). The current results already suggest that *Sorbus torminalis* is capable of responding to release, where a release of the crown by 40 % can be considered as optimal. A free growth area exceeding 15 m^2 is sufficient to achieve an optimum diameter increment of 3.5–6.0 mm per year. According to the increment, it is possible to predict a target felling DBH of 60 cm at an age of 100 years. The overall

results indicate that the target tree method continues to be suitable for tending *Sorbus torminalis* of approximately 60 years of age.

GROUND BEETLES (*COLEOPTERA – CARABIDAE*) AND THEIR RESPONSE TO COPPICE MANAGEMENT

KAŠÁK, Josef; FOIT, Jiří; HULA, Vladimír

Mendel University in Brno, Czech Republic

KEYWORDS: coppice, *Carabidae*, Czech Republic, interecpt trap, biodiversity

Canopy closure is very important characteristic of forest ecosystems largely determining community of beetles. Important part of forest biodiversity constitutes ground beetles (*Carabidae*) that are also useful bioindicators. The main aim of the present study was to evaluate: i) effects of different felling intensity on carabid beetles and ii) their vertical distribution.

The study was carried out in oak forest near Hády National Nature Reserve (Czech Republic) in 2009 and 2010. We used nine triples of flight intercept traps (in total, 27 traps). Traps were hung by three on the trees (oaks), in three different heights from base to tree crown. Sampling was carried out in areas treated by felling of different intensity resulting in various canopy closures.

We collected 340 individuals representing 46 species of carabids. Beetle communities were significantly affected by canopy closure ($F = 3.26$; $P < 0.001$) and height ($F = 1.72$; $P = 0.002$). The analyses documented that abundances of five species significantly increased with sun exposure (intensity of the treatment), whereas abundances of only one species decreased with rising of sun exposure. For plots with low canopy closure were characterised open habitat species (*Amara* spp. and *Harpalus* spp.). In contrast, closed canopy plots were preferred by arboreal forest specialist (*Dromius* spp.). In total, five species declined with higher height above the ground and oppositely abundances of two species increased with height.

Supported by project: CZ.1.07/2.3.00/20.0267

CONSERVATION OF SCARCE FRITILLARY (*EUPHYDRYAS MATURNA*): HOW USEFUL IS COPPICE FOREST?

KRÁSA, Antonín

AOPK ČR, Czech Republic

KEYWORDS: conservation, insect, coppice with standards

Scarce Fritillary is one of the most endangered butterfly species in the Czechia. The majority of local populations disappeared during the 2nd half of the 20th century and there is only one left today. Main reason for this situation is change in forest management, when coppicing was totally abandoned and replaced by high quality timber production. It leads to decrease in the amount of openings and fresh clearings, which are preferred by the species.

The Action Plan for Scarce Fritillary was approved in 2011 to support long-term viability of the species. Employment of coppice forestry was considered from the beginning of discussions because forest management at that time was not suitable. Population abundance showed sharp decrease since 2006 and in 2010 only few individuals were found.

First idea of coppice forest with turnover about 10 years was refused by the owners of the forest. Next draft, coppice with standards, was accepted. A big advantage of this approach is production of some timber and higher general acceptance in society of foresters.

We thus currently work on establishing coppice with standards today, but it is not without problems and challenges. We have to deal with unequal age structure of forest stands where older ones dominate and lower shooting is assumed. There are also coniferous stands which must be replaced completely. We already started with thinning of selected forest stands but a lot of work still remains to be done. We want to continue with support from Norwegian Funds in 2015 and 2016.

COPPICE SILVICULTURE, STANDARDS, SINGLE-TREE-ORIENTED SILVICULTURE

MAIROTA, Paola[1]; MANETTI, Maria Chiara[2]; PELLERI, Francesco[2]; AMORINI, Emilio[2]; TERRADURA, Marco[3]; FRATTEGIANI, Mauro[3]; SAVINI, Paola[4]; GROHMANN, Francesco[4]; MORI, Paolo[5]; PIUSSI, Pietro[6]

1: University of Bari "Aldo Moro", Bari, Italy
2: Consiglio per la Ricerca e la Sperimentazione in Agricoltura. Forestry Research Centre , Arezzo, Italy
3: Arborea co-working, Perugia, Italy
4: Regione Umbria, Servizio foreste, economia e territorio montano, Perugia, Italy
5: Compagnia delle Foreste, Arezzo, Italy
6: University of Florence, Florence, Italy

KEYWORDS: Coppice silviculture, standards, single-tree-oriented silviculture

Coppice silviculture has a very long tradition in Italy. Societal demands have led to the development of forest management techniques for integrating wood production with other kinds of forest uses and regulations have been issued to limit degrading activities. In Italy, 35% of the national forest cover is currently under coppice system, providing 66% of annual forest production and fuel-wood the demand is increasing with Italy being first world fuel-wood importer.

Today's coppice implementation has a reduced impact on ecosystem characteristics and processes. Nevertheless, coppice silviculture is ill reputed, mostly on grounds which are beyond economical, technical and ecological ones. Neither cessation of utilizations, nor a generalised conversion from coppice to high forest, is likely to simultaneously respond to the multi-fold demands deriving from complex and articulated political and economic settings, operating at global and continental down to the stand scale, intersecting all intermediate levels.

We suggest that the combination of different options at the stand and sub-stand level, including spontaneous development and conversion, and the application of innovative silvicultural models (e.g., groups of standards release, single-tree-oriented silviculture) also in Chestnut coppices, novel forest management plans and regionally consistent administrative procedures, represents the bottom up key that allows to respond to the socio-economic and environmental challenges affecting this silvicultural system. Such models have been successfully tested in Italy for more than a decade also within the framework of several EU- and nationally/regionally-funded projects.

SINGLE TREE-ORIENTED SILVICULTURE AS A NEW APPROACH FOR COPPICE STANDS

MANETTI, Maria Chiara; BECAGLI, Claudia; FABBIO, Gianfranco; SANSONE, Dalila; PELLERI, Francesco

Consiglio per la ricerca e la sperimentazione in agricoltura, Italy

KEYWORDS: single tree silviculture, valuable timber, biodiversity, thinning practice

Single tree silviculture is a new management approach where the silvicultural operations are mainly oriented to enhance a limited number of crop trees. The goal of silviculture is the individual, early selection of crop trees and, throughout frequent thinnings, the maintenance of their free growth over the full rotation. This type of silviculture, originally applied to high forests, can be carried out also in coppice system both to maintain or improve biodiversity and to enhance the valuable timber trees. This approach can be applied in different types of ownership, in localized but favourable areas, to the whole stand or integrated with the traditional system. A factor limiting its implementation is the need of specialized and qualified manpower in all the phases, since the selection of crop trees to logging operations.

Experimental trials were established by the Forest Research Centre of Arezzo to verify the suitability of this system in different conditions. In coppices characterized by fast growing species (i.e. chestnut) single tree silviculture has been applied to a limited number of crop trees (50–100 ha) to get more valuable and larger-sized assortments in a shorter rotation, reducing in the meanwhile the silvicultural costs. In mixed coppices, where the ordinary management, the abandonment or the conversion into high forest gave rise to a progressive loss in the species composition, localized thinning around a few (10–40) minority tree species, allowed to maintain a high level of biodiversity and produce favourable conditions for the growth and the regeneration of these valuable species.

CANOPY RELEASE EFFECT AND SEED PRODUCTION OF OLD SPROUT-ORIGIN SESSILE OAKS

MARTINÍK, Antonín; KNEIFL, Michal; KADAVÝ, Jan; KNOTT, Robert

Mendel University in Brno, Faculty of Forestry and Wood Technology

KEYWORDS: sessile oak, release intensity, masting, seed production, trade-off

The seed production of sessile oaks (*Quercus petraea* /Matt./ Liebl.) in the second and third year after crown release was observed. In total, 36 sessile oaks were selected which were subjected to conversion from 100 year old coppices to coppices-with-standards. Basic dendrometric characteristics such as crown volume, crown area, diameter at breast height, tree height and crown bottom heigh were determined for all sample trees. Seed traps were used to determine the seed production. We evaluated release intensity for every individual tree using position-based competition index. In the second year after release (2010), a weak to medium crop – 26 acorns /m^2) of crown projection area) was recorded. The total number and weight of acorns per tree was negatively correlated with the release intensity. In 2011 a mast year with an average production intensity of 439 acorns /m^2 indicated no correlation between tending intensity and total number (or) weight of acorns per tree. In the third year of observation no seeds were produced. Since the positive effect of a release on masting was not proved, the total numbers of acorns per hectare decreased with decreasing number of trees per hectare left after release.

The total number of acorns/ tree was positively correlated with the breast-height diameter of the sample tree during 2010 and 2011. No trade-off was recorded between the total number of produced acorns and the basal area increment during first two years after thinning.

BIODIVERSITY CONSERVATION AND FOREST MANAGEMENT: THE CASE OF THE SWEET CHESTNUT COPPICE STANDS IN CENTRAL ITALY

MATTIOLI, Walter; MANCINI, Leone Davide; PORTOGHESI, Luigi

Department for Innovation in Biological, Agro-food and Forest systems (DIBAF), University of Tuscia

KEYWORDS: Plot sampling, rotation length, floristic diversity, thinning, silviculture, management

The ecological and economic relevance of sweet chestnut (*Castanea sativa* Mill.) has long been related to its widespread geographical distribution and multipurpose product potential. In Central Italy, chestnut management represents a paradigmatic example of the potential conflict between landowner targets and biodiversity conservation: options for preserving stand-scale biodiversity are not fully considered as current management is based on monospecific, even-aged coppice stands and clearcutting on wide areas. Relationships between silvicultural treatment and floristic diversity of chestnut coppices are here investigated focusing the attention on rotation length and on the role of thinning. Seven stands in Central Italy were purposively selected in such a way to be characterized by the same site conditions but with different silvicultural features. Plot sampling was performed across the stands and their floristic diversity was compared and analyzed by means of indicators in order to find statistical relationships between floristic data and stand attributes. The achieved results suggest alternative suitable options for managing chestnut coppice stands in order to enhance biodiversity while maintaining wood production.

SILVICULTURAL MANAGEMENT TRIALS FOR CHESTNUT COPPICE STANDS IN NORTHWEST SPAIN

MENÉNDEZ MIGUÉLEZ, María; CANGA, Elena; MAJADA, Juan

Forest and Wood Technology Research Centre (CETEMAS), Spain

KEYWORDS: chestnut coppice, thinnings, ink disease, management

Chestnut (*Castanea sativa* Mill.) forests have been recognised as habitats of interest in the European Natura 2000 network, and are considered characteristics cultural landscapes of the Mediterranean and Atlantic region. The distribution in Europe reaches from the Southern Mediterranean to central, Atlantic, and Eastern Europe, covering more than 2.5 million hectares. In Spain, the main area of chestnut coppice stands is located in the northwest and accounts for over 95% of the potential area for this type of stands in the country.

Despite the importance of the species, joined with its productive capacity, studies of its growth and yield are practically non-existent. The starting point is to develop management tools – such as biomass equations, taper functions, site index equations, yield tables or stand density management diagrams – to know the current situation of the stands and their growth pattern in order to predict future conditions. Once all these tools are developed, the next step is to establish a network of plots with different types and intensities in management, in which evaluate the evolution of the stands depending on the interventions.

With this study, the current network of 70 permanent plots will be increased with some plots in which thinnings will be carried out with different intensities. These interventions will allow the situation of the stand before and after to be compared, taking into consideration different aspects, such as: evolution/standstill of ink disease development, diameter growth, crown development, intra and inter stool competition or improvement of quality wood.

VERTICAL STRUCTURE OF SPIDER COMMUNITIES ON TREES IN LIGHT COPPICE FORESTS

NIEDOBOVÁ, Jana; HULA, Vladimír; FOIT, Jiří

Mendel University in Brno, Czech Republic

KEYWORDS: spiders, light forest, vertical distribution

Spiders are important predators in different ecosystems including forests. Except basic knowledge on spider communities occurring in tree canopy, there is a a lack of information about vertical distribution of spider communities. In the present study spiders were collected using flight intercept traps that were placed in three experimental coppice forests (Soběšice, Hády and Děvín) in Southern Moravia (Czech Republic). Sampling was carried out during vegetation periods in 2011 and 2012. In total, we placed nine triples of (i. e., 27) intercept traps within each experimental coppice forest during the vegetation. Each trap triple consisted of one trap mounted 1.5 m above the groung, one trap in the middle of the tree height and the last one in the upper half of the tree crown. We have collected 394 specimens of adult spiders belonging to the 72 species, 16 of them are important from the point of view of natural protection and conservation (e.g. *Simitidion simile*, *Clubiona marmorata*, *Philodromus buchari*, *Tmarus stelio*). We found evidence about vertical stratification of spider community within tree canopy. Most of *Philodromidae* and *Salticidae*, thus visually oriented ambush hunters, prefer higher layer of canopies. Most of *Theridiidae* were collected to the lower traps. This phenomenon is caused by different conditions which are typical for each stratification level of tree, especially the amount of light, which is one of factors determining the prey density and intraguild relations. Now, we have also evidence, that different microhabitat conditions influence invertebrates in vertical direction.

PRODUCTION OF WOOD FROM *POPULUS NIGRA* L. CLONES OVER TWO ROTATIONS

NOVOTNÁ, Kateřina; ŠTOCHLOVÁ, Petra; BENETKA, Vojtěch

Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Publ. Res. Inst., Czech Republic

KEYWORDS: black poplar, hybrid poplars, biomass production, tree regeneration, *Melampsora larici-populina*

Populus nigra (PN) is an autochthonous European woody species that is being trialled as an alternative crop for biomass production in short-rotation coppiced stands.

Differences in growth parameters (thickness of shoots, number of shoots), health status (mortality, incidence of leaf rust) and wood production (dry weight of individual plants, dry matter yields per unit area) were studied in a field trial. The trial was established in Průhonice (320 m a.s.l., 545 mm rainfall) in 2009, using 21 PN clones taken from our own breeding programme and using the clone MAX-4 (*P. nigra* x *P. maximowiczii*) as a control. A randomised block design, with four replications, and a plant spacing of 3.0 x 0.55 m. was employed. Harvests are being carried out every 3 years.

Significant differences among clones were observed in all the evaluated characteristics in both rotations, with the one exception of mortality, which was negligible. In the first rotation, although the greatest shoot thickness was measured in the control clone MAX-4, shoot thicknesses in 8 PN clones were not statistically different (unlike the wood production). In the second rotation, the PN clones had higher numbers of shoots in comparison with the control clone, even though the wood production was not as high.

Great variation in the recorded attributes of the tested PN clones was observed, so some of the better performing ones might still be selected, even if the control clone here did have the highest biomass production. The trial will continue to be evaluated in future rotations.

THE EXCHANGE RATE OF TRANSPIRATION THINNED ORIENTAL BEECH (*FAGUS ORIENTALIS* LIPSKY.) COPPICE IN THE BARTIN DISTRICT IN WESTERN BLACK SEA REGION IN TURKEY

ÖZEL, Halil Barış

University of Bartın, Faculty of Forestry, Turkey

KEYWORDS: oriental beech, stump-sprout, transpiration, coppice

Our objective was to expand the knowledge on the hydrological characteristics of oriental beech (*Fagus orientalis* Lipsky.) woodlands by analyzing the response in transpiration by rootstocks of thinned postharvest coppice. Information obtained from this and the earlier study of transpiration will help to make calculations and simulations of water balances in the woodlands more accurate because measured values of transpiration are available. Managers can then determine the relative amounts of streamflow, soil water storage, and groundwater recharge that might be expected with alternative thinning prescriptions of oriental beech coppice.

Minimum, average, and maximum daily transpiration rates for the three thinning treatments and the unthinned control in the text. All of the differences in the average daily transpiration rates were significant. Rootstocks thinned to one stump-sprout transpired the least amount of water, with an average transpiration rate of 8.64±0.124 L/day during the 28-month study period. The unthinned control, with an average of 6.5 dominant stump-sprouts per rootstock, transpired the largest volume of water during the study, 43.6±1.10 L/day.

Annual transpiration by the rootstocks thinned to one stump-sprout for the selected study year was 83.6 mm, the rootstocks thinned to two stump-sprouts was 180mm, and the rootstocks thinned to three stump-sprouts was 215 mm. Annual transpiration of the control rootstocks was 285mm. These findings were coupled with estimates of annual transpiration of the mature oriental beech trees

IMPACT OF PAST MANAGEMENT PRACTICES ON TREE GROWTH

PEJCHA, Vít[1,2]; PLENER, Tomáš[1,2]; ALTMAN, Jan[1,2]; DÖRNER, Petr[1]; DOLEŽAL, Jiří[1,2]; MÜLLEROVÁ, Jana[1]

1: Institute of Botany CAS, Czech Republic
2: Faculty of Science, Department of Botany, University of South Bohemia, Branišovská 31, České Budějovice, Czech Republic

KEYWORDS: Coppicing, tree growth, oak standard, dendrochronology, past management reconstruction

Most of the central European lowland forests were managed by coppicing for centuries. Selected trees (standards) were often left to grow mature among the regularly harvested coppice stools (coppicing with standards) to obtain larger wood for construction. In coppice system, forest conditions were changing markedly following the coppice cycle, shaping the growth dynamics of standard trees. After the underwood harvest, the forest opened rapidly, giving the standard trees the opportunity to benefit from improved light conditions. This primary stage was followed by the canopy enclosure as the coppice stools re-sprouted. This system was mostly abandoned after WW II., and coppices were transformed to high forests or left to overgrow. Today, only remnants of such old management practices are preserved, but still such historical cyclic management practices can be traced in tree rings of remaining standard trees.

In our study we assess the impact of coppicing on oak standard trees by dendrochronological approach. Oak-hornbeam forests on nutrient rich calcareous soils and acidophilous oak forests growing on nutrient poor soils, both in Český Kras Protected Landscape Area, Czech Republic, are investigated. We compare the release events detected using tree-ring data to the historical coppicing events recorded in historical forest archives, examine the influence of environmental conditions on the standard tree increment and response to the coppicing events.

HALF A CENTURY OF VEGETATION CHANGES IN A SUBURBAN FOREST

PETŘÍK, Petr

Institute of Botany, Czech Academy of Sciences, Czech Republic

KEYWORDS: soil degradation, hornbeam expansion, invasive tree species, forest management

The Natural park Klánovický forest lies on the north-eastern fringe of, so it is immediately exposed to human influences. It extends across former agricultural land surrounding extinct medieval villages. Its flora consists of acidophilous and hygrophilous plant species growing on nutrient-poor sandy soils in mostly acidophilous oak forests. Detailed research of forest vegetation in the area was conducted over fifty years ago when former coppice management was still evident. In 2014, based on accurate maps, I carried out a vegetation resurvey of 25 semi-permanent plots and took 18 soil samples from five soil pits.
The main changes in vegetation are a decrease in heliophilous species and invasions of non-indigenous species. The soils in the forest have suffered a drastic loss of basic ions, so a slightly decreased pH and also a change the water regime can be expected.
The following factors significantly influenced the current composition of the vegetation: (i) medieval site history, (ii) spread of cultivated plants from abandoned buildings and plantations, (iii) browsing and disturbances by game and humans, and (iv) forest management.
Differences in species composition revealed by the resurvey probably indicate real changes in vegetation, as evidenced by similar studies. It is certain that the forest communities in the area are being invaded by many non-native plant species and are undergoing massive expansion of hornbeam as a consequence of changes in forest management (i.e. the transition from coppicing to standard forestry practices).
This work was supported by a project COPPICE (CZ.1.07/2.3.00/20.0267).

SILVICULTURAL AND LOGGING IMPACT ON SOIL MICROARTHROPOD COMMUNITY IN MEDITERRANEAN COPPICE

PICCHIO, Rodolfo; PIOVESAN, Gianluca; VENANZI, Rachele

UNITUS, Italy

KEYWORDS: chestnut coppice, logging operation, soil biological quality, QBS-ar

Commonly, in Italy coppice utilizations consists in a felling of about 80-85% in mass of the total woody biomass, with release of standard (about 70-120 standard/ha). This is a crucial operation in forest management, which has important effects also on understory, fauna, and soil. The aim of this study is to assess soil biological quality in a coppice forest of Central Italy. Soil quality was evaluated studying soil microarthropod community and applying a biological index (QBS-ar). The QBS-ar index is based on the concept that the higher is the soil quality, the higher will be the number of microarthropod groups morphologically well adapted to this soil habitat. The results confirm that chestnut coppice soils are characterized from highest biodiversity level among edaphic fauna and from a well-structured and mature microarthropod community, which is typical of stable ecosystems (QBS_ar value >200). While silvicultural practice do not influence QBS-ar values or microarthropod community structure. In particular, QBS-ar values showed as in all sampled sites the soil biological characteristics are impacted only on the machine tracks (QBS-ar value ranged between 100 and 150).This index is a useful tool in monitoring soil biodiversity in coppice forest to prevent the negative effects of soil compaction.

INVESTIGATING THE CONVERSION POSSIBILITIES OF SPROUT ORIGINATED OAK FORESTS IN MARMARA REGION

SAHIN, Abbas[1]; ERGIN, Mehmet[2]

1: Marmara Forestry Research Institute Directorate, Turkey
2: General Directorate of Combating Desertification and Erosion, Turkey

KEYWORDS: Conversion, yield parameters, forest management, coppice, management objective

Coppice systems being managed to produce fuel-wood in Marmara Region were completely ended after the year 2006 and all oak coppice forests were subjected to conversion works.

In this study, the conversion possibilities of sprout originated oak forests were examined in terms of forest management and especially age class parameters. The material of the study constitutes forest management plans in the period of 1963-1972 and current forest management plans. Variables such as areas of oak forests in the region, productivity condition, forest functions and management objectives were obtained from the existing forest management plans. Ecological (the biology of tree species will be discussed in this context) and technical factors amongst the main factors affecting conversion activities and the relationship of conversion activities were examined. In the study, amounts of yield obtained from sprout originated oak forests managed as coppice with rotation of 20 years and amounts of yield from stands planned as high forest with rotation of 100 years were compared.

The study area consists of Adapazari, Balikesir, Bursa, and Istanbul Forest District Directorates in Marmara Region. Considering site conditions and propagation area of oak species in Turkey, Marmara Region is the area with the largest propagation of oak species. Forest areas meeting high-class and qualified raw oak wood demand are located in this region. As oak forests are analysed in terms of management types, it was determined that 61.9% of the forest area is managed as conversion while 38.1 % is managed as pure oak or mixed high forests.

ZONING OF PERSIAN OAK REGENERATION USING GEOSTATISTICAL ANALYSIS: SOUTHERN ZAGROS, IRAN

SALEHI, Alireza

Yasouj University, Yasouj - Iran, Iran, Islamic Republic of

Forest Regeneration, Geostatistic methods, IDW, RBF, Yasuj

Persian oak (*Quercus brantii* Lind. var. *Persica*) is considered a keystone species in Zagros forests. The shortage of natural regeneration in the region poses a serious threat to the sustainability of these endangered regional ecosystems. Using some geostatistical methods, spatial changes and the probability of presence of natural regeneration of Persian oak on the map of a forest stand with an area about 200 ha nearby Yasouj city, the capital of Kohgiluyeh and Boyer-Ahmad Province was evaluated. For this purpose, 55 circular plots with an area of 1000 square meters as main sample plots with a systematic random grid of 250 m × 150 m were inventoried. In each main plot, four small plots were inventoried. Within each main sample plot, in addition to the general characteristics of the stand, various silvicultural characteristics were measured, counted, and or estimated. The number of instances of natural regeneration, consisting of seedlings and stump sprouts of Persian oak were inventoried in the small plots. The collected data were analyzed by using Geostatistic Analysis module in ArcGIS. To evaluate precision and accuracy of the analysis, ME, RMSE and RMSS were utilized. After variography of the regeneration, first all possible models were fitted on that and then using interpolation methods including of kriging and Co-Kriging(ordinary, indecator), IDW and RBF, values for the other - without data points were estimated. The method of indicator Kriging whit a spherical model could be introduced as a good method for zoning of forest regeneration in the study area.

INNOVATIVE COPPICE MANAGEMENT IN UMBRIA: COPPICE WITH GROUPS OF STANDARDS

SAVINI, Paola[1]; CANTIANI, Paolo[2]; FRATTEGIANI, Mauro[1]; PEDRAZZOLI, Martina[1]; PRIETO, Diego[1]; TERRADURA, Marco[1]

1: Arborea coworking, Italy
2: Consiglio per la Ricerca e la sperimentazione in Agricoltura. Forestry Research Centre, Italy

KEYWORDS: coppice, summacop, sustainable management, oak, group of standards

Coppice has always represented a simplified silvicultural system and therefore extremely rigid. Indeed, it is based on few parameters, such as number of standards and cutting age, which allow to harvest products with limited quality and value. In Italy often, official local regulations have been the only references to manage coppice. Only few changes have been made in the past to the coppice treatment types: the introduction of standards release rules, the progressive lengthening of cutting age, the increased intensity of standards release and methods for conversion to high forests.

Since 1999 in Umbria (central Italy), several interventions were carried out in coppice management founded on the concept that a coppice is however a forest and therefore management decisions and silvicultural interventions can enhance its potential synergies with the territorial and social contexts. In particular, it means to manage coppice not only in terms of agamic regeneration, production, cutting age and density of standards release, but also recognizing the necessity to manage it looking out sustainable management and cultural objectives.

Summacop Life project developed this new approach, enhancing the potentiality of each area and overcoming the usual schematic management. In Summacop several techniques have been used, but the most successfull was the coppice with groups of standards.

Fiftheen years later, the main results were observed; key benefits of coppice with groups of standards are: reducing impacts on the landscape, enhancing ecological differences of the environment and improving soil protection without reducing quality and quantity of harvested products.

ASPECTS OF OAK (*QUERCUS* SP.) MANAGEMENT IN SPAIN AND ITS APPLICATION

ŠPLÍCHALOVÁ, Markéta

Mendel University in Brno, Czech Republic

KEYWORDS: Oak (*Quercus* sp.), coppice, global climate change

At present the global climate change is widely observed phenomenon. Fluctuations in precipitations and drought periods are recorded in higher amount. In reaction to these circumstances, Spain is introducing oak forest management on wider scale. According to forestry map of Spain (MFE 50) (DGCN, 2001) oak stands are present on 7.3 million hectares of forest soil (including pastures), which represents approximately 40% of total forest area of Spain. Pastures represent anthropologically influenced landscapes and spread on 2.4 million hectares, mostly in southern and eastern Spain. Research reported a high adaptability of oak trees to changed climatic conditions. Namely coppice forest is a suitable forest shape for accommodation to changed conditions with special regards to water management. Coppicing ability of oak guarantees the stands high resilience against disturbances, such as forest fires. It is possible to expect, that in certain aspect the conditions in the Czech Republic will be comparable to Spain. Oak coppice forests are a viable instrument to maintain all ecological, economical and social functions of forests in the future.

A NEW IDEA FOR SIMULTANEOUSLY MEASURING CROWN RADIUS AND TREE HEIGHT IN ZAGROS FORESTS

TAHERI, Sarteshnizi, MOHAMMAD, Javad; SOHRABI, Hormoz; SALEHI, Alireza; TAHERIAN, Elham

Yasouj University, Iran, Islamic Republic of

KEYWORDS: Tree Height, Crown Radius, Oak, Zagros, Iran

In the present research using a simple square grid idea, the height and crown radius of the total target and adjacent coppice shoots was measured reliably and precisely. To determine statistical differences between the other devices and introduced idea, height of the 30 coppice shoots of the oak species (*Quercus persica* J.&.Sp.) as the dominate species in Zagros forest was measured using the Suunto clinometers. then crown radius of the same coppice shoots was measured with the tape measure. Paired t-test results appeared no statistical differences between Suunto clinometers and the simple square grid idea, and also paired t-test results appeared no statistical differences between tape measure and the simple square grid idea.

MANAGEMENT ALTERNATIVES FOR *CASTANEA SATIVA* COPPICE FORESTS IN CATALONIA (NE SPAIN)

VERICAT, Pau; PIQUÉ, Míriam; BELTRÁN, Mario

Forest Sciences Center of Catalonia, Ctra. Sant Llorenç de Morunys, km. 2 (Ctra. vella). 25280-Solsona (Spain)

KEYWORDS: *Castanea*, Coppice, Spain

Chestnut coppice covers near 13000 ha in Catalonia (NE Spain), in a Mediterranean climate. Traditional management was oriented towards small-sized high-quality timber, by means of a quite homogeneous silvicultural schemes that included two or three thinnings and a final clearcut by a rotation of 20-25 years. At present, chestnut coppices have a high scenic, economic and historical interest. In recent years, management of coppices have declined due to changes in the markets, the incidence of the canker *Chriphonectria parasitica* and a general decay attributed to climate and environmental changes.
With the aim of making chestnut coppices economically sustainable as a basic principle for their conservation, we have developed different alternatives to adapt chestnut coppices management to the new context, based on the following tools (i) adaptation of the objectives (products and silviculture) to the site quality, (ii) change of production objectives, from high quality timber to products with lower technological requirements as poles, staves or laminated timber; (iii) new silvicultural schemes of few interventions, flexible management (final rotation and objective are decided “on the go” according to the evolution of the stand) and integration of the presence of canker in the management schemes; (iii) conversion of coppices into orchards for fruit production by a clearcut, reduction of the number of stumps and grafting some selected resprouts, and finally (iv) replacement of chestnut coppice by other species (mainly *Quercus*) in areas of lower site quality where the effects of climate change are expected to be felt more strongly.

WILD BOAR IMPACT TO THE NATURAL REGENERATION OF OAK AND ACORNS IMPORTANCE IN THE DIET OF WILD BOAR

ZEMAN, Jaroslav; HRBEK, Jan; DRIMAJ, Jakub; KAMLER, Jiří; PLHAL, Radim

Mendel University in Brno, Czech Republic

KEYWORDS: Density, forest, seedling, *Sus scrofa*

Wild boar causes considerable damages to agricultural crops and limits the natural regeneration of forest stands in the last decade. In this study, the impact of wild boar on the natural regeneration of oak and importance of acorns in the wild boar diet were surveyed.

The data were collected in three oak stands: in full stocking stand, hackney stand and stand in the middle of the forest conversion. Within the each stand the 150 m long line with 15 points of 10 meters distances from each other was delineated. Seed containers (potential litter), small fence (expected consumption of rodents) and the control plot (expected consumption of rodents and animals) were installed on these points and periodically checked. After the end of acorns litter the average amount of fallen acorns was determined on 100 randomly distributed plots (0.25 m^2) in each stand. In total 300 sampling areas were checked. Quantity of metabolizable energy in acorns was compared with conserving energy for average size wild boar individual. In spring 2014 the numbers of available seedlings were determined. The production of acorns was 1257, 512 and 402 kg in the first, second and third stand, respectively. The seedlings density was 29600, 32000 and 14000 ind./ha in the first, second and third stand, respectively.

Wild boar is a major consumer of acorns. The production of acorns in the study area is sufficient for food of local wild boar population during winter. In stands remains sufficient amount of acorns for natural regeneration.

LIST OF PARTICIPANTS

Name	E-mail	Country
Adam, Dušan	dusan.adam@vukoz.cz	Czech Republic
Adamec, Zdeněk	zdenek.adamec@mendelu.cz	Czech Republic
Akburak, Serdar	sakburak@istanbul.edu.tr	Turkey
Alberti, Giorgio	giorgio.alberti@uniud.it	Italy
Alvaninejad, Sohrab	salvaninejad@yu.ac.ir	Iran
Aylak Ozdemir, Gafura	gafura@istanbul.edu.tr	Turkey
Bangura, Mohamed Amin	protocol.fccsle2@gmail.com	Sierra Leone
Bangura, Joseph	bangura.john83@gmail.com	Sierra Leone
Bartlett, Debbie	d.bartlett@gre.ac.uk	UK
Biró, Marianna	biro.marianna@okologia.mta.hu	Hungary
Buckley, Peter	peterbuckleyassociates@gmail.com	UK
Bürgi, Matthias	matthias.buergi@wsl.ch	Switzerland
Cabalová, Alena	cabalov@seznam.cz	Czech Republic
Campetella, Giandiego	diego.campetella@unicam.it	Italy
Canullo, Roberto	roberto.canullo@unicam.it	Italy
Ciuvat, Alexandru Liviu	alexandru.ciuvat@gmail.com	Romania
Corbic, Vladimir	corbic.vladimir@yahoo.com	Czech Republic
Čater, Matjaž	matjaz.cater@gozdis.si	Czech Republic
Černý, Tomáš	cernyt@fld.czu.cz	Czech Republic
D'Aprile, Fabrizio	Fabrizio.DAprile@monash.edu	Australia
Dařenová, Eva	darenova.e@czechglobe.cz	Czech Republic
Demeter, László	demeter.laszlo@okologia.mta.hu	Hungary
Dimitriou, Ioannis	ioannis.dimitriou@slu.se	Sweden
Dobrovolný, Lumír	dobrov@mendelu.cz	Czech Republic
Doe, John	zeoss@seznam.cz	Czech Republic
Drápela, Karel	drapela@mendelu.cz	Czech Republic
Dutca, Ioan	idutca@unitbv.ro	Romania
Dwumfour, Kwasi Ohene	netproaes@hotmail.com	Ghana
Erfanifard, Yousef	erfanifard@shirazu.ac.ir	Iran
Ewald, Jörg	joerg.ewald@hswt.de	Germany
Fabbio, Gianfranco	gianfranco.fabbio@entecra.it	Italy
Fedorova, Barbora	xfedorov@node.mendelu.cz	Czech Republic
Feher, Alexander	sandfeher@gmail.com	Slovakia
Friedl, Michal	michal.friedl@email.cz	Czech Republic
Gálová, Andrea	galova.ada@gmail.com	Czech Republic
Garbarino, Matteo	m.garbarino@univpm.it	Italy
Gazdic, Milan	gazdic.milan@gmail.com	Serbia
Haninec, Peter	xhaninec@node.mendelu.cz	Czech Republic
Harasawa, Natsuho	f13e501a@mail.cc.niigata-u.ac.jp	Japan
Hauk, Sebastian	s.hauk@wz-straubing.de	Germany
Hédl, Radim	radim.hedl@ibot.cas.cz	Czech Republic

Heinsoo, Katrin	katrin.heinsoo@emu.ee	Estonia
Hernea, Cornelia	corneliahernea@yahoo.com	Romania
Hort, Libor	libor.hort@vukoz.cz	Czech Republic
Hosseini, Seyed Mohammad	S_hosseini99@yahoo.com	Czech Republic
Hosseinzadeh, Jaafar	j.hoseinzadeh@gmail.com	Iran
Hula, Vladimír	hula@mendelu.cz	Czech Republic
Hurt, Václav	vaclav.hurt@mendelu.cz	Czech Republic
Hytönen, Jyrki	jyrki.hytonen@metla.fi	Finland
Chudomelová, Markéta	marketachudomelova@seznam.cz	Czech Republic
Janík, David	david.janik@vukoz.cz	Czech Republic
Jelenecká, Alžběta	a.jelenecka@seznam.cz	Czech Republic
Jelenová, Lenka	jellenka@seznam.cz	Czech Republic
Johns, Joseph Babadi	joseph.johns@opad.eu	Sierra Leone
Jylhä, Paula Kaarina	paula.jylha@luke.fi	Finland
Kadavý, Jan	kadavy@mendelu.cz	Czech Republic
Kamler, Jiří	jiri.kamler@gmail.com	Czech Republic
Kariminejadghasroddashti, Razieh	kariminejadrazieh@gmail.com	Iran
Karlík, Petr	karlik@fld.czu.cz	Czech Republic
Kašák, Josef	abovic@seznam.cz	Czech Republic
Kirby, Keith	keith.kirby@bnc.oxon.org	UK
Kopecký, Martin	ma.kopecky@gmail.com	Czech Republic
Kneifl, Michal	kneifl@mendelu.cz	Czech Republic
Knott, Robert	knott@mendelu.cz	Czech Republic
Končeková, Lýdia	lydia.koncekova@uniag.sk	Slovakia
Král, Kamil	kamil.kral@vukoz.cz	Czech Republic
Krása, Antonín	antonin.krasa@nature.cz	Czech Republic
Krůček, Martin	krucek.martin@gmail.com	Czech Republic
Kupec, Petr	PKupec@seznam.cz	Czech Republic
Kuular, Khulermaa Bolat-oolovna	fgs_khu@mail.ru	Russia
Kvasnica, Jakub	J.Kvasnica@seznam.cz	Czech Republic
Lazdina, Dagnija	dagnija.lazdina@silava.lv	Latvia
Leugner, Jan	leugner@vulhmop.cz	Czech Republic
Liepiņš, Kaspars	kaspars.liepins@silava.lv	Latvia
Little, Keith Macmillan	keith.little@nmmu.ac.za	South Africa
Machar, Ivo	ivo.machar@upol.cz	Czech Republic
Mairota, Paola	paola.mairota@uniba.it	Italy
Májek, Tomáš	T.Majek@seznam.cz	Czech Republic
Makineci, Ender	emak@istanbul.edu.tr	Turkey
Makovskis, Kristaps	kristaps.makovskis@silava.lv	Latvia
Mancini, Leone Davide	leone.mancini@unitus.it	Italy
Manetti, Maria Chiara	mariachiara.manetti@entecra.it	Italy
Marah, Lahai	opad.togo@gmail.com	Sierra Leone
Marah, Mariama D.	john.bangura83@gmail.com	Sierra Leone
Martiník, Antonín	martinik@mendelu.cz	Czech Republic
Matula, Radim	radim.matula@mendelu.cz	Czech Republic

Menéndez Miguélez, María	mmenendez@cetemas.es	Spain
Mills, Jennifer	jennymills48@gmail.com	UK
Mölder, Andreas	andreas.moelder@nw-fva.de	Germany
Mosseler, Alexander John	amossele@nrcan.gc.ca	Canada
Motta, Renzo	renzo.motta@unito.it	Italy
Müllerová, Jana	jana.mullerova@ibot.cas.cz	Czech Republic
Nicolescu, Valeriu-Norocel	nvnicolescu@unitbv.ro	Romania
Nicolescu, Delia-Larise	larisanicolescu@yahoo.com	Romania
Niedobová, Jana	Naaudia@seznam.cz	Czech Republic
Novosadová, Kateřina	novosadova.k@czechglobe.cz	Czech Republic
Owusu, John Richard	GAMBIADIPLOMACY@YAHOO.COM	Ghana
Özdemir, Emrah	eozdemir@istanbul.edu.tr	Turkey
Özel, Halil Barış	halilbarisozel@yahoo.com	Turkey
Pejcha, Vít	vejcha@gmail.com	Czech Republic
Pelleri, Francesco	francesco.pelleri@entecra.it	Italy
Petřík, Petr	petrik@ibot.cas.cz	Czech Republic
Picchio, Rodolfo	r.picchio@unitus.it	Italy
Pietras, Justyna	pietras.j@czechglobe.cz	Czech Republic
Piqué, Míriam	miriam.pique@ctfc.cat	Spain
Piussi, Pietro	pietro.piussi@gmail.com	Italy
Plhal, Radim	r.plhal@seznam.cz	Czech Republic
Pokorný, Radek	pokorny.r@czechglobe.cz	Czech Republic
Ponikelský, Jaroslav	ponikelsky@nppodyji.cz	Czech Republic
Pyttel, Patrick	patrick.pyttel@waldbau.uni-freiburg.de	Germany
Rejžek, Martin	rejmar@post.cz	Czech Republic
Riedl, Vladan	vladan.riedl@gmail.com	Czech Republic
Roleček, Jan	honza.rolecek@centrum.cz	Czech Republic
Řehořková, Štěpánka	rehorkova_st@centrum.cz	Czech Republic
Řepka, Radomír	repka@mendelu.cz	Czech Republic
Sahin, Abbas	abbassahin@ogm.gov.tr	Turkey
Salehi, Alireza	asalehi@mail.yu.ac.ir	Iran
Salomón, Roberto	roberto.salomon@upm.es	Spain
Šebek, Pavel	pav.sebek@gmail.com	Czech Republic
Sesay, Abibatu	pldc.sierraleone@gmail.com	Sierra Leone
Sesay, Yeamah	manager052@gmail.com	Sierra Leone
Skála, Vít	tajemnik@cesles.cz	Czech Republic
Soloku, Edward Amin	parliament.sierraleone@representative.com	Sierra Leone
Souček, Jiří	soucek@vulhmop.cz	Czech Republic
Stejskal, Robert	stejskal@nppodyji.cz	Czech Republic
Stojanović, Marko	marko.stojanovic@mendelu.cz	Czech Republic
Suanpaga, Wathinee	wathinee.s@ku.ac.th	Thailand
Suchomel, Christian	christoian.suchomel@landespflege.uni-freiburg.de	Germany
Svátek, Martin	msvatek@centrum.cz	Czech Republic
Swaray, Mamie	slango.sierraleone61@gmail.com	Sierra Leone
Szabó, Péter	peter.szabo@ibot.cas.cz	Czech Republic

Šplíchalová, Markéta	marketa.splichalova@mendelu.cz	Czech Republic
Štochlová, Petra	stochlova@vukoz.cz	Czech Republic
Šrámek, Martin	martin.sramek@mendelu.cz	Czech Republic
Taheri Sarteshnizi, Mohammad Javad	forestry.javad.taheri@gmail.com	Iran
Trochta, Jan	j.trochta@gmail.com	Czech Republic
Unar, Pavel	pavel.unar@vukoz.cz	Czech Republic
Unrau, Alicia	alicia.unrau@felis.uni-freiburg.de	Germany
Urbinati, Carlo	c.urbinati@univpm.it	Italy
Valbuena-Carabaña, María	maria.valbuen@upm.es	Spain
Vanbeveren, Stefan	stefan.vanbeveren@uantwerp.be	Belgium
Vandekerkhove, Kris	kris.vandekerkhove@inbo.be	Belgium
Vericat, Pau	pau.vericat@ctfc.es	Spain
Vild, Ondřej	ondrej.vild@ibot.cas.cz	Czech Republic
Višnjić, Ćemal	vicemal@yahoo.com	Bosnia and Herzegovina
Vitali, Alessandro	a.vitali@pm.univpm.it	Italy
Volařík, Daniel	daniel.volarik@mendelu.cz	Czech Republic
Vrška, Tomáš	tomas.vrska@vukoz.cz	Czech Republic
Zukal, Dominik	dominikzukal@gmail.com	Czech Republic

Title: Coppice forests: past, present and future. Conference information, Program & Book of Abstracts.

Edited by: Ondřej Vild

Printed by: ASTRON print, s.r.o.

Published by: Mendel University in Brno, Zemědělská 1, 613 00 Brno

The publication was not checked for language.

Brno, 2015

ISBN 978-80-7509-247-2

NOTES