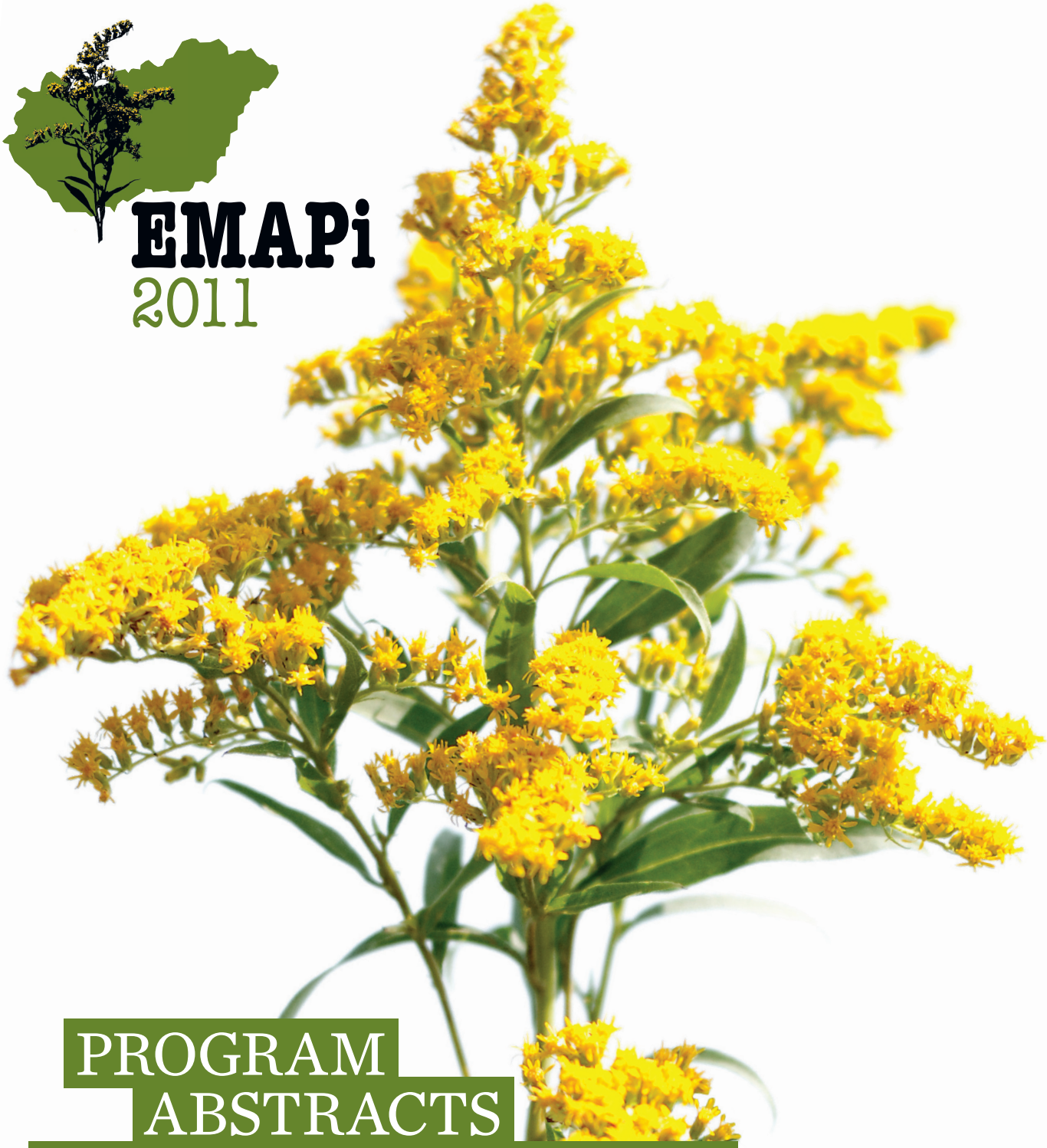


EMAPi 2011

PROGRAM
ABSTRACTS
LIST OF PARTICIPANTS

11th International Conference on the Ecology and Management of Alien Plant Invasions

BRIDGING THE GAP BETWEEN SCIENTIFIC KNOWLEDGE AND MANAGEMENT PRACTICE

30th August – 3rd September 2011

Cultural and Youth Centre of Vas County
Szombathely, Hungary

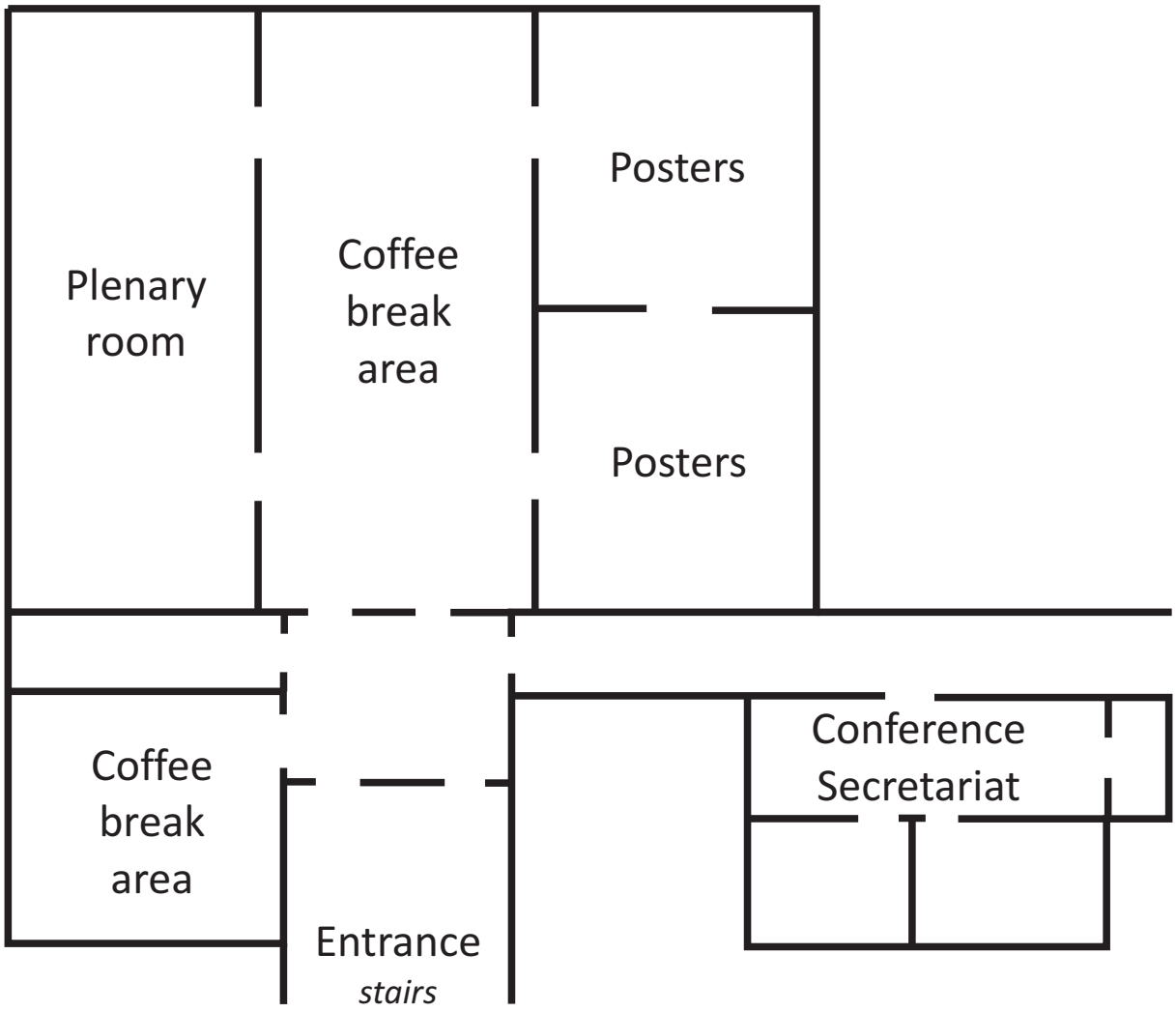
www.emapi2011.org

Floorplan

Cultural and Youth Centre of Vas County

2nd floor

EMAPi 2011



11th International Conference on the Ecology and Management of Alien Plant Invasions

BRIDGING THE GAP BETWEEN SCIENTIFIC KNOWLEDGE AND MAGAGEMENT PRACTICE

30th August – 3rd September 2011
Cultural and Youth Centre of Vas County
Szombathely, Hungary

Contents

Main Patrons

Ferenc KOVÁCS
President of the Assembly of Vas County

Tivadar PUSKÁS
Mayor of Szombathely

Scientific Committee

Zoltán BOTTA-DUKÁT (Hungary)

Lajos BALOGH (Hungary)

Dénes BARTHA (Hungary)

John BROCK (USA)

Giuseppe BRUNDU (Italy)

Lois CHILD (UK)

Sandy LLOYD (Australia)

Attila KOVÁCS J. (Hungary)

Petr PYŠEK (Czech Republic)

David RICHARDSON (South Africa)

Barbara TOKARSKA-GUZIK (Poland)

Local Organizers

Zoltán BOTTA-DUKÁT

director
Institute of Ecology and Botany of the
Hungarian Academy of Sciences, Vácrátót

Lajos BALOGH

chief of collection
Natural History Collection, Savaria Museum,
Vas County Museums' Directorate

Venue

Cultural and Youth Centre of Vas County

Address: H-9700 Szombathely, Ady tér 5.

Phone: +36 94 312 535

Fax: +36 94 312 743

Organizing Institutions

University of West Hungary, Faculty of Natural Sciences

Address: 9700 Szombathely, Károlyi Gáspár tér 4.

H-9700 Szombathely, Pf. 170

Phone: +36 94 504 300

Fax: +36 94 504 404

Institute of Ecology and Botany, Hungarian Academy of Sciences

Address: 2163 Vácrátót, Alkotmány út 2-4.

Phone: +36 28 360 122

Fax: +36 28 360 110

Vas County Museums' Directorate, Savaria Museum

Address: 9700 Szombathely, Kisfaludy Sándor utca 9.

Phone: +36 94 500 720, +36 94 501 948

Welcome to Szombathely

Dear EMAPi 2011 Participants,

We are glad that you are able to join us and hope that your stay at the Cultural and Youth Centre of Vas County in Szombathely is both rejuvenating and educational.

We have a full agenda during the next five days, so please take a few minutes to read through the information in this booklet. It includes our itinerary and other important information.

We would like to express our gratitude to our patrons, sponsors, the members of the Organising Committee and the Conference Secretariat for their contribution to the success of this event.

We are pleased to announce, that we have 136 participants from 34 countries. During the sessions, we will cover all aspects of plant invasion. Hopefully, by the end of this conference we will be able to state, that we have successfully bridged the gap between scientific knowledge and management practice. Thanks for our invited speakers, chairpersons and to all those who are presenting a scientific paper, be it oral or poster.

We look forward to spending this time with you in Szombathely. If we can do anything to make your stay more pleasant, please let us know. Thank you for joining EMAPi 2011.

Sincerely yours,

Zoltán BOTTA-DUKÁT
director
Institute of Ecology and Botany of the
Hungarian Academy of Sciences, Vácrátót

Lajos BALOGH
chief of collection
Natural History Collection, Savaria Museum,
Vas County Museums' Directorate

Program Overview

28th-30th August 2011	Pre-conference tour
	Sights, traditions and flavours of Hungary
30th August, Tuesday	
16.00-20.00	*Registration*
18.00-20.00	***Opening Ceremony and Welcome Reception***
31st August, Wednesday	
08.00-18.00	*Registration*
09.00-09.50	***Invited speaker: David M. Richardson***
09.50-10.50	***Session 1: Biology of invasive alien plants***
10.50-11.20	Coffee break
11.20-12.40	***Session 2: Genetics and evolution of invasive plants***
12.40-14.00	Lunch
14.00-15.40	***Session 3: Risk assessment, prioritization and policy making***
15.40-17.00	***Poster session 1*** & Coffee break
17.00-18.00	***Session 4: Plant invasion in protected areas***
18.15	Sightseeing tour in Szombathely (optional program)
1st September, Thursday	
8.30-18.00	*Registration*
09.00-09.50	***Invited speaker: Anibal Pauchard***
09.50-10.50	***Session 5: Inpact of invasive plant species***
10.50-11.20	Coffee break
11.20-12.40	***Session 6: Interaction with other trophic levels: enemies and mutualists***
12.40-14.00	Lunch
14.00-15.40	***Session 7: Management & communication***
15.40-17.00	***Poster session 2*** & Coffee break
17.00-18.20	***Session 8: Introduction pathways and spread of invasive species***
18.20-18.40	***Introduction to the mid-conference tour***
18.45	Transfer to the Conference Dinner
19.00	Conference Dinner (optional program)
2nd September, Friday	
08.00	Mid-conference field trip
19.00	Dinner with folklore program
3rd September, Saturday	
08.30-15.30	*Registration*
09.50-10.50	***Invited speaker: Philip Hulme***
09.50-10.50	***Session 9: Plant invasion in a changing world***
10.50-11.20	Coffee break
11.20-12.40	***Session 10: Invasion patterns and invasibility***
12.40-14.00	Lunch
14.00-15.00	***Session 11: Mapping, inventories, databases***
15.00-15.30	Closing ceremony
4th-7th September	Post-conference tour
	Cross-section through the characteristic habitats of Pannon ecoregion

Oral presentations

Oral Presentations' Time Allotment: Presentations of contributed papers are allotted a maximum of 20 minutes (including 3-5 minutes for Q&A). This will be strictly enforced by session chairs.

Instructions to Oral Presenters: Your presentations should be prepared in Microsoft PowerPoint and submitted to the Conference Organizers onsite on a CD-ROM or USB Flash Drive. The conference room will be open and ready to accept presentations up to 30 minutes before the session start time each day. Bring a copy of any video files that are part of your PowerPoint presentation. Standard audiovisual equipment will be provided for every session, including: a PC laptop, LCD projector, laser pointer, and podium microphone. You may supply your own laptop computer as a back-up. Please note that VHS Video projection, 35 mm' slide projection and Overhead projection (projection of transparencies) will not be available.

Posters

Poster Session Overview: All posters will be on display throughout the Conference. There will be two formal Poster Sessions during the EMAPi 2011 Conference.

Poster Session I: is on Wednesday, 31st August, from 15.40 to 17.00;
Poster Session II: is on Thursday, 1st September, from 15.40 to 17.00.

The primary goal for these sessions is to provide a more intimate setting for informal discussion between authors and the attendees. Please make every effort to be at your poster during your assigned session.

Poster Set Up and Take Down: All poster presentations should be mounted on Tuesday, 30th August, any time between 14.00 and 20.00. Please refer to the Final Program for the poster board number assigned to you and use the display board with the same number.

Each poster board will be numbered for easy reference, and presentations will be grouped by topic area for the convenience of those attending the sessions.

Please do not remove or change the numbers on the boards! Posters will remain up during the Conference until 15.30 on Saturday, 2nd September. All posters not removed by 16.30 on the 2nd September will be discarded.

The maximum size allowed for each poster is 80 cm wide and 120 cm high.

Poster position: vertical

Posters that do not adhere to the dimensional limits cannot be displayed.
Each poster will be attached to the boards with Blu-tack that will be provided free of charge. Push pins are not allowed.

Onsite registration fee

Professionals	EUR 480
Students*	EUR 250

*In order to receive the reduced fee, students must submit a letter of support from their academic supervisor, confirming their student status.

The registration fee includes:

- attendance to all scientific sessions
- conference official documentation (final program & book of abstract & list of participants)
- conference bag with conference documentation and information leaflets
- coffee and tea during breaks
- lunches during conference
- admission to the Welcome Party on 30th August, 2011.
- full day conference field trip with social event in the evening on 2nd September, 2011

The registration fee does not include:

- optional program: guided sightseeing tour in Szombathely on 31st August, 2011
- optional program: Conference Dinner on 1st September
- optional program: pre- and post-conference tours
- accommodation

Cancellation policy

All cancellations must be sent to the EMAPi Conference Secretariat in writing by the deadlines specified.

Registration fee refund will be made after the event as follows:

Cancellation before 1st June, 2011 - 70% refund

Cancellation between 1st June and 1st August, 2011 - 30% refund

Cancellation on and after 1st August 2011 - no refund

Conference Secretariat

Before and after the conference

ALTAGRA BUSINESS SERVICES AND TRAVEL AGENCY Ltd.
H-2100 Gödöllő, PO. Box 417., Hungary
Phone: +36 28 432 985
Fax: +36 28 419 647
Web: www.altagra.hu

During the conference

ALTAGRA BUSINESS SERVICES AND TRAVEL AGENCY Ltd.
c/o Cultural and Youth Centre of Vas County
H-9700 Szombathely, Ady tér 5.
Emergency phone number: +36 30 547 5300

Registration & Information Desk Opening Hours

Conference registration and information desk will be open as follows:

30th August, Tuesday	16.00-20.00
31st August, Wednesday	08.00-18.00
1st September, Thursday	08.30-18.00
3rd September, Saturday	08.30-15.30

Accommodation in Szombathely

The official conference hotels are the following:

Park Hotel Pelikán****
Address: Szombathely, Deák Ferenc utca 5.

Hotel Claudius****
Address: Szombathely, Bartók Béla krt. 39.

Pável Ágoston Hostel III. Deák Street (utca)
Address: Szombathely, Deák Ferenc utca 57.

You should find your own way to the conference venue, there will be no transfers in the morning. In the evening after some of the social events, transfers will be provided to the official conference hotels and to the conference venue (if you have made a reservation in a hotel other than the official ones, you should find your way there from the conference venue).

You are kindly requested to pay for any extra services (phone call, drinks, laundry, pay-TV) directly to the hotel before leaving.

Social Program

30th August, Tuesday

18.00-20.00 ***Opening Ceremony and Welcome Reception***
Venue: Cultural and Youth Centre of Vas County, Theatre Hall
Address: Szombathely, Ady tér 5.

18.00-19.00 ***Welcome speeches & Cultural program***
Cultural program:
- Saint Martin's Choir of Music Fans
- Isis Quartett

19.00-20.00 ***Welcome Party***
This program is included in the registration fee of the conference participants.
Ticket for accompanying persons costs Euro 20 per person.

Dress code: smart casual

The Welcome Party on the opening night is a relaxing, fun-filled time for conference attendees to come together, to greet old friends and meet newcomers.

Light refreshments and snacks/finger food will be served.

After the party, no transfer will be provided to the conference hotels, you are kindly requested to find your own way.

31st August, Wednesday

18.15 ***Sightseeing tour in Szombathely (optional program)***
Departure: Cultural and Youth Centre of Vas County
Address: Szombathely, Ady tér 5.

Duration: 3 hours

Clothing: please wear comfortable shoes, because you will be walking during most of the tour. Neither forget your pullover (the evening might be cool) nor your raincoat.

After the tour participants will be transferred to the official conference hotels.

Ticket for the Sightseeing tour in Szombathely costs Euro 20 per person.

1st September, Thursday

18.45 ***Transfer to the Conference Dinner***
Departure: Cultural and Youth Centre of Vas County
Address: Szombathely, Ady tér 5

19.00 ***Conference Dinner (optional program)***
Venue: Tó restaurant
Address: Szombathely, Rumi Rajki sétány 1.

The Conference Dinner will be held in a very calm, pleasant and romantic place called 'Tóvendéglő Restaurant & Bar'. You will have a nice view of the small Szombathely lake. You will be served a high quality four-course menu presenting local food with wine and soft drinks included for the duration of 2 hours.

The evening will be complemented by live music from a local musician – Meggie Horváth. An evening full of laughter, good food and entertainment optional to all delegates and partners.

Dress code: semi formal

Ticket for the Conference Dinner costs Euro 20 per person.

After the dinner participants will be transferred to the official conference hotels.

2nd September, Friday

08.00 ***Mid-conference field trip***
Departure: Cultural and Youth Centre of Vas County
Address: Szombathely, Ady tér 5.

Duration: 11 hours

Program: an excursion guide will be given to all participants taking part in the tour, containing: detailed program, description of the plant invasions to be seen at the stops, overview of cultural and local heritage sights.

Clothing: please wear sport shoes, socks and long trousers, to protect yourself against *Ixodes ricinus,* which is unfortunately common in wooded and overgrown areas of Hungary.Don't forget to bring a hat/cap, a pullover or jacket and a raincoat with you.

After the tour participants will be transferred to the Open-air Ethnographical Museum (Village Museum) of County Vas.

The tour is included at the registration fee of the conference participants. Ticket for accompanying persons costs Euro 20 per person.

19.00 ***Dinner with folklore program***

Venue: Open-air Ethnographical Museum (Village Museum) of County Vas
Address: Szombathely, Tóth Árpád utca 30.

This program will take place at the Open-air Ethnographical Museum (Village Museum) of County Vas. The museum - which is situated on the western edge of Szombathely - introduces the rural lifestyle and folk architecture of the county throughout the past two centuries. The introduction of livestock native to Hungary, the flora of the ethno-botanic garden and the regularly organized authentic folklore programs enlighten the sight and atmosphere of the homesteads of the museum village.

Traditional Hungarian meals, cooked on open-fire, will be served in a pot, meanwhile the Boglya folklore band will entertain the participants and authentic folk dance will be performed by the Gencsapáti Folk Ensamble.

The dinner is included at the registration fee of the conference participants.
Ticket for accompanying persons costs Euro 25 per person.
After the dinner participants will be transferred to the official conference hotels.

Departure Information

The Conference Secretariat is providing bus transportation to the Budapest and Vienna airports as follows:

Szombathely - Budapest bus transfer

Date	Departure from Szombathely	ARRIVAL at Liszt Ferenc 1. Int. Airport	ARRIVAL at Liszt Ferenc 2. Int. Airport	Price per person
3 September 2011	12.00 hrs	17.00 hrs	17.30 hrs	€ 32
4 September 2011	08.00 hrs	13.00 hrs	13.30 hrs	€ 32

Szombathely - Vienna bus transfer

Date	Departure from Szombathely	ARRIVAL at Vienna International Airport	Price per person
3 September 2011	12.00 hrs	14.30 hrs	€ 32
4 September 2011	08.00 hrs	10.30 hrs	€ 32

Buses will depart from the Cultural and Youth Centre of Vas county. If you have not reserved your place in advance and would like to take advantage of this service, contact the Conference Secretariat as soon as possible, because places are limited.

The Conference Secretariat is ready to give you information about other possibilities, e.g train, buses, car rental, etc.

Post-conference tours

Post-conference Tour 1 has been cancelled.

Post-conference Tour 2 will start at 08.00 on the 4th of September. The bus will depart from the Cultural and Youth Centre of Vas county. For detailed program please contact the Registration and Information Desk.

Useful Information

Catering Services

Breakfast
Breakfast is included in the hotel reservation fee. Breakfast is served in each hotel from seven o'clock in the morning. No breakfast ticket is needed.

For those accommodated in the Pável Ágoston Hostel, the breakfast will be served at the nearby restaurant, also from seven o'clock (Szombathely, Petőfi út 1). Remember to bring your breakfast ticket with you.

Coffee, tea and refreshments
Coffee, tea and refreshments will be served for those wearing the conference badge during the breaks at the conference venue.

Lunch
Lunch is included in the registration fee of conference delegates. On Wednesday, Thursday and Saturday lunch will be served at the Canteen of the University of West Hungary (Szombathely, Károlyi Gáspár tér 4., a five-minute walking distance from the conference venue). Don't forget your lunch ticket!
You will receive box-lunch during the mid-conference field trip on Friday.

Dinner
Please go the chapter "social programs".

Internet Corner

Free *Wi-Fi* wireless internet access is available at the conference venue. Please contact the registration desk to get your password. If you do not have your laptop with you, visit the internet corner in the coffee area.

Delegate Identification

Admission to scientific sessions and other events is permitted only to those wearing the official conference badge. Be careful and do not loose your badge!
There will be a charge of EURO 20,- to replace a lost/stolen/forgotten badge.
Accompanying persons are kindly asked not to attend any part of the scientific program.

Language

The official language of EMAPI 2011 is English. No translation facilities will be available.

Money issues

Currency
The Hungarian currency is the forint (Ft) and today there are coins of 5Ft, 10Ft, 20Ft, 50Ft,100Ft and 200Ft. Notes come in six denominations:, 500Ft, 1000Ft, 2000Ft, 5000Ft, 10, 000Ft and 20, 000Ft.
There are a number of places which accept Euros too, but the exchange rate merchants tend to use is significantly lower than what one can get at normal exchange office or a bank.

Cash
Nothing beats cash for convenience - or risk. It's always prudent to carry a little cash in case you can't find an ATM nearby or there's no bank or travel agency open to cash your travellers cheques.

ATMs
In Hungary you will find a dense network of ATMs (cash machines) which will accept all major credit and debit cards (Visa, MasterCard, Plus, Maestro, Cirrus and others).

Credit cards
Credit cards, especially Visa, MasterCard and American Express, are widely accepted in Hungary, and you'll be able to use them at many restaurants, shops, hotels, car-rental firms, travel agencies and petrol stations. They are not usually accepted at museums, supermarkets, or train and bus stations.

Moneychangers
It is easy to change money at banks, post offices, tourist offices, travel agencies and private exchange offices. Look for the words *valuta* (foreign currency) and *váltó* (exchange) to guide you to the correct place or window.

There's no black market in Hungary to speak of but exchange rates can vary substantially, so it pays to keep your eyes open. And while the forint is a totally convertible currency, you should avoid changing too much as it will be difficult exchanging it beyond the borders of Hungary and its immediate neighbours.

Taxes & refunds

ÁFA, a value-added tax of between 5% and 25%, covers the purchase of all new goods in Hungary. It's usually included in the price. Visitors are not exempt, but non-EU residents can claim refunds for total purchases of at least 50, 000Ft on one receipt, as long as they take the goods out of the country (and the EU) within 90 days. The ÁFA receipts (available from where you made the purchases) should be stamped by customs at the border, and the claim has to be made within 183 days of exporting the goods. You can then collect your refund - minus commission - from the Global Refund (www.globalrefund.com) desk in the departures halls of Terminal 2A and 2B at Liszt Ferenc International Airport in Budapest, or branches of the Ibusz chain of travel agencies at some 16 border crossings. You can also have it sent by bank cheque or deposited into your credit-card account.

Tipping in Hungary

Tipping is a very common practice in Hungary and you not only tip waiters but also hairdressers, taxi drivers and assistants at petrol stations.

At some restaurants the service fee is included in the bill (it usually ranges between 10% and 15%). Always check your bill or ask the waiter if the service fee is included or not. If not, you are supposed to tip the waiter, the tip should be 10 %.

Electricity

Electric voltage in Hungary is 230 volts, and plugs are of the twopin continental type.

Szombathely, the 2000-year-old City

The settlement lies on the gentle slopes east of the Alps, with a climate somewhat cooler than the average of Hungary. In this town rich in parks, the two most beautiful seasons are the spring and the colourful autumn. The general view of Szombathely has been thoroughly defined by the two springs crossing the town, namely Gyöngyös and Perint, the former being originally directed as a canal across the town by the ancient Romans.

Imprints of Past Centuries

The Amber road has been a connection between the Baltic Sea and the Adriatic for milennia, thus the town and its environs had been an inhabited region in the ancient times too. A town had been founded around 50 A.D. by the Romans, in those times expanding their dominance to the North, under the name Colonia Claudia Savaria, which then had become the leading settlement of Pannonia Province as the administrative center. Saint Quirin died martyrdom here (in 303) during the Roman dominance, and Saint Martin was born here (in 317 or 336). During the time of migration the majority of the Roman inhabitants had left Savaria (in the 5th century), but the town was still inhabited. Following Avar and Frankish dominance, after 907, the Hungarians took over Pannonia, including the town itself too. The Hungarian name refers to the fairs held here on Saturdays. Its fortress was mentioned first in 1291 in charters. In this region considered a border-zone there had been several battles fought. Szombathely got the title of „township" in 1407, later assuming a greater role during the Turkish invasion. From 1578 onwards it is the administrative center of county Vas, and her history will be woven mostly around battles for the next 150 years, since they had been involved in both the Turkish wars, and the anti-Habsburg revolutions. Development of the settlement started in the late 1700s, when on the decision of Empress Maria Theresa the town was appointed the episcopal center of the newly founded religious county.

Flourishing proper was brought about by the Compromise in the second half of the 19th century: due to the railway constructions of the times, Szombathely became the centre of commerce and transportation, the population had quadrupled in four decades, and there was a real civic town in the making. WWI brought to a halt this upwardly change: a great part of county Vas was transferred to Austria, thus losing her central status within the region. WWII had caused severe damages to the town, and the Iron Courtain was established, separating the area from the West. Despite of all this, Szombathely started her development anew: new industrial plants, housing estates were constructed, and with a population of 80 thousand, the town re-assumed her position as an economic and cultural centre of the region. By Hungary's accession to the EU, the borders are no longer constituting limitations, thus there are realistic hopes that the town, with her 2000-year-old history, will re-establish her leading status in the broader region.

Szombathely – today

Although traditions are still powerful, the visitor can encounter a real modern town. In the Main Square (Fő tér) shops, restaurants, and cafés are awaiting the visitor, and the nice parks and alleys, just outside the city centre and on the banks of the two streams crossing the city, are pleasant places for relaxing. Since Szombathely is also a centre for education, culture and university, during the academic year there are a lot of young people in the city. In the evenings many places of entertainment are open, several programs are awaiting those wanting to go out. Szombathely is also a shopping-town, in the outskirts several shopping centres had opened. Also in the outskirts of the town can one find Claudius Industrial Park, having an important role in the town's economic life.

The historical town centre, sights to visit

Nothing is a better testimony to the traditions and century-long history of the town than does the fact that in different historical periods, the settlement's political and cultural centre had been established practically in the same places since the Roman times as long as the Enlightenment Period. The ruins of the ancient Roman provincial centre, including the Governor's Palace are preserved in the Ruin-garden (Romkert) a section of the Amber Road can also be seen here. Excavations are being conducted at present, too, in the Isis shrine, whereas everyday life, the equipment used by craftsmen and tools of ancient technology are displayed in the Historical Theme Park, which is also a centre of the Savaria History Games. A church erected over Roman ruins in the 19th century commemorates Sain Martin's martyrdom – the memorial centre, which is part of the European pilgrimage route, can also be found here. Built in the Middle Ages, the Church of Saint Elizabeth, and the remains of the Szombathely fortress in the Ruin-garden are also important sights worth visiting. The road system of the town is also several centuries old. The Main Square, used as a place for county markets, could be approached by very narrow streets, of which one, Belsikátor street, still exists. Of the historical buildings the episcopal centre built in the 18th century in baroque style had survived best the past centuries. The Cathedral, now occupying the old fortress church's place, the episcopal palace (with a vast Roman collection displayed in the Sala Terrana), the seminary and the adjoining buildings are still showing their age-old glow. The County Hall was also built in the late 1700s, it is still used for housing the regular county meetings. The renovated houses of the civic Szombathely can be found in the Main Square (Fő tér) in Szily János street, in Király Street, but the freshly refurbished building of the Railway Station is also worth a glance. If you wish to get to know more about the history of the town and its environs, visit Savaria Museum and the private collection of Smidt Museum.

(Source: www.viaurbium.com)

Szombathely – good to know

Central emergency number: 112
Ambulance: 104
Fire: 105
Police: 107

Telephone Enquiries:
International: 199
Within Hungary: 198

Hospital
Markusovszky hospital
Szombathely, Markusovszky Lajos utca 5.
Phone: +36 94 311 542

Emergency medical care
Szombathely, Sugár utca 1.
Phone: +36-94 / 311-100, +36-94 / 331-008
weekdays from 4pm till 8am and weekends non-stop

Taxis
Avoid unmarked taxis. The following taxi companies, with logos well marked on the side of the car, are reliable and reasonably priced. Ordering a taxi by phone is cheaper than hailing one on the street.

City Taxi
Phone: +36 94 333 666
Call free: +36 80 626 262

Rádió Szombathely Taxi
Phone: + 36 94 322 222

Dining out
Wagner Vendegudvar
This is one of the best restaurants in the city. It dishes up Hungarian flair and continental cuisine. In addition to the delicious food, the service is first-class. Wagner Vendegudvar is one of the most family-friendly restaurants in Szombathely.
Szombathely, Kossuth Lajos utca 15.
Phone: +36 94 322 208

Gödör Restaurant
Ever since the name Gödör has become a notion not only in County Vas. The red-squared table cloth and the tableware made of granite is a real trademark of the place. Something that never existed before, that is, to offer delicious and rich dishes of high standard at a reasonable price.
Szombathely, Hollán Ernő utca 10-12.
Phone: +36 94 510 078

Nagypityer Restaurant
In this restaurant you will find traditional Hungarian dishes, characteristic for the region (Őrség, Hegyhátság and Göcsej). The fresh and healthy food comes from local farmers. Whereas the flavours go back to the past, the cooking methods used in the kitchen combine the present and the future (molecular and sous-vide technology).
Szombathely, Körmendi út 94.
Phone: +36 30 822 6676

Pásztor Csárda
It may be located a bit far from the city centre but it is a worthwhile place to visit. The traditional local food of the Vas county region is influenced by the Hungarian, Austrian, Slovenian and Croatian kitchen. Taste this mixture of flavours while listening to the Gypsy band.
Szombathely, Dolgozók útja 1.
Phone: +36 94 312 884

Nightlife
Royal Restaurant and Pub
This is one of the top bars in Szombathely. Royal Pub serves the best dark beer in the town. The wooden booths provide some privacy if you want to talk to your friends. The terrace is a nice place to sit around and enjoy a warm summer evening.
Szombathely, Fő tér 16.
Phone: + 36 94 339 727

Palace Café and Restaurant
A newly opened restaurant and café offering several types of entertainment on Fridays and Saturdays only.
Szombathely, Semmelweis u. 2.
Phone: +36 20 257-0790

Bánya Café Bar
This is a mix of a bar and a club. This basement nightspot offers a wide selection of drinks. It is usually packed during weekends because of the live party music played.
Szombathely, Szinyei Merse Pál út 34.
Phone: + 36 94 321 120

Scientific program

30th August, Tuesday
Venue: Cultural and Youth Centre of Vas County
Address: 9700 Szombathely, Ady tér 5.

16:00-20:00 Registration

18:00-20.00 Opening Ceremony and Welcome Reception
Venue: Cultural and Youth Centre of Vas County, Theatre Hall

18:00-19:00 Welcome speeches & Cultural programme

19:00-20:00 Welcome party
This program is included at the registration fee of the conference participants.
Ticket for accompanying persons costs Euro 20 per person.

31st August, Wednesday
Venue: Cultural and Youth Centre of Vas County, Conference Hall
Address: 9700 Szombathely, Ady tér 5.

08:00-18:00 Registration

09:00-09:50 **Invited speaker:** David M. Richardson
"(Plant) invasion science - the roads travelled and the roads ahead"
David M. Richardson, The DST-NRF Centre of Excellence for Invasion Biology, Department of Botany & Zoology, Main Campus, Universiteit Stellenbosch University, South Africa

09:50-10:50 Session 1: Biology of invasive alien plants (3 lectures)
Chairman: Zoltán Botta-Dukát

09:50-10:10 Role of species traits, plasticity and local differentiation in plant invasions: four Impatiens species in Central Europe
Hana Skálová, Institute of Botany of the Czech Academy of Sciences, Czech Republic

10:10-10:30 Quantifying the roles of life-history traits, biogeography, climate match and propagule pressure in invasions
Kirsty F. McGregor, The Bio-Protection Research Centre, New Zealand

10:30-10:50 A Trait Fair of Invasive Species in Germany
Ingolf Kühn, Helmholtz Centre for Environmental Research – UFZ, Germany

10:50-11:20 Coffee break

11:20-12:40 **Session 2: Genetics and evolution of invasive plants (4 lectures)**
Chairman: Philip Hulme

11:20-11:40 What can intra-specific molecular variation tell us about Acacia saligna invasions in South Africa and what are the implications for species distribution models?
Johannes Le Roux, Stellenbosch University, South Africa

11:40-12:00 Comparisons between native and introduced genotypes of Solidago gigantea: a transcontinental common garden experiment
Robert W. Pal, University of Pecs, Faculty of Sciences, Hungary

12:00-12:20 Comparative epi-genetic and genetic population structure of the highly invasive bunch grass, Pennisetum setaceum along an environmental gradient in South Africa
Marguerite Blignaut, DST-NRF Centre of Excellence for Invasion Biology, South Africa

12:20-12:40 Seeds are the predominant vectors of initial colonization of the invasive common reed (Phragmites australis) along highway ditches and in freshwater wetlands
Arnaud Albert, Institut de recherche en biologie végétale - Université de Montréal, Canada

12:40-14:00 **Lunch**

14:00-15:40 **Session 3: Risk assessment, prioritization and policy making (5 lectures)**
Chairman: Llewellyn Foxcroft

14:00-14:20 The need to align local priorities and government initiatives to improve invasive species management on private lands
Stephanie Januchowski-Hartley, James Cook University, Australia

14:20-14:40 The National Invasive Species Information System: Providing data for decision making regarding plant invasions in Mexico.
Yolanda Barrios Caballero, National Commission for Knowledge and Use of Biodiversity (CONABIO), Mexico

14:40-15:00 Catalogues of alien plant species for Poland: implication for conservation, management and legislation
Barbara Tokarska-Guzik, Department of Plant Systematics, Faculty of Biology and Environmental Protection, University of Silesia, Poland

15:00-15:20 Quantifying risks and effects: the Norwegian classification system for alien species
Hanno Sandvik, Centre of Conservation Biology, Norway

15:20-15:40 Prioritization of alien plants for risk analysis
Johan van Valkenburg, Plant Protection Service, The Netherlands

15:40-17:00 **Poster session & Coffee break**

17:00-18:00 **Session 4: Plant invasion in protected areas (3 lectures)**
Chairman: David Richardson

17:00-17:20 Nature rearranged: assessing invasive alien species as a driver of environmental change in South African National Parks
Llewellyn Foxcroft, Conservation Services, South African National Parks, South Africa

17:20-17:40 Ornamentals as invasive plants in Białowieża Forest (NE Poland) - winners and losers
Wojciech Adamowski, Warsaw University, Poland

17:40-18:00 Managing alien plant invasions in Pannonian region - lessons learned from LIFE Nature projects in Hungary
Jan Sliva, Astrale GEIE - Particip GmbH, Germany

18:15 Sightseeing tour in Szombathely (optional program)
Departure: Cultural and Youth Centre of Vas County
Address: 9700 Szombathely, Ady tér 5.
Duration: 3 hours
After the tour participants will be transferred to the official conference hotels.
Ticket for the Sightseeing tour in Szombathely costs Euro 20 per person.

1st September, Thursday
Venue: Cultural and Youth Centre of Vas County, Conference Hall
Address: 9700 Szombathely, Ady tér 5.

08:30-18:00 Registration

09:00-09:50 Invited speaker: Anibal Pauchard
Studying mountain plant invasions using a multi-scale approach: From ecology to management
Anibal Pauchard , University of Concepcion, Chile

09:50-10:50 Session 5: Impact of invasive plant species (3 lectures)
Chairman: Uwe Starfinger

09:50-10:10 Mechanism of interference between invasive knotweeds and their native competitors
Madalin Parepa, University of Bern, Institute of Plant Sciences, Switzerland

10:10-10:30 Allelopathic potential of some invasive or potentially invasive neophytes occurring in Hungary
Ágnes Csiszár, University of West Hungary, Faculty of Forestry, Department of Botany and Nature Conservation, Hungary

10:30-10:50 The impact of Himalayan balsam (Impatiens glandulifera) on invertebrate communities in the UK
Robert Tanner, CABI, Bakeham Lane, Egham, Surrey, UK

10:50-11:20 Coffee break

11:20-12:40 Session 6: Interaction with other trophic levels: enemies and mutualists (4 lectures)
Chairman: Ingolf Kühn

11:20-11:40 Role of nitrogen fixing bacteria in the invasion success of Australian Acacias
Christina Birnbaum, Macquarie University, Faculty of Science, Department of Biological Sciences, Australia

11:40-12:00 Do invasive species create a more negative soil-feedback than their native congeners?
Corina Del Fabbro, Institute of Plant Sciences, University of Bern, Switzerland

12:00-12:20 Successful Invaders Co-opt Pollinators of Native Flora and Accumulate Insect Pollinators with Increasing Residence Time
Petr Pysek, Institute of Botany, Academy of Sciences of the Czech Republic, Pruhonice & Department of Ecology, Faculty of Science, Charles University, Czech Republic

12:20-12:40 Do mutualists matter? The role of seed dispersers in plant invasion.
Elizabeth Wandrag, Bio-Protection Research Centre, Lincoln University, New Zealand

12:40-14:00 Lunch

14:00-15:20 Session 7: Management & communication (5 lectures)
Chairman: István Bagi

14:00-14:20 The potential for the biological control of Himalayan balsam using the rust pathogen Puccinia cf. komarovii: opportunities for Europe and North America
Robert Tanner, CABI, UK

14:20-14:40 Dense wilding conifer control with aerially applied herbicides in New Zealand
Stefan Gous, Scion Research, New Zealand

14:40-15:00 Invasion ecologists - essential for effective restoration decisions and actions
Judy Fisher, School of Plant Biology, University of Western Australia, Fisher Research, Australia

15:00-15:20 Thuja - successful project for general public awareness rising about IAS threats
Nejc Jogan, Dept. of Biology BF UL, Slovenia

15:20-17:00 Poster session & Coffee break

17:00-18:20 Session 8: Introduction pathways and spread of invasive species (4 lectures)
Chairman: Petr Pyšek

17:00-17:20 Estimating the true spread progress of an aggressive weed invasion using imperfect survey data and hierarchical Bayesian modelling
Thomas Mang, Vienna Institute for Nature Conservation & Analyses; and Department of Conservation Biology, Vegetation and Landscape Ecology; Faculty Centre of Biodiversity, University of Vienna, Austria

17:20-17:40 Predicting the spread of invasive plant species
Bruce Osborne, UCD School of Biology and Environmental Science, Ireland

17:40-18:00 Low persistence of a monocarpic invasive plant in historical sites biases our perception of its invasion dynamics
Jan Pergl, Institute of Botany, ASCR, Czech Republic

18:00-18:20 From ornamental to invasive: the role of introduction history, species traits, and climate in explaining the fate of Asian woody species in Europe
Margherita Gioria, University of Konstanz, Germany

18:20-18:40 Introduction to the mid-conference excursion
On the legacy of Imre Szenczy - current invasion tendencies in Western Hungary
Lajos Balogh, Savaria Museum, Natural History Collection, Hungary

18:45 Transfer to the Conference Dinner
Departure: Cultural and Youth Centre of Vas County
Address: 9700 Szombathely, Ady tér 5

19:00 Conference Dinner (optional program)
Venue: Tó restaurant
Address: 9700 Szombathely, Rumi Rajki sétány 1.
Ticket for the Conference Dinner costs Euro 20 per person.
After the dinner participants will be transferred to the official conference hotels.

2nd September, Friday

08:00 Mid-conference excursion
Departure: Cultural and Youth Centre of Vas County
Address: 9700 Szombathely, Ady tér 5.
Duration: 11 hours
After the tour participants will be transferred to the Open-air Ethnographical Museum (Village Museum) of County Vas.
The tour is included at the registration fee of the conference participants.
Ticket for accompanying persons costs Euro 20 per person.

19:00 Dinner with folklore program
Venue: Open-air Ethnographical Museum (Village Museum) of County Vas
Address: Szombathely, Tóth Árpád utca 30.
The dinner is included at the registration fee of the conference participants.
Ticket for accompanying persons costs Euro 25 per person.
After the dinner participants will be transferred to the official conference hotels

3rd September, Saturday
Venue: Cultural and Youth Centre of Vas County, Conference Hall
Address: 9700 Szombathely, Ady tér 5.

08:30-15:30 Registration

09:00-09:50 Invited speaker: Philip Hulme
Botanic gardens and the spread of environmental weeds: causes, consequences and codes of conduct
Philip Hulme, Bio-Protection Research Centre, Lincoln University, New Zealand

09:50-10:50 Session 9: Plant invasion in a changing world (3 lectures)
Chairman: György Kröel-Dulay

09:50-10:10 Socio-economic legacy yields an invasion debt
Franz Essl, Environment Agency Austria, Austria

10:10-10:30 Current and future climate hotspots for invasive alien plants in Australia
Paul Downey, Institute for Applied Ecology, Australia

10:30-10:50 Rapid global change: implications for defining natives and aliens
Bruce Webber, CSIRO Climate Adaptation Flagship, Australia

10:50-11:20 Coffee break

11:20-12:40 Session 10: Invasion patterns and invasibility (4 lectures)
Chairman: Franz Essl

11:20-11:40 Exploring the effects of propagule pressure, climate and land use on alien and native species richness along elevational gradients
Federico Tomasetto, Bio-Protection Research Centre, New Zealand

11:40-12:00 An analysis of the factors that influence the abundance of Ambrosia artemisiifolia in arable fields of Hungary using classification and regression tree models
Gyula Pinke, Faculty of Agricultural and Food Sciences, University of West Hungary, Hungary

12:00-12:20 The relationship between native and naturalized floras under levels of disturbances: Approaches on biodiversity and species association
Shan-Huah Wu, Institute of Ecology and Evolutionary Biology, National Taiwan University, Taiwan

12:20-12:40 Spatial heterogeneity and disturbance create positive native-alien relationship in agricultural habitats
Miia Jauni, Department of Agricultural Sciences, University of Helsinki, Finland

12:40-14:00 Lunch

14:00-15:00 Session 11: Mapping, inventories, databases
Chairman: Barbara Tokarska-Guzik

14:00-14:20 Invasions of non-native plant species and habitat changes in the western ghats of Tamil Nadu, India
Balaguru Balakrishan, Loyola College affiliated to Madras University, Chennai, India

14:20-14:40 Mapping Arundo donax L. (giant reed) an invasive species in the Federal District of Brazil
John Hay, Universidade de Brasilia, Brazil

14:40-15:00 EDDMapS and Other Invasive Species Internet Resources of the Bugwood Center for Invasive Species & Ecosystem Health www.bugwood.org
G Keith Douce, Center for Invasive Species & Ecosystem Health, University of Georgia, USA

15:00-15:30 Closing ceremony

Abstracts of the oral presentations

Invited Speaker

(Plant) invasion science: The roads travelled & the roads ahead

David M. Richardson
Centre for Invasion Biology, Stellenbosch University, South Africa

Invasion ecology has made huge strides in the past few decades, but is facing new challenges on many fronts. This presentation explores some of the major advances in the study of plant invasions and gives a personal and subjective view of important directions for research into the future. Using a large sample of research papers published in 2008 (50 years after the publication of Charles Elton's milestone volume), the paper assesses some seminal contributions to date. The main areas of research activity are examined and recent developments and trends are discussed. The emergence of studies in the field of biosecurity and the urgent need to undertake transdisciplinary research within the broader discipline of "invasion science" are examined. The paper ends with a brief overview of a recent multi-disciplinary examination of Australian *Acacia* species as introduced species around the world.

Session 1 - Biology of invasive alien plants

Role of species traits, plasticity and local differentiation in plant invasions: four *Impatiens* species in Central Europe

Hana Skálová[1], Lenka Moravcová[1], Jan Čuda[1,2], and Petr Pyšek[1,2]
[1]*Institute of Botany, Academy of Sciences of the Czech Republic, CZ-252 43 Průhonice, Czech Republic, e-mail: hana.skalova@ibot.cas.cz*
[2]*Department of Ecology, Charles University, CZ-128 01 Viničná 7, Prague, Czech Republic*

Species traits, plasticity, and local differentiation are assumed to affect the success of invasive plants. By comparing four *Impatiens* (Balsaminaceae) species occurring in Central Europe: native *I. noli-tangere*, highly invasive *I. glandulifera*, less invasive *I. parviflora*, and potentially invasive *I. capensis*, we minimized phylogenetic and habitat-related biases. In a complex study we investigated the seed bank in the original localities, germination timing, frost resistance, response to environmental factors (three levels of nutrient availability and water supply, and two levels of irradiance) in growth chambers, seedling appearance in an experimental garden, and micro-site preferences in the field. We found differences in the performance of species and their populations. The invasion success of *I. glandulifera* is likely to be driven by early emergence of the seedlings and the size of the adults. On the other hand, native *I. noli-tangere* possesses some advantageous traits such as seed bank, comparably high frost resistance, ability to exploit high nutrient levels, good performance under shade, and tolerance to low levels of nutrients and water. Response of the species studied to water levels and simulated canopy shade is in accordance with their different micro-site preferences in the field and indicates thus possible but limited coexistence in the field. Differences in germination timing and frost resistance of *I. noli-tangere, I. glandulifera* and *I. parviflora* populations reflected frost sensitivity of the species, and temperature at the seed-source localities. In addition, individual populations within all four species differed in the response to environmental factors. Performance of *I. capensis* was within the scope of other congeners, which suggests that there are no ecological barriers to its potential spread into Central Europe. Since local differentiation was found both in native and invasive species studied, it is unlikely to provide the invasive *Impatiens* species with an advantage against the native congener.

Quantifying the roles of life-history traits, biogeography, climate match and propagule pressure in invasions

Kirsty F. McGregor[1], Michael. S. Watt[2], Philip E. Hulme[3], Richard P. Duncan[4]
[1]*The Bio-Protection Research Centre, Lincoln University, PO Box 84, Canterbury, 7647, New Zealand, Kirsty.Mcgregor@lincolnuni.ac.nz*
[2]*Scion, PO Box 29237, Fendalton, Christchurch, 8041, New Zealand, Michael.Watt@scionresearch.com*
[3]*The Bio-Protection Research Centre, Lincoln University, PO Box 84, Canterbury, 7647, New Zealand, Philip.Hulme@lincoln.ac.nz*
[4]*The Bio-Protection Research Centre, Lincoln University, PO Box 84, Canterbury, 7647, New Zealand, Richard.Duncan@lincoln.ac.nz*

Invasion biologists have identified multiple factors conferring invasion success, including life-history, biogeographic and human influences. Recent theoretical advances in invasion biology have stressed the importance of viewing invasions as a stage-based process (introduction, naturalisation and spread), where different factors are likely to influence success at each stage. Work integrating these two ideas in an analytical framework is relatively new, yet has already yielded novel insights into invasion drivers. In this study we aimed to quantify factors conferring success at each stage of the invasion process, and how those factors interact with each other, at two locations (New Zealand and the United Kingdom) for the economically important genus *Pinus*. Comparing drivers for one genus in two regions provides replication, which will allow us to assess whether each factor works in a similar way in different regions. For each species we gathered data on life-history traits, native range attributes, climate match and economic uses. We determined which species had been introduced, which species naturalised, and the date of these events using historical sources. We quantified lag-phases and spread by searching national weed occurrence databases for naturalisation dates and locations of wild populations. For each species, propagule pressure was quantified as hectares planted over time using historical records of state forestry planting. To deal with multicollinearity in the explanatory variables we used sparse principle component analysis (SPCA) to extract two components that reflect the major axes of variation in several correlated life-history traits. We quantified the importance of each explanatory variable and/or sparse component using boosted regression tree (BRT) models, modelling each invasion stage separately. Three variables explained over 50% of the variation in introduction success: climate match (32%), native range area of occupancy (14%), and maximum height (11%). Similarly, three variables explained over 60% of the variation in determining which introduced species naturalised: total area planted (31%), climate match (24%) and minimum juvenile period (14%). Our results thus highlight the dominance of anthropogenic effects at both the introduction and establishment stages, with humans selecting common and climatically suitable species for introduction, with fast maturing, widely planted and well climatically matched species more likely to naturalise. We propose that biological traits appearing to confer invasion success, such as height and fast maturation, are traits favoured through human selection, which are then confounded with factors such as planting effort. Further analysis will focus on identifying factors controlling spread, and developing structural equation models to tease apart the relationships between the key explanatory variables we have identified here.

A Trait Fair of Invasive Species in Germany

Ingolf Kühn
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To understand what the factors that make a species invasive, traits of plant species were analysed for almost two decades now. Though the results differ, it seems that some patterns recur frequently. Here I am going to review works on trait compositions of alien and native plant species as well as trait analyses of successful and less successful alien plant species in Germany.
The main results can be briefly summarized as follows:
Successful invaders in Germany are hardy species with a wide native range that are frequently planted in Botanic Gardens in Germany. In a multiple model combing a variety of traits, it seemed that no single trait was significant but interactions among traits were most important, especially those related to flowering season with shoot metamorphoses, mode of pollination and degree of ploidy.
Comparing the frequency of traits native species and of alien species in Germany, we showed that they differed remarkably in their trait compositions within grid cells of the floristic mapping scheme. Neophytes were over-represented in insect- and self-pollinated species and in species with a later and longer flowering season. Furthermore, the proportions of species with mesomorphic or hygromorphic leaf anatomy, of annual herbs and of trees as well as of non-clonals and polyploids were significantly higher in neophytes than in natives.
Lastly, we analysed the distribution of leaf traits in Germany in relation to climatic gradients and applied a climate change scenario. Species with scleromorphic leaves were more frequent in the East of Germany as well as in the Swabian-Frankonian Alb. Species with hygromorphic leaves were more frequent in the nortwestern lowlands and the souteastern mountain ranges. We found a clear relationship between the climatic gradient of water availability and shifts in leaf anatomies: increasing water deficit was associated with a decreasing proportion of species with hygromorphic leaves in the composition and increasing proportions of species with scleromorphic and mesomorphic leaves. The variation in leaf anatomies due to land use was only small. Under future environmental scenarios the proportion of species with hygromorphic leaves was projected to decrease in all parts of Germany, whereas the proportions of species with sclero- and mesomorphic leaves were projected to increase on average. In particular, Germany's south-western and north-eastern areas were projected to experience functional change in leaf anatomy.

Session 2 - Genetics and evolution of invasive plants

What can intra-specific molecular variation tell us about *Acacia saligna* invasions in South Africa and what are the implications for species distribution models?

Johannes J. Le Roux[1], Genevieve Thompson[1], David M. Richardson[1], John R.U. Wilson[1,2]
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[2]*South African National Biodiversity Institute, Kirstenbosch National Botanical Gardens, Claremont 7735, South Africa.*

Research investigating the genetic makeup of alien invasive species in both their native and invasive ranges has the potential to improve our understanding of ecological and evolutionary processes determining their success. *Acacia saligna* (Labill.)H. L. Wendl. is a species complex native to the southern regions of Western Australia and is an aggressive invader in South Africa (and many other regions). We investigated variation at microsatellite loci to compare population genetic structures between invasive and native ranges of *A. saligna.* Bayesian and frequency-based analyses assigned the majority of invasive populations in South Africa to a single genetic entity (tentatively termed a sub-species) of *A. saligna* found in Western Australia. These results were confirmed by reconstructing a phylogeographic network based on DNA sequence data. Levels of microsatellite diversity (number of alleles, number of private alleles and heterozygosity) were similar in the native and invasive ranges, indicating that the majority of genetic diversity resided within populations. Overall, high genetic diversity and low population genetic structure support the known introduction history of the *A. saligna* to South Africa. Lastly, we developed species distribution models in MAXENT to project the distributions of the four known subspecies of *A. saligna* in their native and introduced ranges. Together with niche similarity tests and range size calculations, these models were able to detect variation in the niche between the subspecies in their native and introduced ranges. Moreover, when considering *A. saligna's* current invasive distribution, the models supported molecular data in suggesting that only a proportion of the native subspecies are currently present in South Africa. Together, these lines of study both elucidate aspects of the invasion ecology of *A. saligna*, and suggest strategies to improve the management of the species in South Africa and other parts of the world.

Comparisons between native and introduced genotypes of *Solidago gigantea*: a transcontinental common garden experiment

Robert W. Pal[1], Lauren Waller[2], Ambra Tosto[3], John Maron[2], Ragan M. Callaway[2]
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Giant goldenrod (*Solidago gigantea*) is one of the most problematic invasive plant species in Central Europe. It was introduced from North America to Europe in the 17th century as an ornamental. Today it dominates large areas of wet riparian vegetation and it is spreading towards drier habitats. We set up a transcontinental common garden experiment to determine: 1) whether introduced genotypes of *S. gigantea* have rapidly evolved adaptation to wet or dry habitats in Europe and 2) to compare levels of adaptation to those exhibited by native North American genotypes and 3) explore whether herbivore or pathogen resistance varied between native and introduced genotypes. We transplanted seedlings into wet and dry habitats in Europe (Hungary) and USA (Montana). In this study we report the results of the first vegetation period only.
In the native range, invasive genotypes performed significantly worse than native genotypes when considering vegetative morphological characters. Invasive genotypes produced fewer and smaller leaves ($p<0.001$), less lateral shoots ($p<0.001$) and were smaller than native genotypes ($p<0.001$). Native genotypes in the native range however, accrued more herbivore and pathogen leaf damage than did non-native genotypes ($p<0.01$). Interestingly native genotypes also accrued more herbivore damage than non-native genotypes in the invaded range ($p=0.06$).
In the invaded range plants from dry habitats performed worse than plants from wet habitats, in both dry and wet plots. Invasive genotypes here produced taller stalks ($p<0.001$) and more, leaves ($p<0.001$) than did native genotypes. Interestingly however, the longest leaves were produced by native genotypes ($p<0.001$).
Mortality was significantly higher in dry habitats in both ranges. Invasive genotypes showed higher mortality in the dry habitats of the native range. Native genotypes from wet habitats showed high mortality in the dry habitats of the invaded range. In the native range no plants flowered in the first year, but in Europe 32 (out of 960) plants flowered of which 20 belonged to the wet habitats of the native range. On the other hand non-native genotypes produced almost two times more lateral shoots than native ones in the invaded range. These results show a powerful shift towards greater investment in asexual reproduction over sexual reproduction for non-native genotypes. Our results suggest that genotypes from different continents and from different habitat conditions show a strong adaptation to their original environment and if they are transplanted to a new environment they perform generally worse.

Comparative epi-genetic and genetic population structure of the highly invasive bunch grass, *Pennisetum setaceum* along an environmental gradient in South Africa

Marguerite Blignaut, Johannes J. Le Roux
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Apomictic breeding systems are frequently associated with highly successful plant invaders and are generally linked with developmental and phenotypic plasticity. The apomictic bunchgrass, *Pennisetum setaceum* (fountain grass) conform to these generalizations and is a highly successful invasive species globally. Previously, no genetic variation has been reported for invasive and native populations of fountain grass and high levels of phenotypic plasticity. These findings may indicate that epigenetic variation underlies environmental responses in fountain grass. Epigenetic variation is heritable, biochemical changes to DNA, without change to the underlying DNA sequence, that alters gene regulation and thus phenotypic variation. Here we report on the population genetic and epigenetic structure of three highly invasive South African populations of *P. setaceum* along an environmental gradient. Although monoclonality could not be confirmed, little genetic structure and low variation was observed using inter-simple sequence repeat (ISSR) analysis (Φ_{ST} = 0.19). Using Bayesian assignment tests and principle coordinate analysis we furthermore assessed and compared population genetic and epigenetic structure using amplified fragment length polymorphism (AFLP) and methylation-sensitive amplified fragment length polymorphisms (MS-AFLP), respectively. Our study populations invade very different climatic regions (an arid and a high rainfall region respectively), and MS-AFLP analysis showed strong geographically linked population epigenetic structure (Φ_{ST} = 0.466). Together with low genetic structure these results indicate that population epigenetic structure is primarily environmentally influenced. These findings support epigenetic phenomena as important drivers of phenotypic plasticity in natural populations and present an alternative mechanism that may underlie the so-called lag phase often experienced by newly introduced species.

Seeds are the predominant vectors of initial colonization of the invasive common reed (*Phragmites australis*) along highway ditches and in freshwater wetlands

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The introduced subspecies of the common reed (*Phragmites australis* ssp. *australis*; Poaceae) is considered one of the most invasive plants in North America. It spreads both by vegetative means (fragments of rhizomes, runners or stems) and sexual reproduction (seeds), but the relative importance of these two mechanisms in the initial establishment of new populations is unknown.
To resolve this issue, we examined the genetic variation between and within several *Phragmites* populations in two habitats highly colonized by the species in Quebec (Canada): roadside ditches and freshwater wetlands. We randomly selected 99 linear stands along a 416-km stretch of a highway (H20) and 10 independent circular stands in a freshwater wetland (Parc national des Îles-de-Boucherville). For sampling purposes, H20 was divided into three segments of equal length but differing in age and density of the stands.
A systematic three-tiered sampling strategy was used. At a first level, a leaf sample from a single individual located in the center of each stand was collected. At the second level, eight other leaf samples were collected along the length of linear stands (highway) or along the cardinal axes of circular stands (wetland). At the third level, four additional samples were collected in the immediate vicinity of each of the nine previously collected samples (tiers 1 and 2). Thus, for each stand, a total of 45 leaf samples were collected. DNA was extracted from dried leaf samples and a set of six nuclear microsatellite markers was used on each DNA sample subjected to genetic analysis.
Among the 99 highway stands, at the first sampling level, 81 different genotypes were observed and no genotype was common to more than three stands. At the second level, 44 stands contained a single genotype (among the nine individuals sampled), 25 stands contained two different genotypes and the remaining 30 stands comprised between three and eight genotypes. In the wetland, at the first sampling level, all ten stands differed in their respective genotype. At the second level, seven of the stands were composed of nine identical individuals. Further genetic analyses (third sampling level) are being conducted on stands containing at least two genotypes.
These data strongly suggest that seeds play a predominant role in the initial establishment of new stands (high genetic diversity between stands), after which asexual spread contributes to the expansion of the stands on a local scale (low genetic diversity within stands). The predominant role of sexual reproduction in the spread of *Phragmites* appears to be a recent phenomenon and has important implications for the management of this highly invasive species.

Session 3 - Risk assessment, prioritization and policy making

The need to align local priorities and government initiatives to improve invasives species management on private lands

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In Australia, invasive plant species are a major threat to Australia's biodiversity and agricultural areas because they out compete native species, threaten productive systems and contribute to land degradation. Invasive plants cost the Australian community AUD 4 billion a year, either in control measures or a loss of primary production. Yet, the recognition that invasive plant species pose a significant threat to biodiversity has not directly translated into effective policy reforms (e.g. a ban on the use of introduced species for productive purposes), invasive species policies (e.g. commitment to maintain existing containment lines) and management strategies (e.g. adoption of methods to prioritize management of multiple invasive species with minimal cost). Landholders in Australia are legally responsible for invasive species management on their property, whether those species affect local biodiversity or their productive land uses. It is generally accepted that a number of widespread invasive plants are unlikely to be eradicated, however no formal approaches exist, however, to assist landholders in the management of invasive plant species on their property. We conducted 20 semi-structured interviews with landholders in central Queensland, Australia. We examined their willingness to participate in conservation initiatives and programs to improve riparian and in-stream condition, including invasive species control. Our results showed that there was a significant mismatch between the conservation priorities of landholders and government initiatives. Landholders were frustrated that government conservation programs primarily focused on biodiversity conservation, while they view invasive species management as the leading conservation and production priority on their land. The majority of surveyed landholders ranked invasive species management as their top one or two priority activities, out of seven, for environmental improvement on their properties. Similarly, there was a significant relationship between weed management as a priority for both production and environmental improvement on properties. Landholders also identified both public and private benefits from invasive management on their properties, most commonly identifying improved production, better quality land to hand to future generations and enhanced aesthetics. Based on the results of our survey we propose that participation in biodiversity conservation programs in Queensland may increase if government and non-government agencies offer programs that aim, holistically, to reduce the threat and abundance of invasive species, rather than focusing on biodiversity conservation activities per se, such as species protection. Landholders may also be more willing to make an in-kind contribution if local outreach and conservation coordinators are available to evaluate the invasive species management needs at both the catchment scale and individual property scale to strengthen private action.

The National Invasive Species Information System: Providing data for decision making regarding plant invasions in Mexico.

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The National Information System on Biodiversity (NISB) in Mexico is maintained by the National Commission for the Knowledge and Use of Biodiversity (CONABIO), which, among other functions, acts as an advisory body to different levels and sectors of the government by providing science based information to be used during the decision making process. The growing threat posed by the presence of invasive species in the country let to the creation, in 2007 of the National Invasive Species Information System (NISIS), which is a part of the NISB. Its aims are to gather information on the situation of the invasive species in the country in order to contribute to the conservation of Mexico´s natural capital.
The information is gathered mainly through NISB, by supporting specific projects aimed to fill information gaps, but other sources are government agencies, academic experts, other datasets and scientific papers. Although it is still a work in progress, the system currently has a specific tool to manage invasive species information and holds a list of 408 species recognized as invasive, among which approx. 50% are terrestrial or aquatic plants, 120 species information sheets and over 93.000 records of occurrence across the country.
This effort has been parallel to collaborative work with other institutions, both at a regional and national level, and the development of the National Strategy for IAS in Mexico, which was published and presented in September 2010. It is focused on aligning and coordinating efforts of a broad range of governmental agencies and stakeholders; working towards addressing the different components of the problem. To help fulfill the goals of the strategy, CONABIO will be required to continue providing information to support the actions of other institutions relevant to the prevention, control and eradication of specific species. This includes linking different national and international datasets, to obtain an accurate picture of the situation and the potential risks. The information currently hosted by the NISIS has been used to detect information gaps, predict probable areas of risk and support imports decisions. This work provides some examples of how the system has been used and the implications for the future.

Catalogues of alien plant species for Poland: implication for conservation, management and legislation

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It is predicted that during forthcoming decades the continued degradation of the natural environment at a global scale will generate further biodiversity decline. Among the processes associated with those changes one should expect an increase in the intensity and frequency of biological invasions. These invasions are difficult to conquer where the organisms have already increased significantly beyond their natural ranges. Therefore attempts to stop intentional or unintentional introductions of new species are still undertaken. One such initiative across member states of European Union is the elaboration of the *European Strategy on Invasive Alien Species*. International documents on nature protection ratified by Poland and the fact of our country's accession to the European Union require the preparation of a comprehensive national strategy of alien species management.
Among available prevention actions, great stress should be put on monitoring alien species at different scales. In practice, the principles for undertaking action should be based on the identification of a particular alien species, assessing the degree of its naturalisation, predicting the possibility of further spread and the negative influence on native organisms or ecosystems. Preliminary activities include the creation of different types of alien species lists: "*black lists*" – species whose introduction is strictly regulated, "*white lists*" – alien species assessed as low risk and unlikely to threaten biodiversity or ecosystem services and "*grey lists*" – to include any species not listed on a black or white list or for which data is deficient. In practice the utilization of these types of lists requires solid knowledge of the biology, ecology and current distribution of the alien plant species in the territory of the given country.
The aim of the present study is to gather current knowledge on alien plant species for Poland and to identify actual and potential highly invasive species. To achieve this, it is necessary to develop and achieve acceptance of a robust system based on solid science, with a clear invasion terminology and transparent risk assessments which is also understandable by a wider public.
Alien plants contribute 29 % of species, i.e. 1017 taxa, to the flora of Poland. This includes *ca*. 160 archaeophytes, over 300 neophytes and 511 ephemerophytes. The members of all these groups require cyclical assessment of their current distribution and requirements for management. We are producing selected and up-to-data catalogues of alien species for Poland, which might be a base for developing the black and grey lists and could be used to help to develop regulatory measures to prevent the introduction, establishment, spread and negative effects of invasive alien species. We also advocate testing the prioritisation process for invasive alien plants proposed by the EPPO and make recommendations for preparation of a framework of organizational and legal solutions.

Quantifying risks and effects: The Norwegian classification system for alien species

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Most national classification schemes for alien species are based on qualitative sets of criteria. Qualitative criteria have the benefit of requiring few data and comparatively little time. Quantitative sets of criteria, on the other hand, can be argued to outweigh these benefits by a number of important advantages: a classification of alien species based on quantitative criteria is less vulnerable to subjectivity and arbitrariness; it is transparent and testable; it is easily adjustable to new knowledge about the biology of the species or to changing environmental conditions; it is comparable across different taxa; it allows a standardised treatment of uncertainty or data paucity. All of this increases the legitimacy of the resulting classification, both in terms of scientific legitimacy of the results, and of political legitimacy of the management action derived from these results.
We present a novel classification system of alien species, which is based on quantitative criteria, and which will be the basis of the revision of the earlier Norwegian Black List. The main feature of the proposed classification system is that it is two-dimensional: alien species are assessed along two independent axes, a spread axis and an ecological effect axis. By addressing these two properties of alien species separately, the resulting classification is more informative.
The placement of alien species along each of the two axes is determined on the basis of a number of different criteria. Spread/establishment risk is determined based on the estimated spread velocity; on the populations' expected lifetime as derived from a population viability analysis; and on the proportion of different habitat types that are projected to be occupied by the species. Ecological effect is inferred from interactions with native species; from state changes brought about in natural habitat types; and from the probability of transmission of genetic material and/or diseases or parasites to native species. Effects on threatened native species or native key species, and state changes in threatened or naturally rare habitat types, receive greater weight.
Along each axis, the species receives the highest category in which at least one criterion is fulfilled. This takes the precautionary principle into account, and allows at the same time the classification of species with incomplete data. Uncertainty is incorporated by means of confidence intervals.

Prioritization of alien plants for risk analysis

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Invasive alien plants are recognized as a problem of growing importance in Europe as alien plants are still being introduced deliberately or involuntarily. In order to reduce the threats of new plants becoming invasive, risk analysis should generally precede the importation or planting of species. It is also applied to support decisions about eradication or containment measures against invasive plants. For risk assessment, an EPPO (European and Mediterranean Plant Protection Organisation) pest risk assessment (PRA) scheme is available. The scheme follows the internationally acknowledged IPPC standard.
As a full pest risk assessment is a time-consuming task and the candidate species are numerous, a prioritization of alien species for PRA is necessary. As there is no existing widely agreed method to identify those alien plants that are considered invasive and represent the highest priority for pest risk analysis such a prioritization process was developed in the framework of EPPO's ad hoc Panel on Invasive Alien Species.
The process is designed to produce a list of invasive alien plants that are established or could potentially establish in the EPPO region and to determine which of these have the highest priority for PRA. It consists of compiling available information according to pre-determined criteria. We introduce the main principle of the process and show the results of running the process with different sets of example species.

Session 4 - Plant invasion in protected areas

Nature rearranged: assessing invasive alien species as a driver of environmental change in South African National Parks.

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To develop appropriate policy and management recommendations, assessments of the state of knowledge are required. Science provides a large body of literature, rigorously developed, tested and debated. Much of this scientific knowledge remains out of the grasp of policy makers, and largely in the realms of the scientists' peers. Assessments provide a platform for harvesting, analysing and synthesising information to provide policy outcomes. Here we undertake an assessment of the status of biological invasions across the South African National Parks estate, which covers some 39,000 km^2, or about 50% of South Africa's conservation land area. SANParks' estate has been invaded by a wide range of taxa; mostly vascular plants, but also with, for example, insects, pathogens, fish, birds, snails and earthworms. The overall abundance of invasive alien taxa in SANParks is assumed to be low, except in certain key areas. However, it is difficult to determine if this current scenario is due to the low invasibility of the site or ongoing management actions. Time since introduction and propagule pressure in the adjacent areas are probably also key factors. However, there are very few examples for which the exact pathway of introduction into a specific park is known. Moreover, while invasions present a substantial threat alone, synergistic interactions with drivers such as climate change, increase the likelihood of causing irreversible environmental harm. Thus while the assessment aims to collate current understanding, multiple scenarios of future change remain pivotal. This assessment aims broadly to 1) determine the current status of invasion in South Africa's national parks, 2) to assess what information is available, 3) identify knowledge gaps and priorities for future research, 4) determine options for enhanced management, and 5) provide policy and management recommendations.

Ornamentals as invasive plants in Białowieża Forest (NE Poland) – winners and losers

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Ornamental plants are one of most important sources of invaders. In Białowieża Forest, 118 taxa of non-woody ornamental plants were found growing spontaneously, 59 as ephemerals only and 51 established at least in disturbed habitats. For 8 taxa we have still incomplete information. At least fifteen ornamental species are spreading into natural communities and could be a threat to the native vegetation of Białowieża Forest in the future. Most dangerous are plants well known as invaders in other parts of the world: *Echinocystis lobata*, spreading in reed communities along rivers, *Elodea canadensis*, widespread in water vegetation, *Impatiens parviflora*, the most successful invader in forest communities. However, other well known invasive plants, for example *Impatiens glandulifera*, *Reynoutria japonica*, *Rudbeckia laciniata* have had little success in Białowieża Forest. The author analyses the success of particular species, measured as the number of spontaneous localities in connection with cultivation features (date of introduction, number of cultivated individuals), landscape features (occurrence of proper habitats) and biological features of the particular plant (life form, dispersal modes, ability to reproduce vegetatively etc.).

Managing alien plant invasions in Pannonian region – lessons learned from LIFE Nature projects in Hungary

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Hungary is substantially affected by alien plant invasion both in cultural landscapes as well as in natural areas. The country gives high priority to measures combating the invasions, as some plant species are meanwhile significantly affecting the conservation status of protected areas and become more and more threatening to certain branches of national economy and even to human health. After joining the EU Hungary participates also in the LIFE Nature program of the Union. Since 2002 numerous projects have been focusing on combating invasive plants, such as the Giant and Canadian Golden Rod *(Solidago gigantean, S. canadensis)*, Black Locust (*Robinia pseudo-acacia*), Black Cherry (*Prunus serotina*) and Milkweed (*Asclepias syriaca*). These species increasingly invade in and affect valuable and rare habitats in protected areas inclusive sites of Community importance designated within the scope of the NATURA 2000 network.
In this contribution best practice experiences and lessons learned resulting from already completed or still ongoing project are presented. Based on the results of different vegetation management practices applied in projects implemented mainly by numerous National Park Directorates (e.g. Balaton Uplands, Kiskunság, Duna-Ipoly, Duna-Dráva, Körös-Maros and Hortobágy) diverse methods combating selected plant aliens are compared in respect of their effectiveness and sustainability.
Robinia pseudo-acacia, a very common cultivated tree species of the Hungarian Plain, frequently spreads by root-sprouts and by seed germination after fire events. Among the most threatened indigenous forest habitats are steppic oaks. *Prunus serotina* was mixed into *Pinus* plantations and from there it invades in oak stands and other habitats by seeds distributed by birds, but it does not develop root sprouts. *Asclepias syriaca* penetrates in steppic vegetation by rhizomes and at the same time it occupies new suitable habitats mainly by far-reaching seed dispersal.
Different methods have been used to suppress or eliminate target alien species. For example, in case of woody species their harvest was followed by chemical treatment of stumps or resprouts in the subsequent years, stem injection by herbicides with removal of dried dead trees or bark ringing or, in case of herbaceous invasives, chemical treatment of individuals or entire stands, frequent mowing and/or grazing. Obviously each alien plant invasive require specific management measures according their ecology and population biology.
The most efficient methods tested so far will be presented and their advantages and disadvantages discussed. However, the knowledge and experience is still very incomplete and fragmentary. In order to achieve soon better results in the large-scale combating it is necessary to not only systematically collect further data and field experience but also to accompany further practical testing and application of promising management methods by proper scientific research and monitoring.

Invited Speaker

Studying mountain plant invasions using a multi-scale approach: From ecology to management.

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Mountain plant invasions represent both an interesting study system as well as an important conservation issue. Although mountains were a long time considered resistant to plant invasions, evidence is increasingly showing that plant invasions have simply taken longer to invade higher elevation areas, but that these areas are under similar threats to lowlands. In this presentation, I highlight the challenges and opportunities to study plant invasions both as an ecological phenomenon and as a threat to biodiversity conservation. My review is based on the collaborative work of MIREN (Mountain Invasion Research Network) which encompasses scientists and managers from across the globe. MIREN has used a hierarchical multi-scale approach to survey invasive plants in all of the network's core regions (Pacific Northwest of the USA, Swiss Alps, Hawaii, Canary Islands, Chilean Andes, Australian Alps, Himalaya, South Africa and the Northern Scandes). The results indicate that the factors that determine the abundance and distribution of invasive plant species are scale dependent. Globally, the history of introduction of non-native plants and climate are the main drivers of plant invasions into mountains. Convergence of non-native plant flora can be seen across widely separated regions (e.g. Australia and Chile). Regionally, factors such as land use and propagule pressure tend to show a higher influence on patterns of distribution and abundance of non-native flora. Locally, the elevational gradient is the strongest factor in determining the number and abundance of non-native plants. At the same time, the assembly of non-native floras across the elevational gradient is caused by the unidirectional advance of species from lowland to highlands, causing the ecological filtering of generalist species towards higher elevations (harsher environments). Contrary to ecological patterns, management of invasive plants in mountain environments is highly inconsistent, even in ecologically similar regions. The threat of invasive plants seems to be globally underestimated. However, countries with higher economic development have already started to take action to control the most invasive species. In developing countries, awareness of the threat from invasive plants in mountains is still very low. This talk not only summarizes the theoretical and applied advances in understanding invasive plants in mountain ecosystems but also serves as an example of the power of collaborative international networks on the theme of biological invasions.
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Session 5 - Impact of invasive plant species

Mechanism of interference between invasive knotweeds and their native competitors

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There is increasing evidence that some of the most successful and troublesome invasive plants can suppress the growth of their native competitors through allelopathy. One of the most dominant and at the same time least understood group of plant invaders in Europe and North America are the clonal knotweeds (*Fallopia* spp.). In a series of experiments, we investigated the mechanisms of interference – resource competition and allelopathy – that make invasive knotweeds such superior competitors. In two parallel experiments we studied the effects of *Fallopia* plants, *Fallopia* litter and soil residues on the germination and growth of several native European plant species. We used activated carbon to test for allelopathic effects and separate allelopathy from resource competition. Our results show that invasive knotweeds indeed exert allelopathic effects, even when it is only a rather minor component of the community, but that these allelopathic are subtle, altering life-history traits of the natives, rather than overall native biomass. We did not find any effects of *Fallopia* soil residues on the germination of natives. In another set of experiments, we explore how different levels and temporal fluctuations of nutrient availability affect the dominance of knotweeds over natives. We also used stable isotopes to track nutrient pulses in situations where *Fallopia* is competing with natives. Preliminary analyses of these data indicate that invasive knotweeds benefit particularly from increased temporal heterogeneity of resources, which suggests that, compared to the native plants, *Fallopia* might have a superior ability to take advantage of temporary nutrient pulses. Other, ongoing follow-up experiments investigate the role of soil biota and soil quality in mediating allelopathic effects, as well as the consequences of knotweed hybridisation for the species' allelopathic potential and invasiveness.

Allelopathic potential of some invasive or potentially invasive neophytes occurring in Hungary

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Allelopathy may play an important role in the invasion success of adventive plant species. The aim of this study was to determine the allelopathic potential of some invasive or potentially invasive alien plant species occurring in Hungary. Juglone index of fourteen woody and twenty-one herbaceous alien plant species was determined by the method of SZABÓ (1999), comparing the effects of juglone and substance extracted of plant species with unknown allelopathic potential on the germination rate, shoot length and rooth length of white mustard (*Sinapis alba* L.). Results have proven a more or less expressed allelopathic potential in case of all alien plant species. The juglone index at higher concentration extracts (5 g dry plant material extracted with 100 ml distilled water) of almost every studied species approaches to 1 or is above 1, this means the effect of the extracts is similar to juglone or surpasses it. Among the herbaceous plant species *Phytolacca esculenta* VAN HOUTTE and *Heracleum mantegazzianum* SOMM. et LEV. achieved the highest juglone index. The juglone index of following herbaceous plant species surpassed the 1: *Impatiens balfourii* HOOK., *Impatiens glandulifera* ROYLE, *Rudbeckia laciniata* L., *Fallopia japonica* (HOUTT.) RONSE DECR., *Fallopia* x *bohemica* (CHRTEK et CHRTKOVÁ) J. P. BAILEY, *Impatiens parviflora* DC., *Phytolacca americana* L., *Rudbeckia hirta* L., *Asclepias syriaca* L.. In terms of juglone index of woody species, the allelopathic potential of false indigo (*Amorpha fruticosa* L.), tree-of-heaven (*Ailanthus altissima* (MILL.) SWINGLE) and hackberry (*Celtis occidentalis* L.) were the highest. Besides these species the treatment with the extracts of black walnut (*Juglans nigra* L.), black cherry (*Prunus serotina* EHRH.) and green ash (*Fraxinus pennsylvanica* MARSH. var. *subintegerrima* (VAHL) FERN.) reduced extremely significantly the germination rate, shoot and root length, compared to the control. In vitro researches are suitable for determining the allelopathic potential, but allelopathy should be proven under field conditions too, that is why we are going to investigate the allelopathic effect of above-mentioned five invasive woody species on oak seedlings in seed-orchard.
This study has been supported by TÁMOP-4.2.1.B-09/1/KONV project.

The impact of Himalayan balsam (*Impatiens glandulifera*) on invertebrate communities in the UK

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Himalayan balsam (*Impatiens glandulifera*) is now regarded as the most widespread non-native plant species occurring in riparian systems in the UK. Without management, Himalayan balsam can rapidly colonise a catchment where it can outcompetes native plant species reducing local biological diversity and can impact on the riverbank structure by leaving banks bare of supporting vegetation during the winter months and therefore liable to increase erosion. To-date there are few studies that have evaluated the impacts of non-native invasives plants on invertebrate populations and there are no known studies that have used Himalayan balsam as an example. When Himalayan balsam forms dense monocultures, like it does in the UK, these have the potential to outcompete native plants which in turn can displace their associated invertebrate fauna.

In 2006 we researched the impacts of Himalayan balsam on Carabid populations of exposed riverine sediments by comparing invaded and uninvaded sites in the South West of England using pitfall trapping and hand-searching methods. Then in 2007 we embarked on a two season study to evaluate the impact of Himalayan balsam on the invertebrate community within a 650ha public park in Middlesex, UK. We intensively sampled nine areas invaded with Himalayan balsam and compared them to nine uninvaded areas where the vegetation consisted predominantly of native plant species. Using soil cores, Vortis suction traps and ariel suction traps we sampled the invertebrate community within the vegetation at all structural levels at monthly intervals throughout the spring and summer months. Vegetation surveys at each site allowed us to relate the diversity and percentage cover to temporal changes in the invertebrate community.

This paper will present the results of both studies using multivariate statistical analysis to compare differences and patterns of invertebrate populations between the vegetation types. Based on our results we make recommendations for management and habitat restoration practices which may enhance both plant and invertebrate species diversity.

Session 6 - Interaction with other trophic levels: enemies and mutualists

Role of nitrogen fixing bacteria in the invasion success of Australian Acacias

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Several Australian Acacias have become invasive when introduced into novel areas within Australia. These invasive Acacias may have a detrimental effect on native flora and induce changes to below-ground microbial composition. It has been previously reported that the invasive success of Acacias in novel environments can be at least partly attributed to their ability to associate with N-fixing rhizobial bacteria. A glasshouse experiment had shown that there are significant differences in aboveground biomass between Acacia plants grown in soils from their native compared with non-native environment. The aim of this study was to assess the role of rhizobia in the invasion success of four Acacia species (*A. cyclops, A. longifolia, A. melanoxylon, A. saligna*) and closely related species *Paraserianthes lophantha* in their non-native environment within Australia. Rhizobial abundance, infectivity and efficacy from native and non-native soils of each species were estimated using the Most Probable Number (MPN) method. No significant differences in rhizobial abundance or efficacy among native and non-native soils were found, indicating that these five species are unlikely to be limited due to lack of symbiotic rhizobia when introduced to novel areas within Australia. Results from Terminal Restriction Fragment Length Polymorphism (T-RFLP) analysis to assess rhizobial diversity of native and non-native soils of these five species will enable an assessment of whether rhizobial diversity is reduced in the native range. The outcome of this study will enhance our understanding of the role of plant-soil interactions in Acacia invasions into novel ranges in Australia and also contribute towards a larger global framework of studies on the invasion ecology of non-native Acacias.

Do invasive species create a more negative soil-feedback than their native congeners?

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Several mechanisms have been proposed to explain the success of invasive plant species. The Novel Weapons Hypothesis states that invasive plant species possess biochemical compounds to which native plant species are not adapted and which are therefore harmful to them. Besides this direct effect, these biochemicals can also indirectly affect native plant species by disrupting the mutualistic relationship of plants with mycorrhizal fungi and soil microbes. So far, the Novel Weapons Hypothesis has been tested for only a few plant species. Whether it provides a general explanation for plant invasions remains unclear.
To test the generality of this hypothesis, we investigated the effect of 25 invaders and their native congeners on four other native species and on a plant community. The aim was to find out whether invasive species generally create a more negative soil feedback than closely-related native species. We pre-cultivated soil with either an invasive or a native species for six months and sterilized half of it afterwards in order to distinguish between direct and indirect effects.
We will present results from three experiments testing whether (i) soil pre-cultivated with invasive species have a more negative effect on germination and growth of four test species and a plant community compared to soil pre-cultivated with native species, and (ii) whether this effect vanishes in sterilized soils which would indicate an indirect negative soil-feedback.

Successful Invaders Co-opt Pollinators of Native Flora and Accumulate Insect Pollinators with Increasing Residence Time

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Pollination mode is an important reproductive characteristic, often assumed to play a considerable role in plant species invasiveness. We asked (i) whether alien and native species differed in the frequency of pollination modes (insect pollination, self-pollination, wind pollination, water pollination), (ii) whether the pollination modes affected the invasion success of two groups of aliens, differing in their residence time in Central Europe: archaeophytes (introduced before 1500) and neophytes (introduced more recently), and (iii) whether there were differences in the diversity of insect pollinators of native species, and of alien species at different stages of invasion and with different residence time. The analysis was carried out using 2817 species occurring in the Czech Republic (1596 native and 1221 alien, the latter comprising 331 archaeophytes and 890 neophytes). Data were analyzed using generalized linear models. The alien flora introduced to Central Europe contained a higher proportion of insect-pollinated species than does the Central European native flora and linked to a higher diversity of pollinators per species. However, the frequency of pollination modes in the introduced alien flora gradually changed during the process of naturalization, becoming more similar to that of native species, and eventually, the naturalized species that became invasive did not differ in their frequency of pollination modes from native species. The frequency of self-pollination increased from casual through naturalized to invasive alien species. This suggests a remarkable role for pollination mode in successful invasions; indeed, self-pollination tends to support spread of neophytes more than any other mode of pollination. The range of habitats occupied by plants of different invasion status affected the diversity of insect pollinator species. In contrast, regional commonness of plant species only affected the number of pollinator functional groups. In native species and archaeophytes, there was a steeper accumulation of pollinator species with increasing habitat range than in neophytes. This indicates that groups of plants that have been provided with longer time to sample a wider range of habitats than recently arriving alien species have formed more associations with native pollinator species occurring in those habitats.

Do mutualists matter? The role of seed dispersers in plant invasion.

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Although release from natural enemies has long been held as a major mechanism through which some plants are able to proliferate in new ranges, there is increasing recognition of the role mutualistic interactions may play in facilitating plant establishment and thus their potential importance for plant invasion.
The ability to reproduce and disperse is key to a plant's capacity to establish and invade and, for many species, these processes depend on the presence of animal mutualists. Successful invaders may be those with generalist strategies that are best able to exploit beneficial relationships with local biota. We aim to examine the role of animal mutualisms in the invasion process by focussing on seed dispersal, a key component of plant establishment.
We use Australian species in the genus *Acacia* as our model system. Australian *Acacia* have been widely introduced around the world and, throughout their introduced range, a subset have naturalised of which several are regarded as invasive. *Acacia* largely depend on animals for dispersal, with either ant or bird dispersal syndromes. In their native range, *Acacia* seeds are also eaten by a variety of invertebrates, birds and small mammals.
To determine how seed dispersal is affected by the presence or absence of potential mutualists, we studied the dispersal of *Acacia* seeds in both its native (Australia) and introduced (New Zealand) range by quantifying patterns of seed removal in three species at different stages of invasion in New Zealand. *Acacia dealbata* is highly invasive in New Zealand, *A. balieyana* is spreading but in low numbers and *A. pravissima* reproduces where planted but has not spread. All three species have adaptations for dispersal by ants (a fleshy elaiosome) and fall to the ground soon after pod dehiscence.
We used a combination of exclosures (invertebrate access only, access by mammals and birds, no access) and seed treatments (with elaiosome, without elaiosome) to quantify rates of seed removal and examined the role of distance, density dependent factors and the presence or absence of conspecific and congeneric trees in shaping these patterns in both the native and introduced ranges for each species. Differences observed among treatments, species and regions will be discussed in relation to the role of seed fate in plant invasions and the risk posed by these aliens in New Zealand.

Session 7 - Management & communication

The potential for the biological control of Himalayan balsam using the rust pathogen *Puccinia* cf. *komarovii*: opportunities for Europe and North America

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Himalayan balsam (*Impatiens glandulifera*) is a highly invasive annual herb, native to the western Himalayas, which has spread rapidly throughout Europe, Canada and the United States since its introduction as a garden ornamental. The plant can rapidly colonise riparian systems, damp woodlands and waste ground where it reduces native plant diversity, retards woodland regeneration, outcompetes native plants for space, light and pollinators and increase the risk of flooding. Current control methods are fraught with problems and often unsuccessful due to the need to control the plant on a catchment scale.
Since 2006, CABI and our collaborators have surveyed populations of Himalayan balsam throughout the plants native range (the foothills of the Himalayas, Pakistan and India) where numerous natural enemies have been collected and identified. Agent prioritisation, through field observations and host range testing has narrowed the potential candidates down to the rust pathogen, *Puccinia* cf. *komarovii*. This autoecious, macrocyclic pathogen shows great promise, not only due to its impact on the host but also due to its high specificity as observed in the field and preliminary host range testing. The aecial stage infects the hypocotyl of young seedlings as they germinate through leaf litter containing teliospores. This initial infection severely warps the structure of the developing plant. The aeciospores then infect developing leaves to produce the cycling phase (uredia). This severely affects the photosynthetic capacity of the maturing plant, with the potential of reducing seed-set. Late in the season, teliospores are produced which overwinter in the leaf litter.
This paper will review the research conducted to-date, including a molecular comparison of *Puccinia* cf. *komarovii* with other closely related species, the life cycle and infection parameters of the rust and an up-date on the current host specificity testing under quarantine conditions in the UK.

Dense wilding conifer control with aerially applied herbicides in New Zealand

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Chemical control of wilding conifers using different application methods has been trialled in New Zealand for the past 30 years with mixed results. Despite this research, the scientific literature contains little information on sprayed or aerially applied herbicides that are effective in killing wilding conifers. A joint study between the New Zealand Department of Conservation and Scion Research was initiated to develop new effective herbicide-based management strategies which will assist land managers to control dense infestations of wilding conifers.
For this purpose, five aerial field trials were set up, three trials were conducted on *Pinus contorta* and one each on *Pinus mugo* and *Pseudotsuga menziesii*. Each trial had a similar set up, comprising of four pseudo-replications of 0.25 ha plots applied by helicopter, similar to operational application at 150 l/ha. Treatments focussed on Triclopyr and Glyposate based treatments as indicated by the results from previous pot trials. Treatments included the current operational diquat treatment as a control. In each treatment plot 25 trees were marked and measured prior to treatment and at 3, 12 and 24 months post treatment. This paper describes the results after 2 years.

Invasion ecologists – essential for effective restoration decisions and actions

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As natural environments become altered through local and external anthropogenic change we need to ensure restoration projects are effective in developing resilient natural ecosystems able to withstand future change. This is particularly so in biodiversity hot spots which still maintain unique assemblages of plant and animal communities and naturally diverse ecosystems. As these systems become changed through the intrusion of non native species it is critically important that we are able to understand the manner in which these species may be influencing the functioning of the ecosystem and in turn the effectiveness of restoration actions which occur within them. The involvement of invasion ecologists in restoration projects is critical to understanding and determining the most effective (on ground and financial) interventions, which will ensure a resilient ecosystem able to respond effectively to the rapid changes which natural systems are undergoing. Collection of baseline data, prior, during and following interventions, will establish the effectiveness of the projects and set the direction for future interventions. The involvement of invasion ecologists in restoration projects is critical to understanding and determining the most effective (on ground and financial) interventions. Restoration projects in urban aquatic and terrestrial ecosystems in the southwest Australian biodiversity hotspot are incorporating baseline pre intervention research measurements designed to gain an understanding of how interventions, including weed management actions, are influencing the structure and function of those natural ecosystems being restored. A similar project is being conducted in the Kimberley Region in North-west Australia engaging with indigenous rangers to better understand their ecosystems, responses to disturbances, including consequent weed invasion, and the implications for management. A Research and Management Collaborative Project incorporating stakeholders and scientific collaborators inside and outside Western Australia has been established to work towards establishing the most effective method of managing, and restoring disturbed ecosystems. Outcomes and methodologies from these Projects are applicable to those considering weed eradication and restoration projects and provides a methodology, and new informative manner, to incorporate invasive species experts into management and restoration decisions, for both improved ecosystem outcomes and effective use of resources.

Thuja – successful project for general public awareness rising about IAS threats

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Despite the high level of threat that invasive alien species (IAS) pose to ecosystem services and some of them even directly to man's health (like *Ambrosia artemisiifolia, Heracleum mantegazzianum*) or man-made constructions (like *Fallopia japonica, Ailanthus altissima*), awareness of general public about the IAS threat is very low in Slovenia.
So the main goal of the *Thuja* project was to rise the general public awareness with some particular target groups as e.g. gardeners, pet lovers, horticultural shops and nature park rangers.
For the general public main media for awareness rising campaign were free postcards with well established distribution network all-over Slovenia and an exhibition made of 16 posters presenting different aspects of IAS threat with some exchangeable posters devoted to regional IAS problems. Exhibition in two parallel copies has been moving all over Slovenia exposed for a couple of weeks to few months in several public places like libraries, secondary school, nature park information centres etc. In several occasions, a public lecture accompanied opening of the exhibition. In addition to that, in several newspapers or general public journals articles about IAS threats were published and a well visited home-page (http://www.tujerodne-vrste.info/index.html) set up and maintained.
For the gardeners and garden pond owners a booklet "Alien species – fugitives from the garden" was written and printed in 8000 copies distributed as an attachment of one of the gardening monthly journal (due to great interest it was recently reprinted in 5000 copies financed by Ministry of Environment). On 24 well illustrated pages garden has been presented as a potential stepping stone for spread of IAS, replacement species have been suggested and hints for IAS-free gardening collected. Several big garden shops were contacted checking their awareness about the threat of IAS they sell and offering them leaflets for customers.
For pet lovers, number of articles about potentially invasive aquarium animals and plants were published in their journals or home pages.
For the rangers in nature parks 3 workshops were organized in 3 different regions of Slovenia focused in IAS in the Alps, in the sub-Mediterranean region and in central to eastern Slovenia. All workshops were well visited.
In addition to that a field workshop for eradication of some plant IAS in a nature park Radensko polje was organized.
Project was financed via EEA / Norway grants and conducted by 4 NGOs: "Botanical society of Slovenia" focused on plants, "Akvaviva" dealing with aquarium pets, "Tourist association Boštanj" where field work with eradication took place and "Symbiosis" having focus in other animals and coordinating the project.

Session 8 - Introduction pathways and spread of invasive species

Estimating the true spread progress of an aggressive weed invasion using imperfect survey data and hierarchical Bayesian modelling

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Large-scale spatio-temporal data of biological invasions are frequently based on surveys associated with imperfect detection rates: only a proportion of all extant populations are observed, and frequently a considerable delay compared to the true founder event applies. These inflated data do not only hamper scientific analyses, but can also give rise to misguided management efforts.
Here we show a generally applicable hierarchical Bayesian modelling framework, which accounts for the inflated survey data nature as well as implicitly estimates the true spread progress. This framework is applied to model the *Ambrosia artemisiifolia* invasion in Austria over once century, and numerically integrates the processes of dispersal; local growth and propagules production rates; temporal dynamics; local habitat suitability; and finally, spatially and temporally heterogeneous survey detection rates. The hierarchical model is comprised of two layers, in which the bottom layer constitutes the true yet unobserved invasion itself, while the anthropogenic detection of the invasion is modelled in a separate layer. Both layers are jointly fitted using Markov chain Monte Carlo (MCMC) as workhorse and delivering estimates for essential parameters of the invasion (e.g. kernel, propagules pressure rates) and, foremost, the true colonization time spatially explicitly for each of a total of 2,612 lattice cells.
We show that the integration of heterogeneous detection rates constitutes a core model component. Depending on survey effort, yearly detection probabilities range between one-half and nearly zero, and the delay between first colonization and detection of populated sites can exceed one decade. According to the raw data, by the end of the survey 366 (14%) cells are known to be colonized, while the model concludes that estimates between 450 and over 700 colonized cells are much more realistic of the spread progress. Further, integrating detection uncertainty into the model yields a significantly different, more short-distanced kernel parameter estimate, highlighting the importance of possible parameter estimation biases if not adjusting for imperfect detection.
Our analysis concludes that proper integration of spatially and temporally heterogeneous survey efforts into quantitative analyses is feasible using modern-day computational resources, and constitutes an important step in the numerical analyses of biological invasions. Not only are more robust scientific inferences yielded, but the derived estimate of the realized spread progress also aid the development of efficient management strategies. Due to its highly allergenic pollen, the invasion of *A. artemisiifolia* exhibits a particularly aggressive human-impact component, and control efforts are urgently needed. Our modelling approach delivers robust input for such efforts and hence constitutes an essential improvement for both scientific investigations as well as applied invasion biology management.

Predicting the spread of invasive plant species

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Predicting invasive species spread, together with any underlying causal explanation, is clearly a major challenge, but will be essential for future risk assessments and the application of appropriate management practices. A variety of different modelling techniques have been proposed, the majority of which can be described as correlative, niche-based bioclimatic envelope approaches. Whilst these models have provided useful information their predictive accuracy has sometimes been questioned and they have a number of limitations. They do not include habitat-type, a factor that may have a greater impact than climate alone, have only a coarse resolution and are constrained by a non-mechanistic approach to propagule dispersal, clearly a potentially key feature in determining invasive species spread. Also rarely have they been validated against the actual distribution of the modelled species. In order to address these issues we have developed a novel model called the Plant Spread Simulator (PSS) that incorporates the advantages of several model types, facilitates the rapid parameterisation of heterogenous environments with high-resolution and can be used for designing as well as testing complex management protocols. The PSS model is temporally and spatially explicit and includes both habitat and climate as inputs. The simulated environments are of high-resolution and incorporate biotic and abiotic features. Habitat invasibility is simulated using a correlative approach. Individuals within the simulation possess a basic life history, can be genetically-explicit and can form populations. Propagule dispersal is simulated using a novel process-based approach that incorporates the influence of landscape features such as roads, rivers and human habitation. Application of the model to data on *Gunnera tinctoria* showed that it can accurately reproduce the current distribution in Ireland based on a number of statistical criteria and indicate that habitat/habitat type plays a critical role in determining the future spread of this species. The model also has potential as a management tool for identifying priority areas for conservation and the development of targeted control measures for reducing spread.

Low persistence of a monocarpic invasive plant in historical sites biases our perception of its invasion dynamics

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The persistence of species at sites once colonized affects their distribution in the landscape. Since precise actual distribution of the species is rarely available our knowledge usually relies on cumulative records, while the issue of persistence is largely neglected. This issue is highly relevant in changing modern landscapes, especially for dynamic invasive species and unstable human-made habitats. This is even more pronounced in the case of alien species where most attention is paid to the spread and colonization.
In this study, we explored the persistence of a monocarpic invasive species, *Heracleum mantegazzianum*. Of the total number of 521 historical sites, in which the species occurred between the end of the 19th century and present, it persists in 23.8% of sites. The persistence rate differed with respect to individual habitat types and the results indicate that factors that best explain the persistence are: type of habitat; urbanity; proximity to the place of the species' introduction into the country; metapopulation connectivity; and distance to the nearest neighboring population.
The results show that using cumulative historical records as a measure of species distribution, as is often used in invasion literature, can yield seriously biased results that overestimate both the actual distribution and the rate of spread. Therefore, in the case of highly-fugitive alien species with low persistence, estimates of distribution and the rates of spread based on cumulative historical data reveal more about the distribution of habitats potentially suitable for colonization than providing an accurate picture of their real occurrence.

From ornamental to invasive: the role of introduction history, species traits, and climate in explaining the fate of Asian woody species in Europe

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Improving our understanding of the major determinants of the naturalization and/or invasive success of alien species introduced in a new geographic range is central to improve our capacity to predict the identity of the species that are more like to become invasive. A number of studies have shown that only a small fraction of introduced species becomes naturalized and, of those, only few become invasive. Here, we plan to use information on the introduction history, climatic data in the introduced and native range, as well as a number of species traits to predict the invasiveness in a number of European countries of 952 Asian woody species, 128 of which are established in Europe. The relationship between invasive status (established or not), based on information available on the DAISIE database) with a number of and the set of predictive variables will be calculated using univariate and multivariate models. For those species that have become invasive, additional species traits and climatic variables will be used. An assessment of the invasive success of these species in other introduced geographic regions will also be made. Year of introduction into Europe and the proportion of gardens where a species was planted in each country will be used as a proxy for propagule pressure. Moreover, we will explicitly test whether species with certain traits were introduced earlier and more frequently. Among species traits, we will use information on life form, phenology, morphology and reproductive strategy to evaluate their contribution to the invasive success of a species as well as to the distance or degree of dissimilarity between invasive and not established species. Phylogenetic data will also be used as an additional predictive variable in some of the models that will be developed. This information is central to improve our ability to predict the fate of woody species introduced into Europe for ornamental purposes, and to make prediction on their potential future distribution under different climate change scenarios.

Introduction to the mid-conference excursion

On the legacy of Imre Szenczy – current invasion tendencies in Western Hungary

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Hungary still harbours a relatively rich heritage of natural and semi-natural vegetation, where biological diversity and man-made traditional environment have been mostly preserved. This heritage is threatened now by multiple factors, one of which is the invasion of alien plant species. The significant role of alien plant migrations in shaping native Hungarian flora and vegetation was addressed as early as 1847 by Imre Szenczy, a Premonstrant teacher in Szombathely, and whose herbarium has been preserved in the Savaria Museum up to the present time. This presentation gives an overview on the most widespread invasive plants in the land of Imre Szenczy, Western Hungary, providing an outlook on the current situation at the national level as well. In addition to general information on the most important taxa (e.g. type of invaded habitats), major taxonomic problems (e.g. *Fallopia*, *Helianthus*) will also be exposed. Furthermore, new emerging invaders (e.g. *Humulus japonicus*, *Heracleum* spp., *Phytolacca esculenta*) will also be discussed in detail. Wherever possible, the examples in this presentation were taken from sites, which will be visited during the mid-conference field tour.

Invited speaker

Botanic gardens and the spread of environmental weeds: causes, consequences and codes of conduct

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Botanic gardens are acknowledged to play a major role in the protection of biodiversity through ex situ preservation of endangered plant species; research to underpin conservation, and public outreach. Yet, increasing evidence highlights the role botanic gardens might play in plant invasions across the globe. Botanic gardens, often in global biodiversity hotspots, have been implicated in the early cultivation and/or introduction of most environmental weeds listed by IUCN as among the world's worst invasive species. IUCN Red-listed species account for only 3.5% of species in botanic gardens and are found in few collections. Most plants are ornamentals with a better representation of major invasive species than Red-listed species. When other important correlates of alien plant richness are taken into account, a significant effect of botanical gardens on alien plant species richness across the world is found. The variation explained by botanic gardens is around 10% which is consistent with these institutions being only one source of alien plants, with other sources of alien plant introduction such as the use of species in erosion control, landscaping, and horticulture as well as feral crops and grain contaminants also contribute to alien plant species richness. Furthermore, these results highlight that the establishment of botanic gardens is strongly related to socioeconomic factors such as population density and per capita GDP. The risks posed by invasive species in living collections should not be underestimated but a balanced approach is required that ensures the minority of problem species are dealt with effectively and with stakeholder support. Voluntary codes of conduct to prevent the dissemination of invasive plants from botanic gardens have had limited uptake with few risk assessments undertaken of individual living collections. Information sharing on invasive plants would significantly improve weed risk assessments and inform listing in Index Seminum to ensure invasive species are not shared among botanic gardens. A stronger global networking of botanic gardens to tackle biological invasions involving public outreach, information sharing and capacity building is a priority to prevent the problems of the past occurring in the future. As a result, botanic gardens can play a key role in the management of invasive plants worldwide and further consolidate their position as leading players in global plant conservation.

Session 9 - Plant invasion in a changing world

Socio-economic legacy yields an invasion debt

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Globalization and economic growth are widely recognized as important drivers of biological invasions. Consequently there is an increasing need for governments to address the role of international trade in their strategies to prevent unintended species introductions. Yet, many of the most problematic alien species are not recent arrivals but were introduced several decades ago. Hence, current patterns of alien species richness may better reflect historical rather than contemporary human activities, a phenomenon which might be called "invasion debt". Here, we show that across 10 taxonomic groups (vascular plants, bryophytes, fungi, birds, mammals, reptiles, amphibians, fish, terrestrial insects and aquatic invertebrates) in 28 European countries, current numbers of alien species established in the wild are indeed more closely related to indicators of socio-economic activity from the year 1900 than to those from 2000, although the majority of species introductions occurred during the second half of the 20th century. The strength of the historical signal varies among taxonomic groups, with those possessing good capabilities for dispersal (birds, insects) more strongly associated with recent socioeconomic drivers. In case of the two taxonomic groups of plants included (vascular plants, bryophytes), the historical indicators clearly provided superior models. Overall, our results suggest a considerable historical legacy for the majority of the taxa analyzed. The consequences of the current high levels of socio-economic activity on the extent of biological invasions will thus probably not be completely realized until several decades into the future.

Current and future climate hotspots for invasive Alien plants in Australia

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We applied the concept of biodiversity hotspots (ie identification of biogeographic regions of high species diversity) to identify potential "invasion hotspots" for alien plant species under current and future climates, based on areas of potentially suitable climate, which encompass multiple alien plants. Climate suitability surfaces for the 72 Australian Weeds of National Significance (WoNS) under current and projected 2020 and 2050 climates were determined using species distribution records and the modeling tool Maxent. The climate suitability layers for all 72 WoNS were amalgamated to determine invasion hotspots under current and future climates to determine how they might change with time. From which we identified two invasion hotspots, being (1) the south west corner of Western Australia (SW), and (2) a larger area spanning the south east region of Australia (SE). The SE hotspot contained the greatest number of alien plants. The area of both hotspots was predicted to retract southward and towards the coast under future climate scenarios, reducing in size by 39% (SW) and 47% (SE) by 2020 and a further 70% and 45% by 2050, respectively. This reduction in area is likely to be driven by the dominance of southern temperate species (47 of 72), of which 44 were predicted to experience reductions in bioclimatic range by 2050. While climate is likely to become less suitable for the majority of WoNS in the future, potential invasion hotspots based on climate suitability are likely to remain in these area by 2050 suggesting that these areas should be the focus of management.

Rapid global change: implications for defining natives and aliens

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The ability to ascribe native or alien status to species in a rapidly changing world underpins diverse research fields that overlap with global change and biological invasions via biodiversity. Current definitions generally link alien status to anthropogenic dispersal events, but this can create conflicts for active management and global change adaptation strategies, such as managed relocation and restoration ecology. Here we propose a unifying approach that allows for the incorporation of rapid global change into biological invasion terminology. We introduce the concept of a projected dispersal envelope (PDE) to define the region where a species is or could be native, irrespective of human involvement. The PDE integrates biogeography and niche theory with existing invasion terminology to place a spatial and temporal context on species movements. We draw on a diverse suite of topical organism movements to illustrate these concepts. Our restructured definitions allow for native species movement into or with rapidly shifting climatic regions, as well as identifying the inappropriate introduction of alien species to new areas. Moreover, our definitions framework forms a timely and essential component of adaptation policies and responses for invasive species management and the enhancement of biodiversity in a rapidly changing world.

Session 10 - Invasion patterns and invasibility

Exploring the effects of propagule pressure, climate and land use on alien and native species richness along elevational gradients

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The distribution and spread of alien species is influenced by a range of environmental, biotic and anthropogenic factors. The question of whether native and alien species respond differently to these factors is important to understand for more effective management of invasive species. We aimed to investigate the relative importance of these drivers on alien and native species richness across Banks Peninsula (c. 103,000 ha), New Zealand. Banks Peninsula is a hilly region characterised by extensive human modification with large-scale replacement of native forests by tracts of open farmland, fragmentation of remaining native habitats, and the introduction of alien plants for agriculture, forestry and ornament. We used data from a floristic survey of 1227 6m × 6m plots, systematically located across Banks Peninsula within which all plant species were recorded. We fitted statistical models to explain variation in species richness in relation to climatic, environmental and anthropogenic variables using multiple regression at two scales: (1) across all of Banks Peninsula in order to test whether the richness of alien and native species were linked to variation in climate, land use and propagule pressure, and; (2) within different elevation bands to reduce the influence of climate variables. In the first analysis we found a significant negative correlation between alien and native plant species richness per plot, contrasting with previous studies that typically show a positive correlation at similar scales. High alien species richness was found at lower elevation in warmer climates and at higher soil pH, with native richness showing the opposite pattern. Overall, there was no evidence that anthropogenic variables associated with propagule pressure explained additional variation in alien species richness. Within different elevation bands, native and alien species richness were positively correlated at lower elevations, but negatively correlated at higher elevations. Areas at low elevation are highly modified and native and alien species may be responding to similar environmental drivers. At high elevation, where the landscape is less modified, native species richness is higher and many native species are concentrated in less-modified fragments, leading to a negative relationship between native and alien species richness.

An analysis of the factors that influence the abundance of *Ambrosia artemisiifolia* in arable fields of Hungary using classification and regression tree models

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Common ragweed (*Ambrosia artemisiifolia* L.) is the most noxious invasive weed species in Hungary. The aim of this study was to quantify the environmental and land-use factors that explain the variance in its abundance in arable land. A weed survey was carried out in 243 arable fields across Hungary, and 19 environmental and 12 land-use factors were measured. These were used as explanatory variables to build classification and regression tree models. The abundance of *A. artemisiifolia* was significantly higher in the field edges than that of in the field centres. The most important land-use variables explaining variance in abundance of *A. artemisiifolia* were crop type and crop cover with highest abundance found in sunflower fields and fields with low crop cover. A number of explanatory environmental variables were also identified with significantly higher *A. artemisiifolia* abundance on sites with sandy or acidic soils, mean April precipitation >39 mm, mean annual precipitation >592 mm, and mean May temperature <15.5 ºC. *A. artemisiifolia* abundance was significantly lower on soils with high concentrations of Na, K and Mn. Both farmers and nature conservationists should be increasingly familiar with the conditions and practices favouring ragweed infestations, in order to advance effective, but selective ragweed control, particularly in arable habitats of higher weed biodiversity.

The relationship between native and naturalized floras under levels of disturbances: Approaches on biodiversity and species association

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The positive or negative relationship between native and naturalized biodiversity have been related to invasion mechanisms, such as invasion meltdown or biotic-resistance; however, the bottom-up mechanism contributing to the relationships from species level are seldom approached and yet revealed. Significant species associations within invaded communities may be considered as foundation of the relationship between native and naturalized biodiversity. The relationship and species association may be modified by environmental factors, e.g. disturbances. Nevertheless, the effect of disturbance levels on shaping the balance between native and naturalized biodiversity is barely known. In this study, we hypothesized that species association pattern is related to the balance between native and naturalized diversity, and disturbance is one of the determinants. The objective was to connect native-naturalized species associations to biodiversity patterns under three intensities of disturbance to approach the underlying mechanism shaping the relationship. Field data were obtained from 2,160 independent plots of a subtropical montane parking lot paved with perforated concrete blocks. Chi-square(X^2) analysis was employed to entangle species associations of each plant member, and the results were utilized to puzzle up the correlations between native and naturalized biodiversity under different levels of disturbances. Results showed that the intermediate disturbance levels harbored the most species, especially native species. Native biodiversity was maintained by high intensity of disturbance, while naturalized species had the advantage to take over the territory under low disturbances intensity. Both of positive and negative associations were found between native and naturalized species. The highest native biodiversity often associated with common positive native-native interferences and negative native-naturalized associations, while the highest naturalized biodiversity were related to abundant negative naturalized-naturalized associations. Although disturbance may create chances for invasions, it is also critical in maintaining native biodiversity, and the intensity of disturbance is the key. Natives may be excluded by competitive naturalized species if frequently created niches are not available. The dynamic between native and naturalized biodiversity is not only determined by disturbance level, complicated species association suggests that mechanisms of invasion meltdown and bio-resistance coexist and determine the patterns of the relationship between native and naturalized biodiversity.

Spatial heterogeneity and disturbance create positive native-alien relationship in agricultural habitats

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Plant communities with high native species diversity have been regarded less vulnerable to invasions than relatively simple communities due to competition-driven biotic resistance. This understanding has been frequently supported by the small-scale experiments, whereas most of the broader scale observational studies established a contrasting pattern, indicating that native and exotic species diversity was positively correlated. This contradiction (i.e. invasion paradox) has been proposed to result from different processes operating at different spatial scales, including niche exploitation, resource availability, disturbance and competitive abilities of the species.
We examined the relationship between native and alien plant species diversity components (α-, β- and γ-diversity) in semi-natural agricultural habitats of Finland at three spatial scales: 1 m^2, 50 m^2 and 0.25 km^2. We hypothesized that (1) the positive relationship between native and alien plant species at broad spatial scales (50 m^2 and 0.25 km^2) results from heterogeneity in the environmental conditions, and (2) that low spatial heterogeneity of the agricultural habitats and species competition leads to a negative relationship between native and alien species at the fine spatial scale (1 m^2). The investigated the relationship between native and alien species diversity components using Pearson´s correlation and generalized linear mixed models (GLMM). Furthermore, we analyzed with GLMM, how environmental variables describing spatial and habitat heterogeneity affected the diversity of alien and native plant species.
We found native and alien species diversity components to be positively correlated across spatial scales. The diversity of native species was positively correlated with environmental heterogeneity at the 1m^2 scale, whereas alien species diversity was uncorrelated. At 50 m^2 and 0.25 km^2 scales, alien and native species diversity responded similarly to geographical location and climate, but differently to the variables of environmental heterogeneity. Alien species diversity was positively correlated with disturbance regime (measured as area of bare ground and arable field cover), whereas native species favored increasingly forested areas and rockiness.
Our results suggest that a positive relationship between native and alien diversity at broad spatial scales is due to environmental heterogeneity rather than to favorable environmental conditions benefiting both species groups. Contrary to our expectation, we did not observe a negative native-alien relationship at fine spatial scale. Disturbance regime typical of agricultural habitats may limit species competition, and increase resources availability and propagule pressure even at fine spatial scales and lead to a positive relationship between native and alien species.

Session 11 - Mapping, inventories, databases

invasions of non-native plant species and habitat changes in the western ghats of Tamil Nadu, India

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Biological invasions are considered to be the second largest threat to global biodiversity. Habitat destruction, overexploitation, fragmentation and introduction of exotic species are the major causes of biodiversity loss in India. Understanding habitat changes and fragmentation would be essential for predicting and managing the spread of invasive species. The study is carried out in Palani hills, Western Ghats of Tamil Nadu India, since it is proposed to be upgraded as a wildlife Sanctuary. The Palani hills are exploited for cultivation of exotic fruits and vegetables along with coffee, eucalyptus and wattle plantations and also enjoy status as a hill resort. The study identifies changes in specific forest habitat/cover based on the spatial estimates of forest cover loss for two decade to detect the extent of anthropogenic pressures. Buffer zones are generated for various road networks and for villages and overlaid on select vulnerable vegetation types and based on their influences, the vegetation communities are identified which are extremely sensitive to habitat loss. Quadrats were laid in these communities and the Native and Non Native Plant Species Diversity was assessed. The study reveal that the weeds such *Lantana camera, Eupatorium divergences* affect the evergreen and Tree Savanna forests. *Coffea arabica* is a major cultivar in this region which intrudes into the evergreen forests on the fringes. The extent of habitat loss was classified into high, moderately and low sensitive zones and the areas demarcated for effective management of protected area.

Mapping *Arundo donax* L. (giant reed) an invasive species in the Federal District of Brazil

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The rapid propagation of invasive species has caused irreparable damage in several ecosystems around the world. Their impact on biodiversity is so relevant that this process is considered a major threat to species loss, second only to habitat destruction. *Arundo donax* L. (giant reed) is a vigorous invasive species that has established and spread in riparian habitats in warm climates, principally in coastal fresh water systems in North America, including the southwestern region of the US. Once established this species spreads rapidly, substituting the native vegetation, destroying habitat for species, alters the physical and chemical characteristics of the soil in the invaded areas and also affects water conservation and inundation and fire cycles. This species is currently recorded in 8 of the 27 Brazilian states, principally in the south, southeast and center-west, including the Federal District, being present in the Cerrado and Atlantic Forest biomes, both considered to be biodiversity hotspots. The object of this study was to map, using GIS tools, the occurrence and extension of *A*. *donax* in the Federal District to provide a basis for future management or eradication plans. The location of *A donax* stands in the Federal District was determined by driving along all primary and secondary roads, with emphasis on roads near or through preserved areas. When found the position of the stand was marked with a GPS and these data were plotted using ArcGis. The highest abundance of *A*. *donax* was found in disturbed areas in and around the center of the Federal District and with increasing distance from the center the occurrence of this species diminished. Different from what is observed in the US, where this species principally occupies riparian habitats, in the Federal District it was predominantly observed in drier sites where the soil had been disturbed or deposited, in sites with presence of construction debris, in landfills and in frequently mown areas. The presence of *A*. *donax* in mown areas may be related to the management practice adopted by the government of the Federal District since the grass mowers used may act as dispersers of of *A*. *donax* by carrying pieces of cut stems to previously uninvaded sites. The data presented show the current state of distribution of *Arundo donax* in the Federal District and that it is present in or close to several of the protected areas in the Federal District.

EDDMapS and Other Invasive Species Internet Resources of The Bugwood Center for Invasive Species & Ecosystem Health, http://www.bugwood.org/

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Bugwood Center's focus is education and outreach and provides information as „tools" to be used by others and programming on invasive species, forest health, natural resources and agricultural management (IPM focus) topics. The Center uses the Web to deliver programs and information to educators, users and the general public. The 33 Bugwood Network web sites received 223.8 million hits and were accessed by a global audience of 8.4 million users during 2010. The systems that make-up the Bugwood Network are based-upon and interconnected through a fully-relational taxonomic database backbone system.

EDDMapS (Early Detection and Distribution Mapping System) http://www.eddmaps.org is a fast, easy to use, web-based mapping system that doesn't require Geographic Information Systems experience that is based upon Google Maps. Launched in 2005 as a tool for (US) State Exotic Pest Plant Councils to develop more complete distribution data of invasive species and is now used across the U.S. and in Canada and contains over 1 million records on 1,853 species entered directly by 2,443 users or that were imported from other databases.

Bugwood Images (http://images.bugwood.org/) makes over 138,000 images available for educational use at no cost on 15,287 subjects taken by 1,700 photographers. Images are accessed through one of the following four topic/user specific interfaces: http://www.Invasive.org; http://www.ForestryImages.org; http://www.IPMImages.org and http://www.InsectImages.org.

BugwoodWiki http://wiki.bugwood.org/ operates on a customized version of MediaWiki software that enables content developers to better support extension and outreach educational applications. BugwoodWiki enables developers to search and select images from Bugwood Images to include in developed Wiki content.

EDDMapS uses a simple on-line data form through which users submit their observations or view results through interactive database queries. Data is immediately loaded to the Website, allowing real-time tracking of species. EDDMapS provides users with Internet tools that maintain their personal records and enable them to visualize data with interactive maps. Data is reviewed by state verifiers to ensure all data is accurate. The data is freely available to scientists, researchers, land managers, land owners, educators, conservationists, ecologists, farmers, foresters, state and national parks. This data will become the foundation for a better understanding of invasive species distribution around the world.

Since all Bugwood Network resources utilize the Bugwood database backbone and are fully integrated, EDDMapS makes use of the BugwoodWiki and BugwoodImages to support and deliver educational materials, images and other content to users and other educators to develop customized training and educational materials to support their programs and users. Please visit http://www.bugwood.org

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Poster Session 1 – Biology of invasive alien plants

Long-term changes in clonal structure of *Asclepias syriaca* L. in natural psammophilous vegetation in the Hungarian Great Plain

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Asclepias syriaca, common milkweed, is one of the most dangerous invasive transformer species in Hungarian vegetation, which primarily endangers the natural psammophilous vegetation.
Earlier, in 1995, clonal characteristics of six milkweed genets were recorded, that were embedded in natural, semi-natural psammophilous vegetatation in the Kiskunság area (Central Hungary), later, in 2009, the same sampling was repeated. All clones were isolated and far from each other, but they laid inside in a 1-km radius circle. (The geographical coordinates of the most central clone are: N46.88909^{o}, E19.40859^{o}). The investigation extended to the localisation of the ramets by measuring their relative positions at 10 cm accuracy, to determine the vitality and fruit-production of ramets, and the supported spatial relations of spacers were analysed.
The main characteristics of the clonal structure of *Asclepias syriaca* can be outlined as follows: Besides the solitary ramets there are ramets that form clusters with 2-6 shoots, the ramets remain integrated by root-stolons, the pattern of ramets and their clusters in a genet can be built up by iteration of three basic elementary modules (one linear, and two types are branched).
During the time between the two investigations, the most characteristic changes in the clonal structure can be summarized as follows: 1) The clones had shown significant growth in their extensions and in their number of ramets, the later meaning that there was between 2-4 times more ramets, 2) The growth of clones was more intense to the direction to the less natural vegetation types, 3) The basic pattern and elementary modules of the clones as well as the vitality parameters had not changed, 4) The number of shoots in a cluster had decreased significantly, and at the same time the number of solitary ramets had increased, 5) These phenomena had shown in case of all clones, but the turning to more even distribution of ramets seems to be in correlation with the originally higher number of ramets in a clone.
Fundamental observations: 1) In spite of unfavourable conditions, the clones of *Asclepias syriaca* are able to grow into the natural vegetation, and, 2) A density autoregulating mechanism is an important component of the clonal plasticity.

Can invasive plants use the thermal time more effectively than native?

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Growth and development in plants (as in all ectotherm organisms) strongly depends on the outdoor temperature. Since plants require certain combination of time and temperature, called **thermal time** *(TT)*, the development is a function of a given temperature and time over which it is acting. The linear approximation of the relationship between the rate of development and temperature makes it possible to calculate two constants: **the sum of effective temperatures** (*SET*), i.e. the amount of heat needed to complete a developmental stage, and **the lower developmental threshold** (*LDT*), i.e. the temperature below which the development ceases. **Thermal window** *(TW)* is defined as the range of temperatures between which the minimum and maximum developmental rates occur. So far, the effect of *TT* on ontogenetic development has been investigated mostly for ectotherm animals, insects in particular, but much less so for plants. The use of *TT* in plants has been so far limited to crops in order to (i) estimate the lengths of different phases of crop development and optimize the final crop production and (ii) parameterize mathematical models predicting the growth of weeds in crop fields. The aim of our study was to find out whether this approach could be used to predict invasiveness of plant species. We collected data on *TT* requirements of wild-growing plant species, comprising both native and alien species in the Czech Republic. The experiments were carried out in growth chambers under stable regimes (light, moisture and nutrition) differing only in temperature. The treatment temperatures were 10, 14, 18, 22 and 26 °C under 14/10 hours light/dark regime, which well captures the range of temperatures and day lengths in the temperate zone during development of juvenile plants in the field (spring and late summer). The time needed for four early phenological phases was measured: (1) between appearance of the 1st and 2nd stem leaf or pair of leaves, (2) between the 2nd and 3rd leaf (leaves); (3) between 3rd and 4th leaf (leaves); (4) 4th and 5th leaf (leaves), excluding cotyledons. The differences in *TT* needed for individual developmental stages, *LDT, TW* and the optimal developmental temperatures in alien and native wild-growing species will be compared and discussed with regard to their phylogeny.

Factors influencing the establishment of common ragweed in a newly invaded area

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The common ragweed (*Ambrosia artemisiifolia*) is an unwanted invasive plant in a considerable part of Europe due to its highly allergenic pollen and the quick spread in human-altered habitats. Thus, factors influencing its establishment in newly invaded habitats are of major interest from management point of view. Broadly speaking, three factors determine whether a plant species establishes in a new site: the available propagules, abiotic conditions and the biotic interactions individuals experience. In case of the latter, resident competitors and high resident diversity were suggested among others to function as effective biotic resistance. We tested whether (1) the identity, diversity or cover of the resident plant species affect the establishment and early development of common ragweed seedlings in a new habitat (an abandoned agricultural field) and (2) the allelopathy of high density neighbours (*Daucus carota*, *Artemisia vulgaris*, *Epilobium tetragonum*, *Crepis biennis*) influence the emergence of seedling. The autumn-sown 100 seeds per field plots showed a moderate germination (8% on average), this number being positively influenced by the cover of therophytes (other annual species), but negatively affected by the competitor perennials. In contrary, the cover of competitors stimulated, while the empty surfaces reduced the height of the ragweed seedlings. Among the dominant resident species, the cover of *Artemisia vulgaris* negatively affected the development of ragweed seedlings. The negative effect of *Artemisia* was also emphasized in the allelopathic experiment as well: the aqueous leaf and root extracts of *Artemisia* and *Epilobium* caused a 10% decrease in the rate of emerging seedlings. Our results outline the possible selective forces the ragweed faces in a newly colonised area, namely a reduced success in the establishment and development of seedlings. This might be due to the biotic resistence of the resident plant species both by their competition and/or allelopathic effects. Other factors not considered here (e.g. soil properties, the presence of mycorrhizal fungi, intraspecific competition) should further contribute to the reduced establishment success.

Phenotypic plasticity of the chosen reproductive traits within *Impatiens glandulifera* Royle and *Bidens frondosa* L. populations

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Generative reproduction ensures the aclonal plants to get established in new areas and to survive in the colonized place. Despite the growing interest, the current knowledge of sexual propagation of many invasive species is still insufficient. Previous research works carried out among *Impatiens glandulifera* populations, focused, inter alia, on finding the impact of the location of habitats above sea level (m a.s.l.) on the height of individuals and on the production of fruits and seeds (Willis, Hume 2004), as well as the impact of temperature and insolation on the recruitment and development of seedlings (Skálová, Pyšek 2009; Perglová et al. 2009). In *Bidens frondosa* populations the research works covered the effect of the conditions of existence on the length of generative stem and on flowering time (Wisskirchen 2006), as well as seed germination ability (Gubertová i in. 2001). As the state of knowledge is still unsatisfactory, research works have been carried out aimed at phenotypic plasticity of the chosen features connected with generative reproduction of the above-mentioned species. The detailed goals have been aimed at finding the population size, the height of generative stems, as well as the production of fruits and seeds under different habitat conditions.
The studies were conducted in the Polish Carpathians in localities showing an untypical taxonomical structure. *Impatiens glandulifera* populations were found on roadsides dominated by low species, in willow thickets, as well as on the border and inside the carr forest. *Bidens frondosa* populations appeared on riverside gravels, i.e. on sun-heated plots with a poor floristic variety and dominated by the taxa with delicate procumbent stems; in a partially shaded site with a small species variety and with a significant share of high perennials, as well as in a shaded stand with a rich floristic variety and dominated by high perennials and shrubs. The biometrics research was carried out on permanent plots in the period 2008-2010.
The observations indicate phenotypic plasticity to ensure the domination of the discussed species in the open sun-heated spots and, at the same time, to enable their survival in the shaded spots which are dominated by the taxa reaching significant heights.

Re-evaluation of diversity, distribution and invasiveness of alien *Solidago* L. (*Asteraceae*) species in Lithuania

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In Europe the genus *Solidago* L. (*Asteraceae*) is represented by *S. canadensis* L. s. l. and *S. gigantea* Aiton – two highly invasive alien species in Central Europe. Both species belong to the most taxonomically challenging group of the *Solidago* L. sect. *Solidago* subsect. *Triplinerviae* (Torrey et A. Gray) G. L. Nesom., the *S. canadensis* complex.
In the latest revision of the genus *Solidago* L. in the *Flora of North America* (Vol. 20(2), pp. 107–166), Semple & Cook treated *S. canadensis* L. in a narrow sense and accepted *S. altissima* L. as separate species. The species of this complex can be distinguished by characteristics of stem pubescence (kind and distribution of hairs), leaf features (hairness, width, serrations) and features of arrays. In Europe, the name *S. altissima* L. is being applied with increasing frequency for plants formely known as *S. canadensis* L. s. l.
Revision of herbarium specimens of *S. canadensis* L. s. l. collected in Lithuania and deposited in the Herbarium of the Institute of Botany of Nature Research Centre (BILAS, Vilnius) revealed the presence of two species, i.e. *S. canadensis* L. s. str. and *S. atlissima* L.
According to the data of herbarium specimens, *S. canadensis* L. s. str. is a rare species, recorded in 8 localities in North, Central, East and South Lithuania. Escaped from cultivation it was first collected in 1989 in Radviliškis. According to the data provided on herbarium labels, this species occupies rather small patches close to settlements, railways or in vicinity of dumps. It is supposed that as an ornamental plant *S. canadensis* L. s. str. was introduced in the second half of the 20th century, and now the beginning of its spread is observed. However, detailed field studies on distribution, ecology and invasiveness are required.
S. altissima L. escaped from cultivation was first collected in 1983 in Radviliškis (north-western part of Central Lithuania). This species is distributed all over the country, but it is more frequent and abundant in the western and eastern parts of Lithuania. *S. gigantea* Aiton (= *S. serotinoides* Á. Löve et D. Löve) escaped from cultivation was first recorded in 1977 in Jurbarkas district (south of Western Lithuania). Its distribution has no clear geographical pattern. In general both species occur in a wide range of habitats; however, *S. altissima* L. is more frequent and abundant in areas with rather dry soils, while *S. gigantea* Aiton usualy occupies areas with moderately humid or humid soils.
Significant increase of *S. altissima* and *S. gigantea* frequency and abundance during the last decade is, probably, related with the increasing areas of abandoned meadows and arable lands. In certain regions of Lithuania the spread of both species reached the level of invasion. Therefore, they should be legally recognized as invasive species and urgent measures for their eradication should be taken in several protected areas in order to preserve the most valuable and vulnerable meadow ecosystems.

Azolla filiculoides Lam. (Azollaceae) in Central Europe: increase of frost resistance, expansion and coexistence with native organisms

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Azolla filiculoides is a water fern, floating on surface of water. After last Ice Age, it was native to Central and North America. After introduction into Europe in the end of 19th century it became an invasive species of high negative impact in its western and southern parts. In Poland, it has been noted as an ephemeral plant since the end of the 20th century. In last 15 years this species appeared in 6 locations in Lower Silesia (south-west Poland), and since 2007 its stabile populations have been observed.
Frost resistance of local populations is higher than reported so far; fern may winter and regenerate the population after frost reaching 25^{o}C. It stays sterile and propagates only in a vegetative manner. Wintering organs are top buds, submerged in mass of decomposed leaves of dead ferns.
Azolla filiculoides occurs in oxbow lakes and anthropogenic ponds, in eutrophic or even polluted water where it forms dense mat, up to 15 cm thick. Size of the populations is changeable during the vegetation season. Time of regeneration of population depends on number of survived buds. After cold winter, the process is slow and *Azolla* covers the entire surface even a month later. *A. filiculoides* enters the floating plant communities of the class Lemnetea minoris R. Tx. 1955 in which substitutes native species. *Lemna* sp. and *Azolla* are competitors depending on temperature; *Lemna* dominates in springtime, *Azolla* covers the surface of water in summer up to frost in autumn (july to september/october). Plant association Lemno minoris-Azolletum filiculioidis Br.-Bl. 1952 and *Azolla filiculoides* aggregation described from Central Europe seems to be only dynamic stage of the same plant community. During the studies it was find an adaptation of *Cataclysta lemnata* larvae to the changeable plant cover. Larvae of *C. lemnata* are semi-aquatic, built cases made of fragments of foodplants and feeding on *Lemna* sp. In researched ecosystem larvae prefer *Lemna* as a feed, but *Azolla* as a material for cases. *Azolla* is a food plant only when it became a dominating species in ecosystem.

Influence of environmental factors on the spreading of *Prunus serotina*

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In Central and Western Europe the black (American) cherry is considered a highly invasive species. It also poses a threat to the nature of Kampinos National Park (385 km^2) which is located on the plain in Central Poland. The nature of the park has been transformed by human activity but 1/5 of the forest covered area (approx. 55 km^2) can be considered similar to natural. The black cherry was introduced in low numbers in the 50ties and 60ties of the XXth century as a species improving the habitat's features. Currently, on 1% of the park's area, it is the dominating species of the understory and undergrowth, on 17% it is a common species and on 22% it occurs sporadically.
The aim of the research was to get to know the rate of the spreading of the black cherry in relationship to environmental factors. It was also sought to answer the question if the invasion takes place in plant communities similar to natural.
The research was conducted in the years 2009 and 2010 and consisted of dendrometric measurements on double, one-are areas (150 altogether) located every 20m along transects. The transects spread radiantly form the sources of the specie's dispersion – groups of fruiting trees, the age of which was determined on the basis of historical forest management data or tree-trunk drilling results. The soils were analyzed by stripping while the vegetation was described with phytosociological methods. The research was conducted in four areas representing different plant communities in respect to fertility, moisture and anthropogenic disturbance.
Typical fresh coniferous forests *Peucedano-Pinetum* and wet *Molinio-Pinetum* growing on poor podzols, created from dune sands, turned out to be resistant to the invasion of the black cherry. The situation was exactly opposite in pine forests classified to the *Dicrano-Pinion* alliance association planted on post-arable lands on mesotrophic brown podzolic soils created from alluvial materials, where the black cherry had high abundance and displayed high dynamics. Oak-hornbeam forests *Tilio-Carpinetum* with a disturbed structure with pine in the upper-story and a poor second-story or undergrowth turned out to be susceptible to the neophyte. Together with the increase of numbers of native species in the second-story, such as: hazel, bird cherry the abundance of black cherry significantly decreased. Completely resistant to the invasion of the black cherry were alder forests *Ribeso nigri-Alnetum* and tall-sedge communities *Magnocarcion*.
The black cherry, in the conditions of Kampinos Forest, has a dynamic invasive character in environments transformed by man, where it finds the necessary natural resources. Man is the cause of the invasion of this species not only through direct introduction but also indirectly by the transforming of vegetation.
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Invasive alien species as a arable weeds in central Poland

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Arable fields can be a major source for the expansion of alien plants, including invasive species due to regular disturbance by farming factors and intensive intervention of a man in the agroecosystems. The aim of study was to present a review of the arable weeds occurring in agrocoenoses in central Poland that have been classified as alien invasive species (IAS) with their biological and ecological characteristic.

The study was based on floristic data obtained from the literature and the author's own studies conducted on various arable fields (cereals, roots, stubbles, one-year fallows) located in seven landscape parks (LP) in central Poland: Bolimowski, Międzyrzecza Warty i Widawki, Przedborski, Spalski, Sulejowski, Załęczański and Łódź Heights. These objects were chosen due to long-term agricultural use, traditional methods of land and plant cultivation, variety of crops and well-documented state of arable weeds flora and vegetation.

Twenty species known as invasive in Poland were found on arable habitats in the investigated objects which constitutes 4.0% of their total arable weed flora. The highest number of IAS was recorded on arable fields from Spalski Landscape Park (18 species), while the lowest number of invasive weeds occurred in agrocoenoses in Załęczański Landscape Park (6). Similarity analysis performed for discussed species points to a strong similarity between two landscape parks with a similar soil conditions – Sulejowski LP and Łódź Heights LP.

Recorded invasive alien species belong to twelve families, mostly to *Asteraceae* (5 species), *Brassicaceae* (3), *Fabaceae* (3) and *Poaceae* (3). They are mainly annuals (9 species) which reproduce by seed. Among them there are perennials that reproduce by seed and vegetatively. The distinguishing feature of the alien invasive weeds is their wide spectrum of modes of dispersal, including different types of zoochory and anthropochory. Amongst listed weeds coming from North America prevail (10 species). Some species originated from south-eastern parts of Europe and the Middle East.

The most widespread invasive species were *Amaranthus retroflexus*, *Anthoxanthum aristatum*, *Conyza canadensis* and *Galinsoga parviflora*. They are considered as a problematic weeds for all crops because of their high frequency and abundance. They often form dense populations and may even pose a threat to diversity of agrocoenoses, as they occupy niches of other weeds (mainly native, stenothopic species). In the analysed group there are some species that may constitute a potential threat to agrocoenoses. *Bunias orientalis*, *Epilobium ciliatum, Lupinus polyphyllus* are still rare in agrocoenoses, but they have a high invasive potential for spreading to other sites and their increasing frequency shows, that they became permanent components of segetal communities.

Ecological requirements, short-term dynamics and competition of native and invasive *Impatiens* species in the field

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Comparison of invasive, naturalised non-invasive and native plants can provides useful insights into factors conferring invasiveness if carried out on congeners because such approach eliminates phylogenetic biases. We studied ecological requirements, short-term dynamics and competition of native and invasive species of the *Impatiens* genus (Balsaminaceae) widespread in the Czech Republic in two field experiments. *Impatiens noli-tangere* is native in the study region, *I. glandulifera* and *I. parviflora* were introduced from Asia; the former species spread rapidly in Central Europe especially in the last 50 years, while the rate of spread of the latter has been lower recently. We established two sets of permanent plots in five localities. In the first set site characteristics such as tree cover and soil humidity were directly measured and nutrients, light, temperature, continentality, humidity and soil reaction estimated using Ellenberg indicator values. Although the species often occur in the same locality, there were signs of micro-site differentiation. The preliminary results show that the occurrence of *I. noli-tangere* is strongly correlated namely with a high soil moisture but also with a high tree canopy cover, that of *I. glandulifera* with a low tree canopy cover, and that of *I. parviflora* with a low soil moisture and a high tree canopy cover. These results indicate possible but limited coexistence of the three species in the field. In the second experiment one of the species of native-invasive congener pair was removed, the intact controls included. In all treatments, abundance and cover of the target species increased when the congener was removed. The strongest increase in the number of plants was found in *I. noli-tangere* in response to removal of *I. parviflora* and the weakest in *I. parviflora* in response to removal of *I. noli-tangere.* The highest increase in cover was recorded for *I. noli-tangere* in response to the removal of *I. glandulifera* and the weakest in *I. noli-tangere* in response to the removal of *I. parviflora*. The results point to rather poor completive abilities of the native *I. noli-tangere* and its different response to the invasive congeners.

Is there a need for distinguishing between 'oldcomers' and 'newcomers' among alien plants? A case study in the Silesian Uplands (S Poland)

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In Poland the nomenclature and classification of the synanthropic flora elaborated by Thellung (1918-1919) and then modified by Kornaś (1968, 1981) has been applied. The concept adopts as the one of the basic criteria the time of arrival of a species. Plants introduced before 1500 are classified as 'oldcomers' i.e. archaeophytes while those established after 1500 are 'newcomers' i.e. kenophytes (=neophytes). Some authors dispute the sense of such a distinction and propose a simplification of the existing classification. In Poland, some 465 vascular plant species (*ca*. 13% of the total Polish flora) are considered naturalized aliens including some 165 archaeophytes and 300 neophytes. One of the most striking differences between these two groups is in the dynamics of their distribution. While 74 taxa of archaeophytes are considered as extinct or threatened and are consequently included in national and/or regional red books and lists, numerous neophytes are regarded as noxious weeds or transformers (*sensu* Richardson et al. 2000).
The main purpose of the studies reported here was to identify differences between oldcomers and newcomers which might confirm the validity of the classification adopted in Poland. Detailed investigations of naturalized alien plants have been carried out in the Silesian Uplands during the growing season for the last 15 years. There are as many as 320 alien species recorded in the research area, including 125 archaeophytes, 195 neophytes and a further 18 classified as species of uncertain status in the Polish flora (Tokarska-Guzik et al. 2010). Each species was characterised biologically, geographically and historically. Special attention was paid to the different life history traits and ecological preferences of particular species which enable them to occupy a variety of habitats. Among archaeophytes 13 species were classified as weeds of cultivation, while among neophytes seven species were considered weeds and 25 were regarded as transformers. For 43 selected species phytosociological data (*ca.* 1000 relevés) were collected in a broad range of habitats. The results of the studies conducted suggest that there are significant differences between the oldcomers and the newcomers. The vast majority of archaeophytes are therophytes while among neophytes, hemicryptophytes and therophytes predominate. Moreover the life form spectrum is broader among the neophytes, which include, for example, woody plants. A distinguishing feature of the newcomers is the relatively high proportion of species with great competitive potential (type C life strategy). Quantitative assessment across the habitats where alien plants occurred showed that archaeophytes are usually components of annual (short-lived) vegetation of human-made habitats, i.e. arable fields and recently-created ruderal sites. Neophytes, on the other hand, occurred in a different type of anthropogenic habitat and penetrate into various seminatural or natural types of vegetation.

Sexual Reproduction in the Japanese Knotweed (*Fallopia japonica*) in Slovenia

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Fallopia japonica (Polygonaceae) is known as one of the most troublesome invasive plant species worldwide. Its vegetative reproduction is very well studied and is recognised as the main way of reproduction in introduced regions. It has been reported that all specimens of *F. japonica* in Europe belong to one extremely large clone of female plants. In Slovenia, *Fallopia japonica* is very common along rivers, railways, roads and in some other ruderal habitats. Less frequent is *Fallopia sachalinensis* with only few known localities around Slovenia. For *F. x bohemica*, the hybrid of *F. japonica* and *F. sachalinensis,* only few data from central Slovenia were known so far but it was expected to be more frequent.
Field observations showed various amounts of seeds produced on *Fallopia* specimens. *F. japonica* evidently produced more seeds in comparison to *F. sachalinensis* and *F. x bohemica*. In this study, we tested the germination capacity of seeds and analysed nuclear genome size of young seedlings to determine the source of pollen. The pollen sources pollen for pollination of *F. japonica* flowers could be a hybrid *F. x bohemica*, which has around 50 % of viable pollen grains, hermaphroditic plants of *F. sachalinensis* with almost 100 % of viable pollen grains or representatives of other *Fallopia* species that are present in Slovene flora (*F. baldschuanica, F. convolvulus, F. dumetorum*).
The results of germination showed relatively high germination capacity of seeds in *F. japonica* and less successful germination of seeds in *F. x bohemica* and *F. sachalinensis*. Young seedlings successfully overwintered in the open air containers filled with soil. The results of genome size measurements are in correlation with the results of previous measurements. The genome size values mostly coincide with different ploidy levels known for hybrid *F. x bohemica* (hexaploid) and *F. x japonica* (octoploid). Along with that there is an undefined group of seeds with higher values of genome size that could be the result of copulation of different combinations of unreduced gametes and/or polyploidisation. Similar observations were recorded in seedlings grown from *F. x bohemica* seeds.
Genome size measurements and morphological examinations of floral parts of *Fallopia* samples revealed that the presence of *F. x bohemica* was underestimated. Our study showed that the hybrid is the most widespread *Fallopia* species in central Slovenia. *F. x bohemica* has mostly male flowers and only few flowers per plant with female fertile floral parts that could produce seeds. We also confirmed the presence of both types of *Fallopia sachalinensis* for Slovenian flora – female and hermaphroditic plants Therefore *Fallopia sachalinensis* could be the direct donor of pollen for pollination of *F. japonica*.

Invasive *Acer negundo* outperforms native species in non-limiting resource environments due to its higher phenotypic plasticity

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To identify the determinants of invasiveness, comparison of traits of invasive and native species are commonly performed. Invasiveness is generally linked to higher reproductive, physiological and growth-related traits of the invasives relative to the natives in the introduced range. Phenotypic plasticity of these traits has also been cited to increase the success of invasive species, but was hardly studied in invasive trees. In a greenhouse experiment, we compared ecophysiological traits between an invasive species to Europe, *Acer negundo*, and early and late-successional co-occurring native species, under changing light, nutrient availability and disturbance regimes. We also compared the same species groups in situ, in riparian forests.
Under non limiting resources, *A. negundo* showed higher growth rates than the native species. However, it displayed equivalent or lower photosynthetic capacities and nitrogen content per unit leaf area compared to the native species; these findings were observed both on the seedlings in the greenhouse experiment and on adult trees in situ. These physiological traits were mostly conservative along the different light, nutrient and disturbance environments. Overall, under non limiting light and nutrient conditions, specific leaf area and total leaf area of *A. negundo* was substantially increased. The invasive species presented a higher plasticity in allocation to foliage, and therefore in growth with increasing nutrient and light availability relative to the native species.
The higher level of plasticity of the invasive species in foliage allocation in response to light and nutrient availability induced a better growth in non-limiting resource environments. This could explain the ability of *A. negundo* to outperform native tree species and spread in European resource-rich riparian forests whereas it should impede its establishment under closed-canopy hardwood forests.

Poster Session 2 – Genetics and evolution of invasive plants

Unraveling the spatial dynamics of Lantana camara invasions in Kruger National Park, South Africa using a genetic approach

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Unraveling patterns of post-establishment spread by non-native species is crucial for management intervention, especially if these species occur in protected areas. The globally invasive and highly variable species complex, Lantana camara, is particularly troublesome in South Africa's Kruger National Park (KNP). Lantana camara reproduces both sexually and vegetatively and is associated with multiple dispersal vectors, making it a promising system to investigate spatial genetic patterns. Here we explore such patterns in populations along the Sabie River catchment in and adjacent to KNP. The history of the species' presence in the park suggests several scenarios of spread: 1) downstream dispersal of seeds during normal flow and flood event (for example, an extreme flood event in the Sabie River in 2000 is said to have triggered alien plant recruitment); use of L. camara as an ornamental plant in park villages in the 1950s; 2) long distance dispersal by birds, larger animals and wind; and via roads. Using inter simple sequence repeat (ISSR) markers, we assessed the distribution of within and between population genetic variation and, spatial genetic structure. We then used this information to indirectly infer patterns of dispersal at multiple spatial scales. Results indicate that genetic variation resides predominantly within L. camara populations (60%) as opposed to between them (40%). Further, we found that there's preceding gene flow between populations located at the upper and lower reaches of the catchment, but in the middle region where the Sabie intersects with one of its main tributaries, the Sand River, populations are genetically unique. We speculate that this resulted because of the 2000 flooding event. We anticipate that with the addition of more populations, we will be able to determine the spatial pattern of invasion, and identify the „outside" source of lantana in KNP. We suggest that insights into spread patterns will help management direct efforts to minimize spread and post-control re-introduction and infestation.

Oxalis pes-caprae L.: molecular surveys in the Mediterranean area

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The South African heterostylous species *Oxalis pes-caprae* L. is an invasive plant in the Mediterranean region where it reproduces mainly asexually by bulbils. This study deals with molecular analyses on different populations of this species. We sampled 34 populations in the Mediterranean area (28 in Italy) and 3 populations in South Africa. Extracted DNA was amplified with 4 SSrs plastidial primers, and two of them resulted as highly polymorphic. Such analyses have shown a high haplotypic diversity both among and within the Mediterranean populations. This result is surprising, especially in consideration of the fact that the analyses were performed at chloroplast level in a species that is believed to reproduce only asexually. In the Mediterranean populations we found also some haplotypes that are not present in sampled South African ones; it is our plan to collect more populations from the origin area of *Oxalis* in the near future. The haplotypic diversity can be due to various reasons, like the introduction of different genotypes from different populations, the occurrence of genetic mutations, and the possibility of occasional sexual reproduction.
In parallel with the molecular surveys we also studied the history of the species spreading in the Mediterranean and European areas, especially in Italy. A database with more than a thousand data collected from the main Italian and European herbaria and literary sources has been realized. Both this historical study and the molecular analyses converge to the same result: it seems that multiple introductions of this species have occurred in several Mediterranean countries in different times, leading to the rejection of the hypothesis - supported by a few authors - of its spreading from a unique clone introduced in Malta in 1806.
Further developments of this work will include the use of nuclear microsatellites and sampling other populations of *Oxalis*.

A biogeographical study of the genetic adaptation and phenotypic plasticity of two invasive maple trees, *Acer negundo* and *Acer platanoides*

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Rapid population evolution and increased plasticity are two mechanisms that can both play a role in plant invasion success. Indeed, rapid evolutionary changes may contribute to increase the performances of the invasive populations (Blossey and Notzold 1995). On the other hand, it was demonstrated that a higher plasticity of plant traits in response to environmental changes is a key determinant of invasion success (Vila et al 2007).
Based on a biogeographical approach, we investigated the existence of genetic diversity and phenotypic plasticity for two maple tree species; *Acer negundo* L., native from North America and invading southern Europe riparian habitats and Acer platanoides L., native from Europe and invading North America. Reciprocal common garden experiments were settled in Canada and France in 2007, with individuals coming from 10 native and 10 invasive populations for each species. Seedling growth rate, leaf phenology, leaf morphology and physiology have been investigated over a three year long period after planting.
Both native and invasive populations exhibited contrasting phenotypes across gardens, indicating that both native and invasive populations exhibited plastic behaviours. Genetically based differences were found between native and introduced populations for *Acer negundo* for all traits measured. Indeed, significant differences were found between native and invasive populations of *A. negundo* in the magnitude of the phenotypic plasticity, reaction norms being generally steeper for the invasive populations. On the contrary, the populations of A. platanoides did not present any differences in the magnitude of the plasticity.
This biogeographical approach allowed us to demonstrate the existence of a genetic differentiation in an invasive tree, which results in better growth performances. Moreover, the higher plasticity of invasive tree populations could favor their spread, considering the current climate chane.

Poster Session 3 – Risk assessment, prioritization and policy making

Predicting spread pathways and population growth of an emerging invader, *Acacia stricta*, for potential eradication

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Key aspects of the early detection and rapid response approach to invasive species are to determine where a particular species has and is likely to have spread to and what would be required to eradicate it.
We explore these aspects for an emerging invasive species to South Africa, *Acacia stricta* (*Fabaceae*, Hop Wattle). A formal risk assessment and bioclimatic niche modelling indicates that this species poses a significant threat to local ecosystems and has the potential to become widespread across approximately 10% of the country. The date of introduction of *A. stricta* is unknown, but it has been recognised as an invasive species and a potential target for eradication in the last 10 years. The only known populations of *A. stricta* in South Africa occur in the Knysna area of the Western Cape province, with a total invaded area of approximately 110 ha.
We used a simple matrix modelling approach, incorporating detection probabilities, to assess population responses of *Acacia stricta* to alternative management scenarios. We also used environmental and land-use correlates of *A. stricta* occurrence (e.g. slope, vegetation type, road usage) to predict factors that may promote its spread, and to highlight areas with high risk of future invasion and those that require more intensive surveying to detect possible unrecorded populations. We discuss the implications of these results in terms of long term monitoring and resource allocation required for successful management and/or eradication of *A. stricta* in South Africa.

Banksia ericifolia invading South Africa as predicted— a major threat or just symptom of a peculiar fire regime?

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Proteaceae are emblematic to South Africa but several Australian Proteaceae species have established and become invasive in South Africa. Recent records suggest that at least two species of *Banksia* are starting to invade, both of which were predicted to be the most invasive *Banksia* species 15 years ago. We examined the only known site in South Africa where *B. ericifolia* has become invasive to determine the cause of its spread.
The population was mapped and levels of recruitment and size estimated for the majority of plants. From these data size distribution and time to first flowering were calculated and an allometric model developed.
The population appears to have arisen from an ornamental farm hedge more than 20 years ago with sporadic recruitment into the surrounding natural vegetation. It now covers an area of about 150 hectares with approximately 10 000 individuals, but has reached a monoculture in an area of about 5 hectares. As plants are highly attractive to local pollinators and represent a substantial change in nectar availability in the area, we suggest this invasion will impact on local pollination networks. We also present preliminary analyses linking a particular human-induced fire regime in the immediate area of the invasion to the observed episodic recruitment. We contrast this to other sites where *B. ericifolia* has been grown under different fire regimes, and discuss our results in the light of risk analysis of the species.

Poster Session 4 – Plant invasion in protected areas

The ecology and management of invasive alien plants in protected areas.

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Protected areas are the cornerstones of national and international conservation initiatives. They provide refuges for representative portions of natural landscapes, ensure the persistence of key ecosystem processes and biodiversity, provide ecosystem goods and services, and often contribute significant economic benefits. However, protected areas are also becoming increasingly isolated in a matrix of human-altered landscapes. The growing global impacts of habitat loss, fragmentation and over-exploitation are often eliminated or can be managed to some extent within protected areas. Many anthropogenic threats to biodiversity are, however, not removed by giving these areas formal protection. These include 1) rapid, human-mediated climate change, 2) pressure to allow increasing and unsustainable use of basic natural resources and conversion of natural capital to food production, 3) encroachment of human and livestock into protected areas and the resulting human/wildlife conflicts, and 4) the increasingly pervasive influences of invasive non-native organisms. The interactions of these threats with climate change specifically are likely to change approaches to the protected area system globally. As far as we know, the last international research programme to focus specifically on protected areas was a working group on invasions in nature reserves, which was initiated under the SCOPE programme on biological invasions in the 1980s. A series of six papers were published in Biological Conservation in 1988. The aim of this working group was to use PAs as samples of ecosystems with minimal anthropogenic disturbance. This programme aimed to provide insights into differences between levels of invasibility between natural and disturbed systems, and also to provide information on the consequences of invasions for indigenous species, and to provide management recommendations. Much work has been done in PAs since then, but the focus and areas of the work varies considerably in different parts of the world. Nonetheless there has been a substantial increase since the 1988 reports with which to work. Therefore we aim to examine and provide an assessment of alien plant invasions in protected areas, over as wide an area as possible. The chapters will provide much more than a catalogue of what is being done in different regions; the volume will attempt to synthesize what is known and how this can be applied in invasion science and resource management in the future. Specifically we aim to 1) synthesize insights on plant invasions in PAs and to integrate these with current models and theories of plant invasion ecology, 2) determine the status of knowledge of IAPs in Pas, 3) determine key knowledge areas for successful management strategies.

Expansion of *Epilobium ciliatum* into Non-forest Communities of Kampinos National Park (Poland)

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Alien plant species in Poland are a group of approx. 460 taxa, 54 of which have been labelled invasive. One of them is American willowherb - *Epilobium ciliatum* Rafin. (syn. *E. adenocaulon* Hausskn.), a genus of the Willowherb family (*Onagraceae)*. The species, like most invasive species, originally native to North America, was first reported in Poland in 1917 in forest clearings in Białowieża Forest. In 1980s the species was reported as an invasive weed in European forest nurseries, orchards and fields and in Poland in forests and wastelands. *Epilobium ciliatum* stands are found all over the country, with the highest density observed in the south. It has become so widespread mainly due to the fact that it produces up to 60 000 seeds per plant and can also overwinter in rosette form. Despite the fact that the species was labelled invasive, there are hardly any studies of its distribution and habitat preferences. *Epilobium cilliatum* is mostly omitted in geobotanical studies probably because it is difficult to discern amidst many other, morphologically similar taxa (such as. *E. montanum, parviflorum, paluster, roseum*). Therefore, in contrast to species like *Solidago* or *Bidens* which are considerably different from native ones, it is not reported in the studies.
The aim of this paper was to analyse the invasion of *Epilobium ciliatum* into non-forest communities of Kampinos National Park. Phytosociological studies of meadows and rushes of swamp patches of the west part of Kampinos Forest were first conducted between 1993 and 1995. *Epilobium ciliatum* was found in only 3 patches out of 315 phytosociological releves recorded at the time. American willowherb was found in phytocoenoses of two stands with tufted hair-grass - *Stellario-Deschampsietum* and in *Dechampsietum caespitosae*. Between 2008 and 2009 the studies of swamp vegetation were repeated and a total of 188 phytosociological releves were recorded. The results confirmed invasive nature of the species – it was found in 26 patches and was most common in dry meadows where *Deschampsia caespitosa* was dominant, yet now it was also found in several rushes communities (*Caricetum acutiformis, Caricetum hudsoni, Caricetum gracilis, Carici-Agrostietum caninae*), often characterised by disturbed water conditions, and in meadow phytocoenoses with *Festuca rubra*.
Control of the invasive species in areas of considerable natural values is of key importance because they threaten biological diversity by crowding out native species. Such control is heavily dependent on proper understanding of their biology and ecology but also of the habitat susceptible to invasion in a given area. Due to its small size and similarity to numerous native species, direct elimination of *Epilobium ciliatum* is impossible. The studies have shown that probably the only way to stop invasion of the species in Kampinos National Park would be to improve hydrologic conditions.

Poster Session 5 – Impact of invasive plant species

Perceptions and ecological challenges caused by alien plant invasions in King Sabata Dalindyebo (KSD) Local Municipality (LM), Eastern Cape Province, South Africa: A preliminary study.

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The loss of biodiversity due to alien plants invasion has become a public concern globally, but less attention is being directed at them locally. Strategies aimed at controlling these plants in the medium to long term should be complementary, integrated and sustainable. Baseline studies at local and regional scale therefore remain a crucial starting point. The overall objective of this study was to document invasive plant species at selected sites within the KSD LM, their impact on native invertebrate biodiversity, and perceptions about these plants in the rural (Xhosa) communities. Twenty-seven (27) invader plant species belonging to eighteen (18) families were recorded along the Mthatha river and most of them were under CARA category 1. Habitat patches invaded by alien plants were also shown to support overall fewer invertebrate assemblages, compared to indigenous vegetation patches. The study also showed that most people were not aware of invader plants, requiring education. We concluded that riparian sections of the Mthatha River were heavily infested by noxious invader weeds, needing immediate eradication. The identification and classification of these invader plants as presented in this study could be useful in prioritizing species on which to focus management attention within a wider spatial and temporal scale. Awareness-raising and education of local residents from all age groups and educational backgrounds about the ecological impact of invasive plants on the ecosystem constitutes a crucial component of an integrated strategy towards controlling invasive alien plants at local scale in the medium term.

Effects on plant and lichen diversity of black-locust invasion in Tuscany (Central-Italy)

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Robinia pseudoacacia L. (black-locust), a worldwide invader, is the most widespread invasive species in Italy. In central and northern regions, its establishment was promoted by both chestnut blight and oak exploitation in the early 20th century, causing relevant changes in the landscape.
The process of invasion is still increasing, being enhanced by both forest management in native oak and chestnut woodlands and the increase of urbanization in hilly areas. Despite this situation, exhaustive studies on biology, ecology and distribution of black-locust are still scanty in Italy and the effects of this invasion on biodiversity are poorly known. The aim of this work was to compare species richness and composition of vascular plants and epiphytic lichens between native broadleaves and black-locust forests in Tuscany. For this study, the distribution of black-locust was mapped in detail (scale 1:10.000) in the whole administrative province of Pistoia (north-western Tuscany). According to structural features, black-locust formations were classified into three successional stages, from young to mature. In each stage, seven 10x10 m plots were randomly placed, minimum distance between plots of the same stage being 500 m. Seven additional plots were placed in selected neighboring oak and chest-nut forests. In each plot, species richness and composition of vascular plants and epiphytic lichens were assessed using standardized methods. Significant differences in species richness and composition between native deciduous and black-locust forests were found for both organism groups, species richness being higher in native forests. Differences in species composition are mainly associated to a shift from plant and lichen communities typical of montane deciduous forests to more disturbance tolerant communities. In the study area, the loss of native forest habitats, almost restricted to fragmented patches or transformed in black-locust formations, caused relevant changes in the landscape which are expected to pose a severe threat for biodiversity conservation. Since, these problems are likely to be common also in other regions throughout central and northern Italy, a national strategy in the management and monitoring of black-locust forests should provide the framework for local restoration projects and conservation-oriented practices.

Which traits determine the survival of native species in plant communities dominated by alien plants?

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Traits of species growing in communities invaded by by 13 species alien to Central Europe (*Aster novi-belgii*, *Fallopia japonica*, *F. sachalinensis*, *F.* × *bohemica*, *Helianthus tuberosus*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Imperatoria ostruthium*, *Lupinus polyphyllus*, *Mimulus guttatus*, *Rudbeckia laciniata*, *Rumex alpinus* and *Solidago canadensis*) were compared with those of uninvaded adjacent vegetation. The aim was to identify whether there is a suite of traits characterizing species capable of growing in vegetation dominated by alien species or those that are eliminated due to invasion. The null hypothesis was that the loss of native diversity associated with invasion (Hejda et al. 2009) occurs at random, independently of species´ traits.
The data were analysed by ordination analysis, regression and classification trees and related data-mining methods. The ordination analysis revealed a highly significant pattern in the distribution of traits attributable to invasion ($p = 0.002$). Herbaceous, clonal and perennial species retreated from invaded communities to much higher extent than woody, non-clonal and annual species. It is suggested that saplings of woody species are preadapted to low light levels enabling them to grow under the invader's canopy, while non-clonal and annual species may benefit from a life strategy different from that of the invading aliens, majority of which are clonal and perennial species. Many of the invasive alien species studied invade disturbed vegetation. Therefore, their invasions have impact mainly on ruderal and nitrophilous species that are more numerous in the invaded vegetation but grow there with low abundances, most likely due to the competition with the dominant alien species. In contrary, some of invasions (*L. polyphyllus*) occur on rather low-nutrient soils or in vegetation less affected by humans (*R. alpinus*) where native species are not adapted to compete with dominant alien species, resulting in stronger impact on species diversity of invaded communities.

To weed or not to weed: is that the question for today's wildlife?

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Interactions between animals and invasive plants (or weeds) have been poorly studied in comparison to other aspects of invasive plant management. The relatively recent proliferation of invasive plants in Australia provides the opportunity to identify these interactions as invasive plants and animals co-evolve. Additionally, where plant invasions are managed for biodiversity conservation, an understanding of animal/plant interactions is needed to ensure invasive plant management helps rather than hinders animal conservation. In this study bird communities showed similar patterns with respect to the presence of two invasive plant species: *Chrysanthemoides monilifera* ssp. *monilifera*, an understorey species invading a woodland ecosystem, and *Lycium ferocissimum* an emergent species invading a coastal wetland ecosystem, in Victoria, Australia. In both ecosystems, richness of birds was lower at sites dominated by invasive plants compared to those dominated by native plants. Bird communities experienced a further reduction in richness when *C. monilifera* and *L. ferocissimum* were actively controlled. While not necessarily providing high quality habitat for bird communities, invasive plants still offer resources, suggesting that management needs to account for this before invasive plants are controlled.

Invasions by giant herbaceous species: increase in the invasibility of native communities by secondary plant invaders

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Plant invasions may substantially alter the richness, abundance, and composition of resident plant communities. In the long-term, these alterations may affect a range of properties of the invaded ecosystems, including their invasibility, by creating novel conditions that may facilitate invasions by other alien or weedy species. Here, the characteristics of standing vegetation and of soil seed bank communities recorded from a site experiencing a process of secondary invasion by *Fallopia japonica* after having long been invaded by *Gunnera tinctoria* are described. These are amongst the largest herbaceous plant species in the world and amongst the worst invasive plants in Ireland. Specifically, this study aims at 1) characterizing the differences in the impact of these invaders on resident communities; 2) discussing the potential role of changes in the vegetation associated with *G. tinctoria* invasions in promoting secondary invasions by *F. japonica*; and 3) discussing the potential role of niche and fitness differences in determining the outcomes of competition between these invaders. A rigorous comparative assessment of the soil seed bank associated with these invaders is presented. *Fallopia japonica* significantly altered the structure of the resident standing and below-ground flora within few years only and showed a higher competitive ability compared to *G. tinctoria*. This study suggests that the formation of a persistent soil seed bank by an invasive species is not sufficient to guarantee its persistence at a locality, at least in the standing vegetation, and to prevent its displacement by another invader. It also suggests that, despite being invasive at the study site for over 50 years, *G. tinctoria* may occupy only a fraction of the available niches at a locality. These findings are critical to improving our understanding of the long-term implications of plant invasions on ecosystems.

The impact of *Impatiens parviflora* DC. on riparian forest *Fraxino-Alnetum* species diversity

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Small balsam (*Impatiens parviflora* DC) is one of the most invasive species threatening biological diversity of Europe, including Poland. In Poland its stands were first reported in mid 19th century. Over the last 150 years it has spread its way through Poland and is now common in the majority of forest ecosystems. Over the last 50 years numerous studies have been performed concerning the biology of the species, and the materials concerning its biology, habitat preferences and competitive interactions are full of mutually exclusive conclusions. However it is widely accepted that its invasion is one of the biggest threats to native vegetation, including Natura 2000 habitats and protected species.
Studies conducted in 2010 were aimed at determining the effect of small balsam invasion on the groundcover of *Fraxino-Alnetum* riparian forest – Natura 2000 habitat (code *91E0-3). The area under study was Wolbórka reserve (Central Poland). The reserve area was divided into 50 m x 50 m quadrats so that 168 plots were created. In the centre of each plot, a 1 m x 1 m subsquare was established where detailed floral studies were performed, which included preparation of a full plant inventory with the population of each of the species given in Londo scale and determining the individual number of small balsam.
The two dominant plant communities in the reserve are *Fraxino-Alnetum* riparian forest and *Ribeso nigri-Alnetum* alder forest. The distribution of *Impatiens parviflora* within the reserve is not even. The species was limited to riparian forest phytocoenoses and was found within 61 experimental plots. The highest density (163 individuals per 1 m^2) was recorded in the south part of the reserve – close to the national road, from where the species has probably spread its way through the reserve.
Then, in order to determine small balsam's effect on the groundcover of the riparian forest, the plots invaded by small balsam were compared with uninvaded ones. It was found that invaded areas are characterized by smaller density of mossy groundcover with a higher number of herbaceous species on the surface. The studies have also shown that riparian forest patches inhabited by small balsam are characterized by lower humidity and higher floral light factor.
The findings have shown that small balsam invaded the reserve mainly through dry patches of a riparian forest and along Wolbórka bed. The species was particularly abundant in patches inhabited by a high number of oak-hornbeam forest species.

The colonization success of invasive *Fallopia* taxa and the biodiversity threat along river valleys in southern Poland

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The project presented links community ecology and population genetics, providing a possibility of multidimensional analysis of the colonization success of invasive species introduced into riparian forests. The study is a part of the on-going project (2010-2013). It is based on the example of *Fallopia* taxa (*F. japonica*, *F. sachalinensis* and their hybrid *F.* ×*bohemica*) in selected river valleys. Taxa from this genus can be regarded as a model example because of the possibility of establishing hybrids and observing the microevolutionary processes.
The aim of the study is to test the hypothesis that native and alien plants which represent the same or similar plant functional types (PFT), playing the same ecological roles, can replace one another. At the same time we test the possibility of making use of such biological interactions in management practice.
For the purpose of this study a comparison of the participation of various PFT in sites with and without *Fallopi*a were conducted in a series of permanent plots. In total 30 invaded plots were set up in riparian communities along two river valleys in southern Poland. During the first year of the project the experimental plots were established with the following design: i) homogenous *F. japonica* populations in five replicates; ii) mixed populations consisted of *F. japonica* plus *F. ×bohemica* in five replicates for each type; iii) mixed populations consisted of *F. japonica*, *F. ×bohemica* plus *F. sachalinensis* in five replicates for each dominating taxa. Apart from 30 replicates without *Fallopia* complex in vicinity of analyzed populations were established. As a preliminary exercise, habitat conditions in the two river valleys were compared and no significant differences in terms of soil properties were found. Some minor differences were observed in habitat conditions in the three types of *Fallopia* taxa populations. The preliminary results suggest that not only habitat conditions are responsible for the distribution of the *Fallopia* taxa. We expect that in relation species diversity and genetic diversity, sites without *Fallopia* are characterized by higher biodiversity. In the paper we discuss which of the PFT distinguished, i.e. life and growth forms, properties of leaves and seeds, types of dispersal, types of mycorrhiza, Ellenberg indicator plant values are the most explanatory. Finally, we consider which plant traits might be useful for the selection of plant species to be sown or planted in sites invaded by *Fallopia* taxa in order to protect natural habitats from invasion. In the next stage of the project we will look for other phenomena such as species composition, PFT composition, genetic and cytogenetic variations inside the studied populations of *Fallopia* complex for explanation of invasion success.
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Invasive botanical species in the Kosice region (Eastern Slovakia), problems associated with the occurrence and proposals for solution.

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Invasive plants are species that are able to quickly establish and flourish in new areas due to a competitive ability over other vegetation.
We discovered the occurrence of invasive alien plants in Kosice -region. Through the growing season we registered 34 invasive alien and expansive plants species.
We registered: *Ailanthus altissima, Ambrosia artemisiifolia. Ailanthus altissima, Ambrosia artemisiifolia. Aristolochia clematitis, Asclepias syriaca, Aster lanceolatus, Aster novi-belgii, Bunias orientalis, Conyza canadense, Echinocystis lobata, Fallopia bohemica, Fallopia japonica, Fallopia sachalinensis, Helianthus tuberosus, Heracleum mantegazzianum, Impatiens glandulifera, Impatiens parviflora, Lycium barbatum, Negundo aceroides, Partenocissus quinquefolia, Rhus typhina, Robinia pseudoacacia, Robinia pseudoacacia, Rudbeckia laciniata, Solidago canadensis, Solidago gigantea, Stenactis annua agg*.
To the expansive plants species belong: *Artemisia vulgaris., Calamagrostis epigejos, Humulus lupulus., Melilotus officinalis., Phalaroides arundinacea, Sambucus ebulus, Typha laxmannii., Urtica dioica.*
Prevention of infestations is the most successful and cost-efficient method of dealing with invasive plants. Elimination may be possible for established infestations if the area is not too large and re-infestation by neighbouring plants is not likely. In some instances, infestations are too large to be practical for elimination, but must be controlled to prevent spread and new infestations. Control or elimination efforts generally have three options: mechanical, chemical or biocontrol methods.

Invasiveness of *Fallopia japonica* (Houtt.) Ronse Decraene determined by its plant traits and alteration of mycorrhizal community

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Exotic invasive plants are thought to create favourable growing conditions for themselves, which enable them to persist and spread. Comparative studies have revealed that the most successful invaders are species that, being characterized by high specific leaf area, high relative growth rates, rather high nutrient turnover, introduce novel functions in the invaded ecosystem. Moreover, recent works have proven that some invasive species influence the underground microbial communities in the new habitat, affecting mainly the mycorrhizal fungi which are involved in nutrient absorption and plant performance. In most case studies the investigated invader alters the mycorrhizal fungi to benefit itself and inhibit native plant species.
A number of studies clearly demonstrate the negative effect of F. japonica (an East Asian invasive perennial herbaceous plant) on biodiversity (i.e. native flora, invertebrate assemblages), on topsoil mineral nutrient concentrations, and consequently on economy. The species is recognized as a highly invasive noxious weed in its invaded area and one of the world's worst invasive alien species, yet the mechanisms underlying the high invasive success of the species are not thoroughly understood. Evidence of the effects of the invader on native mycorrhizal communities is still lacking.
The aims of this study were then to investigate the effects of F. japonica on native plants from adjacent uninvaded areas through i) direct competition and ii) altered mycorrhizal community structure. The research was conducted in Northern Italy.
A greenhouse experiment was conducted in 2010 to test the effect of several factors: soil type (soil collected from a heavily invaded vs. one collected from an adjacent non-invaded site), presence of native mycorrhizal fungi (sterilized vs. non sterilized soil) and direct competition between F. japonica and two native plants (growing monocultures vs. mixed culture), on the performance of native species. These points were approached by measuring aboveground biomass production, plants' height, specific leaf area of both invader and native species.
The same functional traits of the invader and of a set of native species, as well as canopy cover were estimated in field conditions.
Estimation of arbuscular mycorrhizal fungi (AMF) colonization of roots and diversity of AMF in the rhyzosphere of F. japonica and some of the plant species in the invaded site was accessed by confocal microscopy and molecular methods.

Litter decomposition rate of *Fallopia japonica* (Houtt.) Ronse Decraene and related soil fungal decomposers

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Fallopia japonica is one of the most troublesome non-native plant species in Europe. Several studies have been conducted to reveal the mechanisms by which the plant succeeds to invade different ecosystems, yet knowledge on the correlation between its litter decomposition rate and associated soil fungal decomposers is lacking.
One of the most evident impacts of *F. japonica* in the invaded ecosystems is the displacement of native plant species and formation of vast monospecific stands, thus leading to altered plant litter reserve in the soil. *F. japonica* affects nutrient cycling through biomass production and the quality of its litter. Functional leaf traits, nitrogen and lignin concentrations control leaf litter decomposition rates. Litter decomposition, a key process in nutrient cycling, regulates the nutrient supply of plants and is dependent on three main factors: litter quality, soil characteristics and the structure of decomposing fungal communities.
The following hypothesis were posed, and the experimental design built according to them: *F. japonica* alters i) nutrient cycle, especially the N- and C-flows by accumulating nutrients in low-rate decomposing litter ii) soil chemistry; iii) soil fungal decomposers community.
A field experiment using litter decomposition bags was conducted in 2011 in order to assess the decomposition rate of *F. japonica* leaves and stems compared to decomposition rate of native prairie plants that are usually displaced by the invader. Decomposition was studied under different site conditions to assess the role of the fungal decomposers community in soil under *F. japonica* canopy compared to soil lacking the invader and dominated by native prairie species.
The decomposition curve was assessed by periodical collection of the litter bags. Measures of total C and N concentrations were determined by dry combustion of ground plant material using an elemental analyzer every two months over a one-year period.
Moreover identification of the main taxonomical fungal groups involved in the decomposition process was carried out in soil under *F. japonica* canopy compared to native species canopy.
Differences in decomposition rate in invaded compared to the non-invaded stand are discussed referring to both initial litter quality and fungal decomposers diversity.

Transformer plants on arable lands as a special subset of invasive plants

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Transformer invasive plants are definite by some articles, but the most known and accepted definition by Richardson *et al.* (2000) identified transformers as a subset of *invasive plants,* which change the character, condition, form or nature of ecosystems over a substantial area relative to the extent of that ecosystem. According this term, transformers are those taxa that have clear ecosystem impacts and several categories of transformers may be distinguished.

In "Actual list of neophytes in Hungary and their classification according to their success" titled article by BALOGH, DANCZA & KIRÁLY (2004) comprises and indicate seven transformers on arable lands, which are typically weeds, such as: *Amaranthus chlorostachys* [syn.: *A. hybridus* p. p.], *Amaranthus retroflexus, Conyza canadensis* [syn.: *Erigeron c.*], *Cyperus esculentus* var. *leptostachyus*, *Iva xanthiifolia, Panicum miliaceum* subsp. *ruderale* [syn.: *P. ruderale*] and *Sorghum halepense.*

According to results of the Fifth National Weed Survey on Arable Lands in Hungary (2007-2008) the mentioned plant species were presented in the most important weeds in Hungary. Detailed article by PÁL (2004) presents the effect of invasive plants, which threaten weed vegetation on extensive arable lands in South Hungary.

Based on the weed surveys in Hungary, relevant results of the studies as reference samples give causes to define '**transformer plants on arable lands'.**

The author proposes that the term of '**transformer plants on arable lands**' as a subset of transformers is necessary to definite, also. The suggested definition is hereinafter: **transformer plants on arable lands** are those invasive plant species, which change biodiversity mainly on arable lands by their significant impacts such as allelopathy and competitiveness. The most dangerous weeds, which cause decreasing of biodiversity on extensive fields; moreover they cause enormous ecology and economy damages in the agriculture ecosystems are presented in this subset. Recently about 10% of transformer plants are **transformers mainly on arable lands** in Hungary.

Although *Abutilon theophrasti* is not considered a neophyte in Hungary but it can be considered as a good sample for transformer on arable lands for Western and Northern European countries.

Poster Session 7 – Management & communication

Evaluation of control strategies for *Cymbopogon nardus* in grazing areas of Uganda

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Cymbopogon nardus is an invasive grass weed in the grazing lands of south-western Uganda that impacts negatively on the livestock industry of the country. The species forms dense tussocks that affect growth of other species and impede movement of livestock during grazing. In order to improve the grazing potential of the area, farmers have for long been using manual removal using the hand hoe as a control strategy of the weed in order to allow growth of palatable species. An experiment was set up to evaluate different potential control strategies of *Cymbopogon nardus* on rangelands. Manual removal with the hand hoe, the use of fire and spraying with glyphosate herbicide were evaluated for effectiveness in controlling the weed. The trial was replicated on 4 different sites. Results indicated that both manual removal and the use of gyphosate herbicide were effective in controlling *Cymbopogon nardus*. The differences between the two control methods were not significant. Plant species biodiversity recovery was faster in the manually controlled plots than in those sprayed with glyphosate but the number of species were not significantly different. The frequency of occurrence of species was however significantly different with manually controlled plots registering a higher frequency of the species. Fire had no effect as a control strategy. Instead fire increased the number of tussocks, growth vigour of the re-growth, flowering and hence seed setting of *Cymbopogon*. After 3 seasons, no significant difference was observed in species biodiversity between manual and herbicide control.

Experiments on reduction of abundance of invasive species (*Impatiens glandulifera, Solidago gigantea, Adenocaulon adhaerescens*)

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Subjects under investigation – *Impatiens glandulifera* Royle (annual), *Solidago gigantea* Ait. (long rhizome) and *Adenocaulon adhaerescens* Maxim. (short rhizome), growing in masse on the territory of the Main Botanical Garden (Moscow).
Experimental plots of 2×1 m were established. Small plot size was adequate for sampling relatively species-poor herbaceous plant communities. Plots had a high covering of examined species (80-100 %). Vegetation composition was assessed using frequency measures (shoots/m²) of investigated species and accompanying ones. Each experimental plot was further divided into 2 parts: one of them (1×1 m) was assigned to a removal treatment, while the remaining part was left unmanipulated (control). During the next 2-3 years the changes occurred on experimental plots have been registered and removing of invasive species has been made repeatedly.
For *Impatiens glandulifera* experimental plots were established: 1) along Lihoborka river , 2) on flood plain under willow curtains, 3) in small fen with *Phragmites communis*. Our attempt to reduce the *I. glandulifera's* abundance wasn't successful. On the control parts density of stands in 2006-2008 varied insignificantly (200-350 plants/m²), depending on ecotope characters, while on parts where removal was made, density of stands was increasing year after year, and in 2008 was already about 700 plants/m². Native species weren't marked on plots, however seedlings of another agressive species - *Heracleum sosnovskii* - appeared.
Better results were received for *S. gigantea* (supervision 2007-2009). Experimental plots were established: 1) on the wasteland, 2) on a margin of oak grove, 3) on a pond coast. As a result of treatment photon flux density at the ground level on the removal plots was 6-10 times higher than on control ones. On the first plot shoot number of *S. gigantea* had decreased by 2,5 times (101 vs. 260) and the number of native species had increased (7 vs. 4) in 2 years. On the second plot shoot number of *S. gigantea* had decreased by 1,2 times (144 vs. 179) and the number of native species had increased (6 vs. 2) too. On the third plot shoot number of *S. gigantea* hadn't decreased, but increased by 1,2 times (153 vs. 131), nevertheless, the number of native species had increased (11 vs. 6), and 2 other invasive species (*Geum macrophyllum* and *Impatiens parviflora*) had appeared.
The greatest success was achieved in eradication of *Adenocaulon adhaerescens*. This species "escaped" from culture about 15 years ago and has widely extended along garden roads and footpaths. The density of its stands was from 83 to 211 plants/м² (average 133,4±35,8). No native species can grow on those sites. 24692 individuals (about ¾ growing in a garden) were destroyed in 2009. Next year the number of plants on all experimental plots decreased by ten times (473 vs. 4247) and some native species appeared - *Galeobdolon luteum, Aegopodium podagrarium, Impatiens noli-tangere,* etc.

Educational, public outreach, and research opportunities with the Global Garlic Mustard Field Survey (www.garlicmustard.org)

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Many invasive species are quickly changing the world's natural ecosystems. For this reason, invasive species are of great interest to researchers and students in ecology and evolution, as well as to nature conservation and the broader public. Many contemporary ecological hypotheses for explaining successful plant invasions assume that plants grow more vigorous, produce more seeds, and reach higher population densities in introduced populations than in their native range. Yet there are insufficient data to test this assumption for most invasive plants because geographic variation and environmental heterogeneity within native and introduced regions requires the field sampling of many native and introduced populations, which is beyond the financial and time budgets of most research labs. Here we report on our experience from the first two years of the Global Garlic Mustard Field Survey (www.garlicmustard.org), an ongoing global collaborative effort that attempts to compile such comprehensive data for the invasive plant garlic mustard (*Alliaria petiolata*) through the joint effort of many scientists, students and citizens. We developed a relatively simple, standardized protocol for estimating plant growth and reproductive success, population densities, and herbivore attack rates in natural populations. This protocol, together with a project website and online data entry, allows participation of many contributors, including such without a specialized training, and it can be easily incorporated into high-school or university courses. Educators can offer their students an invaluable opportunity for hands-on participation in peer-reviewed scientific research, while citizen scientists will find a rare opportunity to contribute to cutting-edge biological research and learn more about how scientists come to understand the natural world. During the first two years, we received data for approximately 200 populations – approximately equally many from Europe and North America – from more than 50 participating individuals or student classes. Although the project is still ongoing, and a major analysis of the data will only be done after the 2011 season, we will present preliminary analyses of the available data at the EMaPi meeting. This project demonstrates that a mass collaboration is an efficient method for gathering data across large geographical areas, and provides exciting opportunities for education and public outreach.

Working the plan(t) together

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Management of invasive species is more difficult in continental areas as these are usually subject to administrative and national boundaries that difficult coordination of management actions. A good instance of this is Basque Country (NE Spain), a small territory up to 5 fuzzy administrative levels. First invasive plant management trials took place in the late 90's. Since then, there has been neither assessment nor review of those experiences Thus, knowledge is scattered, unconnected and lessons learnt are poorly transferred. We conducted a review of management actions on *Fallopia japonica* considering scale, methods and detected needs. After reviewing more than 10 actions and holding interviews with responsible persons we identified the following problems in common: incoherent geographical scale, lack of leadership, misidentification of responsible authority and, inconsistent methodologies.
Based on the former diagnosis, we held a multi-agent workshop with 17 different authorities and associated institutions, scientists, and management enterprises. We worked with them in different sessions. First, we made 2 groups (government and associated institutions; researchers and enterprises) and we asked them to identify improvement areas for the other group to boost up their own results. Second, working with a draft document, we ask all stakeholders to identify needs of acting and knowledge gaps to develop a sound management plan on Japanese knotweed. We found significant disagreements among agents in terms of: aims of each guild, methodology needs, management urgency, treatment scale and waste disposal. Third, working together, were identified several knowledge and policy development needs as a legal back-up for management: regulation of used toxics, ban on knotweed commercialisation and uses, authorisation to work in private-owned lands, shaping vertical coordination, creation of a coordination agency, options for proactive management in private lands, reserve funds for emergency situations requiring fast response, and common places for sharing experiences and knowledge. Furthermore, lack of leadership was agreed with one voice to be the main drawback of invasive management in Basque Country. It was agreed that the leading institution of the process should be an authority at the broadest coherent management scale and the agency involved should act in an agile manner to response quickly. However, management of knotweed as well as other invasive species should not be restricted to Basque Country Government management competences. Thus, a supranational institution involving other Spanish regional governments and neighbouring countries would be most welcome to lead management of invasives. To conclude, participants found the workshop interesting and useful for future actions and, considered that should be regularly repeated to update knowledge, share experiences and devise together coordinated actions.

Growth and reproductive traits as a basis for the development of management strategies of the invasive *Ambrosia artemisiifolia* L.

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Knowledge about growth and reproductive traits and their variation in different environments is essential for the development of efficient management strategies of invasive plant species.
Environmental factors such as site, habitat management, accompanying vegetation, but also population density influence those traits.
The invasive *Ambrosia artemisiifolia* L. (Common Ragweed) has spread all over the world during the last decades and represents an increasing health and phytosanitary problem in many countries.
We studied the influence of cutting regime, of different competing vegetation and of ragweed population density on several vegetative and generative traits in glasshouse experiments.
As many countries face the serious problem of linear spread of this species along roadsides, we started parallel experiments in the field on natural populations along roads and highways.
In glasshouse experiments regrowth ability (resprouting) or number of produced seeds turned out to be influenced significantly by sown accompanying vegetation, the cutting regime, and ragweed population density. Germination and recruitment rates of Ragweed were altered by slight differences in the composition of vegetation. For many vegetative traits, population density effects were found whereas the cutting regime influenced mostly reproductive traits.
Latter traits are most important as this annual plant produces high amounts of seeds if cut improperly; and after cutting it can resprout successfully from the basal nodes that escape the cutting.
The same traits are studied in field experiments that are still running. Intermediate results indicate a high trait variation with respect to site conditions. Ragweed plants grown under field or glasshouse conditions differed sometimes to a great extent. Thus, in case of Common Ragweed, field experiments give more realistic results for future control plans compared to the disproportional impressive results from glasshouse experiments.
The results show that the commonly applied control strategy of mowing of roadsides (especially its timing and frequency) should be designed in a more sophisticated way. i.e. considering the target plant traits such as resprouting ability or phenology and not orientating on calendar date as often done in current praxis of management regulations.

Biological control of Oxeye daisy, *Leucanthemum vulgare*

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Originating from Europe, Oxeye daisy (*Leucanthemum vulgare*) has been introduced to many other parts of the world as a contaminant of seed and as an ornamental. In North America, Oxeye daisy has become a particularly aggressive invader in pastures and meadows. Because this species is difficult to control by conventional means, a project has recently been initiated to assess the prospects of classical biological control against Oxeye daisy in North America.
Several monophagous herbivore species are reported in the literature to feed exclusively on *Leucanthemum* spp. In order to determine their potential as biological control agents, we selected several of these herbivores for in-depth studies on their host specificity and impact on the target weed. As there are no native North American species in the genus *Leucanthemum* there is a good chance to find a herbivore that is sufficiently host specific to be released as a biological control agent. However, the ornamental Shasta daisy (*Leucanthemum* x *superbum*), which is widely planted in North America, is thought to be a hybrid of different *Leucanthemum* species.
In Europe, Oxeye daisy is often considered to be a species complex, consisting of various taxa with different ploidy levels. According to the literature, two different cytotypes have become invasive in North America, i.e a diploid (*Leucanthemum vulgare* sensu strictu), and a tetraploid form (often referred to *Leucanthemum ircutianum*), but their level of invasiveness remains unclear. To assess the abundance and distribution of the different *Leucanthemum* taxa in Europe and North America, we started collecting populations across the native and the introduced range and to characterize the field-collected populations as well as Shasta daisies using molecular markers and flow cytometry.
We will outline the main research questions and first results obtained during the initial phase of this biological control project.

A new attempt of fighting ragweed in Europa

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The European Commission, DG Environment, is funding a new project on ragweed. The project has started in spring 2011 and is executed by a consortium of German, Hunagrian, Austrian, Slovenian, Danish and Swiss researchers. The overall aim of the project is to contribute to the reduction of the prevalence of Ambrosia artemisiifolia in European countries in order to reduce the burden on public health, agriculture and biodiversity. This will consist of developing strategy elements for the reduction of occurrence of ragweed and its pollen in countries where the species is already established, e.g., Hungary, Slovenia, parts of Austria, and South-eastern Central Europe and for the prevention of further import and spread in countries not yet heavily infested, such as Germany, the Netherlands and Northern European countries. To this end the gaps in the existing information needed for understanding historical successes and failures of control and eradication activities will be analysed. This includes

- a fuller understanding of critical elements in the life history of common ragweed,
- an evaluation of existing chemical, mechanical and biological control measures,
- recommendations on how to best choose the most successful method for control and eradication in different situations, such as agricultural and non-agricultural sites or more or less heavily infested areas.

Results of laboratory and field experiments will cover the germination biology and seed bank behaviour, including a protocol for assessing viability of seed populations, the proportion of viable/germinable seeds produced by different populations or found in transported commodities, such as bird seed and soils. The impacts of chemical and non-chemical control measures on Ambrosia and on other plants will be demonstrated.

The project will make existing experience and know-how of the project partners widely available by enhancing communication structures and by critically reviewing existing information. Experiments in the laboratories and in the field will be carried out in several countries with varying degree of ragweed infestation: Hungary, Slovenia and Austria with lower and Germany and Denmark with lower abundance of the species. Germination and seed bank biology and the plant's reaction to mechanical and chemical control measures will be studied in experiments. Options for biological control and impacts of control measures on the biological diversity will be analysed in desk studies. Results will be integrated into management recommendations distributed via printed material, websites and conferences.

Our contribution will introduce the project and report on early findings. The aim of the contribution is to raise awareness about the problem and the project and to invite discussion.

Biofuel crops with invasive potential: could biocontrol provide a safety net?

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Biofuels are increasing in prominence, as the need to reduce our reliance on fossil fuels to supply future energy needs becomes more critical. One significant environmental issue that is coming to the fore is that of invasiveness of crops being considered for biomass. In most cases, biomass crops are being planted outside of their centre of origin, and have only relatively recently been introduced into the new area for mass cultivation. Consequently, they are likely to have a paucity of pests and diseases attacking them. This, together with many of the other invasive characteristics they possess (e.g. rapid growth rate, wide environmental and climatic tolerance), which makes them ideal as biomass crops, increases the probability that some may escape the confines of the agroecosystem. Biological control is one approach that could be exploited to help mitigate this perceived and known risk. The recorded natural enemies on a number of key potentially invasive biofuel crops are presented and discussed in relation to the future management of these species.

Control of Common Ragweed (*Ambrosia artemisiifolia* L.) by vegetation management

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Ambrosia artemisiifolia L. (Common Ragweed) behaves invasive in Europe and causes health problems and crop yield losses. Rapid spread throughout Europe can be observed along the roadsides. We look for environmentally friendly control measures by vegetation management: sophisticated cutting regime and seeding competitive natural vegetation.
Ragweed is a shading-intolerant plant. In a pot experiment we test the efficiency of sawn vegetation under high and low ragweed density. Two commercial seed mixtures differing in their respective quantities of competitive grasses and clover are selected to compete with ragweed. We measured the development of ragweed population size and biometric variables before each cutting event and once after the last cutting.
We found lower germination rates for the ragweed plants growing in Mixture 2 (higher proportions of Perennial Ryegrass) than in the Mixture 1 (0.2 and 0.4, respectively). Between the two terms we found 65% (Mixture 1) and 64% (Mixture 2) ragweed-mortality.
This negative trend slowed down after the second term but continued until the end of the experiment.
In glasshouse conditions the use of simultaneously sown competing vegetation showed to be very effective in reducing ragweed density and therefore prevent high seed production.
Experiments with sowing of competing vegetation on newly constructed roadsides under field conditions were already established.

Aerial spot control of wilding conifers in New Zealand

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Wilding conifers threaten over 200,000 hectares of land administered by the Department of Conservation in the South Island of New Zealand. Sparsely scattered wilding conifers are a major concern, as they increase the point of invasion once they seed. It is therefore of extreme importance to effectively control these individual trees before they seed. Current control methods rely on cutting trees down by chainsaw. Due to the isolation and remoteness of these wildings, a chainsaw operator has to be flown to each individual tree by helicopter to cut it down. This method is costly and time consuming.
Two herbicide treatments, triclopyr (in oil) and a mixture of glyphosate and metsulfuron (in water) were tested on *Pinus contorta*, *P. nigra* and *Pseudotsuga menziesii*. Treatments were applied by helicopter with a purpose built spot gun at 500 ml herbicide solution per tree. For each trial 150 individual trees of varying age and sizes were marked and monitored prior to treatment. Tree response was monitored by scoring percent damage at 3 and 12 months post treatment. This paper describes the results after 12 months.

Management of invasive plants in a riparian landscape within the restoration programme of the river Traisen, Lower Austria

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In recent decades, a dramatic acceleration of the changes in the composition of species in the vegetation of riparian landscapes was observed. These developments are primarily for the benefit of invasive neophytes. Their propagation, among other things enhances the loss of biodiversity. During this project, the floodplain in the opening section of the Traisen in Lower Austria will be examined on the occurrence and development of invasive species. The regulated riverbed of the Traisen will be revitalized as part of the LIFE + project "TRAISEN". The creation of a natural river course requires a lot of engineering measures and management of invasive species in the floodplain. The evaluation of the situation and the development of invasive species are done by means of a grid that is placed over the research area. This creates a network of 135 recording surfaces, each 200m ². In the first study in 2010 during which the current situation was examined, 27 neophyte species were recorded on the grid points. Of these, 7 invasive neophytes were found (*Acer negundo, Impatiens glandulifera, Impatiens parviflora, Robinia pseudoacacia, Ailanthus altissima, Fallopia japonica, Solidago canadensis, Bunia orientalis*). In the following study years, the development of invasive species will be monitored during the construction of the new course of the river. The goal of this work is to assess the quality of plant diversity before and after the change of the course of the Traisen. Here the value-giving species represent floodplain-typical habitats, species of the Red List as well as invasive species. The polluter-affected-effect is to be analyzed. Furthermore, the interaction between the intervention and the spread of invasive species and endangered species and value imaging has to be analysed. Sensitive floodplains without intervention serve as a basis for comparison.

Successes and failures in a national campaign to control a new invasive plant—pompom weed in South Africa (*Campuloclinium macrocephalum:* Asteraceae)

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Campuloclinium macrocephalum (pompom weed) is a garden ornamental of South American origin that over the past 20 years has become a serious threat to the higher rainfall grasslands of South Africa. Rapid dispersal of seeds by wind, water and vehicles all contribute to the rapid spread of pom-pom weed to new localities. Here we discuss the development of a national approach to combat this species, including the mapping of existing infestations, modelling future invasions, an awareness campaign to locate new foci, designing effective control methods, research and implementation of a management programme overseen by a select committee. The project focused on outlying infestations and the likelihood of eradicating incipient populations. In 2009 the first attempts were done to use chemical control teams to focus on small isolated populations. These control operations have been expanded to cover all known populations in all provinces where the species was still considered emerging. Over the past 3 years a minimum of between 1-4 rapid response teams per province were contracted for clearing the species for the duration of each flowering season. A total of 4 clearing follow up operations have been conducted to date. For the main infestations around Pretoria and Johannesburg (Gauteng province), chemical control is too costly, and control will have to rely on the biological control programme using natural enemies from the country of origin. First releases of the bi-control agents are expected within a year.

While the idea was to have control units rapidly responding to calls during the flowering season, the efficacy of chemical control teams has been seriously hampered by logistical and administrative red tape compounded by access problems to private properties and a lack of commitment from landowners to do follow-up and maintenance control. An efficient awareness campaign has so far been very effective in locating such new incipient populations which are then targeted for control.

The integrated approach has contributed substantially to capacity building in many disciplines, including training and research on invasive plants, small business management of control operators and the training of skilled spray operators. Liaising with all the many stakeholders has been a major challenge to the programme. This experience is most valuable where new projects on new emerging invaders are unfolded.

Spread of *Ambrosia artemisiifolia* in the states Brandenburg and Saxony in Germany and its control with herbicides

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In the year 1993, *Ambrosia artemisiifolia* was registered as a weed an arable land for the first time in the in the south-west part of the state Brandenburg (Cottbus). In the year 2007, the total area of infested fields in Brandenburg has been approximately 1500 ha. On the contrary in Germany, during weed monitoring in maize in the years 2000 - 2004 the occurrence of *Ambrosia* was very low. Its frequency was lower than 0.1 % for 2602 monitored maize fields.
Measures for the control of *A. artemisiifolia* have to be adjusted to allow for the plant density in the stands. In Brandenburg and Saxony numerous locations of *A. artemisiifolia* have been reported. For those stands eradication arrangements are scheduled and also practicable. Furthermore there are, especially in Brandenburg, agricultural areas with a high density of *A. artemisiifolia.* The goal in these locations is the control of further spread, combined with the reduction of allergean potential. Approaches to the control *A. artemisiifolia* are demonstrated by testing of herbicides in maize, peas, sunflowers, grassland, non-crop areas. High efficacy (up to 100 %) was reached in maize using approved herbicides. The active substance imazamox showed the highest efficacy against *A. artemisiifolia* in peas. Cultiviation of tribenuron- tolerant sunflower varieties and the use of tribenuron-methyl offers the opportunity to eliminate the competition of *A. artemisiifolia* even in strongly infested areas. In grass land and public green space the active substance clopyralid controls *A. artemisiifolia* well. Non-selective active substances like glyphosate and glufosinate are appropriate to control *A. artemisiifolia* in non-crop areas. Organic farming shows a reduction of *A. artemisiifolia* taking adequate agricultural measures. However further spread of *A. artemisiifolia* cannot be prevented in organic farming.
Referat 74 "Pflanzenschutz"

Eradication of Rosa rugosa with grazing short-tailed sheep

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Since 1875 when Rosa rugosa was first naturalised in Denmark it has become an invasive species. Rosa rugosa rapidly spreads in coastal areas reducing the species diversity because of the shading effect. Many efforts and a lot of money are spent on eradication. Digging up the roots seems to be the only efficient way to remove Rosa rugosa.
We describe a successful eradication procedure in a recreational area. The mean is a cut down followed by grazing with northern European short- tailed sheep. The following 5 years with intensive grazing has eradicated most of the Rosa rugosa in the area.

Preventing the spread of Pompom weed (*Campuloclinium macrocephalum*) through communication

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Pompom weed *(Campuloclinium macrocephalum)* is an ornamental asteraceous herb from South American which is becoming a very aggressive invader in South Africa. Pompom weed is rapidly spreading across the South African Grassland Biome and poses a major threat to biodiversity (the grasslands being rich in endemic and threatened species) and to grazing lands. Lack of public knowledge about this invader is a major factor contributing to its spread. The South African National Biodiversity Early Detection and Rapid Response Programme is launching a communication campaign to raise public awareness, with funding from the Working for Water Programme and the Gauteng Department of Agriculture. The aim of the communication campaign is to prevent the spread of pompom weed by raising awareness about its negative impacts, develop partnerships with appropriate stakeholders and relevant institutions, encourage the public to report new sightings of pompom weed and to inform the public about control methods and eradication efforts put into controlling this species. The target audience includes the public, government organizations, conservation institutions, education and research institutions, non-government organizations and the media. Information brochures have already been distributed and the campaign will be expanded to include an information call centre, pompom weed open days, exhibitions at selected public events and distribution of information brochures, plant spotter flyers and identity guides in selected print media. In addition, the communication campaign will undergo ongoing monitoring and evaluation, measuring progress by the number of people who support the campaign, the number of coordinated events, the quantity of communication materials produced and distributed and the number of new reported sightings of pompom weed. The monitoring and evaluation report will give insight into the strength and weakness of this campaign which will assist in developing future communication strategies.

Introduction of activity of a small eterprise specialized for eradication of invasive plants in Hungary

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Our company established in 1997 specialized for mapping, project planning, technological development of application methods, advising and eradication of invasive plant on national parks and forestries thorough Hungary. Our aim to find "gentle" chemical treatment methods against invasive plants, which can be used with minimal impact for the environment. This melts the herbicide usage with protection of sensitive areas on cost effective way.
We deal with mapping – project planning – budgeting – managing different size of project preparations, EU applications. Due to our accumulated experience, our activity covers the managing projects from the field assessments of invasive coverage – coenological assessment – preparation on GIS – determination of eradication technology – scheduling, budgeting and managing projects.
To find the proper herbicide against particular plants for own activity or for request of different institution or national parks we make plenty of field trials evaluating the effect of different selective/non-selective herbicide against the target plant as well as the existing plants of the target area. We try to find selective herbicides, which can be tolerated by dominant part of the natural flora. In order to that that mass combination of active ingredients and were/are tested in different areas.
Our chemical eradication annual capacity with mainly hand-held applications is around 1.500 hectares keep increasing continuously from the beginning... We developed an endogen technology killing against trees and shrubs. The technology with drills, automatic injection of concentrated herbicide and closing the holes by glue provide environmentally safe, closed method. The high herbicide intake provides considerable decrease of the sprouting in the following years.
With wiping of concentrated glyfozat with fluid or with own developed gel formulation makes no drifting and defend the natural habitat around the treated plant. These technologies were applied mainly against Asclepias syriaca.
With spot spraying mainly using mainly selective herbicide makes quicker and cheaper method for eradication. With proper surfactant and nozzle usage the small droplet size fraction of the spray can be eliminated result minimal drift in the protected areas. Alternative methods are also we used, as bark and trunk wiping or overall spraying with selective herbicide when is allowed.
In our present development projects we mounted spraying equipment into ATV, which can be used in pastures and flat areas. The low weight of the machine minimizes the soil treading. A weed-wiper adapter are also in use provide high area performance.
We want to finalize the development of herbicide-foam, which provide zero-drift and 100% efficiency reaching all of the target plant in this year.

Poster Session 8 – Introduction pathways and spread of invasive species

Expansion of *Geranium sibiricum* L. (Geraniaceae) in Poland

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Siberian cranesbill *Geranium sibiricum* has broad distribution stretching from East Asia to Central Europe. The species was unintentionally brought to many European countries as well as to North America. In Poland it has the status of kenophyte (epecophyte). The first information on its occurrence in Poland comes from the foothills of the Sudety Mts. (Dzierżoniów, 1840). Until World War II there were only four localities of the species known: three from the 19th century in the Lower Silesia region (SW Poland) and one from the 1930s in Szczecin (NW Poland). Expansion most probably started with the end of World War II and closer economic ties with the former USSR, as confirmed by collections from Przyręb n. Zator (1949; S Poland) and the Hrubieszów region (1960-1964; E Poland). Until recently Siberian cranesbill was a rare plant in Poland, having only a dozen or so localities, mainly in the southern and eastern parts of the country. Field studies by the authors, revision of herbarium materials, and data sent by other botanists in Poland gave a chance to supplement data on the distribution of *G. sibiricum* in Poland, invaded habitats, degree of naturalization and history of spread. The occurrence of *G. sibiricum* was confirmed in 75 10 x 10 km units of the ATPOL cartogramme, mainly in the eastern and southern parts of Poland. Most probably the main routes of its invasion are railways, where the species is spreading from east to west. Another way is spreading in ruderal habitats outside of the railway network, and the newest is escape from ornamental cultivation. Siberian cranesbill was most often observed along railways and railway embankments, on forest borders, city lawns, store places, cemeteries and roadsides, in well lit places, predominantly with lowered competition from other plants. Abundance on different localities was very variable, from single individuals on railways to thousands of individuals in big patches on railway embankments and forest borders. Most localities seem to be stable. We predict the further spread of *G. sibiricum* in Poland.

Dynamics of *Ambrosia* L. (*Asteraceae*) species and prospects of their establishment in Lithuania

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In the flora of Lithuania the genus *Ambrosia* L. (*Asteraceae*) is represented by two alien species, i.e. *A. artemisiifolia* L. and *A. trifida* L. Much attention to the immigration, distribution and establishment of these species is paid because their pollen is recognized among the strongest airborne allergens that induce hay fever symptoms during pollination period. Certain amount of airborne pollen is being registered during August–September in Aerobiological Stations in Lithuania.

In Lithuania *Ambrosia artemisifolia* was first recorded in 1884 in Klaipėda; however, until 1980 it remained a very rare immigrant. During the period from 1884 till 1980 this species was recorded only 6 times. The most intense immigration of *A. artemisifolia* in Lithuania took place since 1980s. During 10 years (1981–1990) it was recorded 88 times. In the course of the subsequent decade (1991–2000) the number of records decreased to 45. In the period of 20 years (1981–2000) *A. artemisifolia* was found almost throughout Lithuania in railway station and grain mill yards, dumps, along railways, on road sides, etc. Starting with 2001, the number of *A. artemisifolia* records in Lithuania significantly decreased. During the first decade of the 21st century (2001–2010) this species was recorded 8 times in 7 localities in South and East Lithuania. Decrease of *A. artemisifolia* frequency during the last decade of the 20th century and the first decade of the 21st century is related with the reduction of grain import into Lithuania because the imported grain is the main source of its seeds.

Although seeds of *A. artemisifolia* are still occasionally recorded among imported grain, the number of its records might have decreased because of strict management of railways, railway station and grain mill yards as well as their surroundings. Nevertheless, *A. artemisifolia* plants frequently flower, produce seeds and create short-lived populations in Lithuania. Furthermore, lower sensitivity of plants to autumn frosts was noted, e.g. in 2010 in Vievis (south-eastern Lithuania). These facts presume the beginning of *A. artemisifolia* establishment in Lithuania.

A. trifida in Lithuania was first recorded in 1947 in Vilnius. New records of this species were made only 40 years later, in 1987. During the period of eight years (1987–1994), 26 records of *A. trifida* were made in Lithuania in railway station and grain mill yards. Starting with 1995 no plants of this species have been found, though their seeds are occasionally recorded among the imported grain.

Flowering of *A. trifida* was registered only twice (in 1947 and 1992) in the country. Though under experimental conditions this species flowers and produces seeds, its establishment, at least in the nearest future, is hardly possible.

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Solidago canadensis, Impatiens glandulifera and Fallopia japonica - invasion scenarios north- and southward the main chain of the Alps

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The aim of the study was to reconstruct the invasion history of Eastern Alpine area by comparison of two adjacent regions, separated by the main chain of the Alps. The study area encompasses North- and South Tyrol (ca. 20.000 km^2) in the centre of the Eastern Alps. Size and landscape are comparable and they have a common past till the end of the First World War. But there are also important differences. Amongst others South Tyrolean main valleys are extending in north-south direction and the area is open to the south whereas the North Tyrolean Inn valley extends in east-west direction with just one corridor in the northeast into the northern alpine foreland. Thus leads to partly different climate conditions and different pathways for alien taxa. Not least the main chain of the Alps is an efficient barrier to plant migration.
Fallopia japonica, Solidago canadensis and Impatiens glandulifera are three of the most problematic invasive alien plant species found in the study area. The two latter are the most widespread problematic neophytes in the total area. Ancient and recent literature, herbaria and results of actual mappings were used to trace invasion.
Fallopia japonica was first documented from North Tyrol (Innsbruck) in 1906 with no tendency to expand till the early 1960-ies.Then a first step of moderate expansion started. Since the 1980-ies distribution of Fallopia japonica increased enormously. The first finding for South Tyrol is published in 1960. Within the last 3 decades the species expands rapidly. Similar to Fallopia, Impatiens glandulifera was first published from the city of Innsbruck in 1906. During the following decades till the end of 1970-ies there is a continuous, but moderate increase of distribution. Then the invasion process got much faster. To point out is the situation of South Tyrol, where Impatiens glandulifera is known since only 1980. But since then the species spread explosively, totally lacking a lag phase.
Invasion history of Solidago canadensis differs. Although it is the most widespread and problematic alien of the studied area first documentations are dated with 1964. They originate from Innsbruck and Kitzbühel. Till the 1970-ies lowland areas along the Inn valley were invaded. During this period the first and disperse populations in South Tyrol appeared. Within the next decades the expansion of Solidago canadensis increased enormously.
Despite of comparable conditions, the results show very distinct differences for the first decades of invasion for both, the taxa and the two regions as well. Since the 1980-ies this changed and all the species expand rapidly in both regions during last three decades and the process still goes on. Nevertheless distribution and impact on native flora and vegetation are still much more pronounced northern of the Alpine main chain.

Herbaceous perennials on the Estonian horticultural market: the issue of bio-invasion

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We have previously demonstrated in the case of Estonian Alien Flora (Ööpik et al. 2008) that the establishment and naturalisation of alien species depends on the level and type of human mediation. Humans are not just dispersers of alien species but may increase the propagule pressure created by cultivar selection both before and after the introduction and/or long-term presence of the species in the area (e.g. ornamental plants, via their presence on the market). Furthermore, cultivation has tended to prefer perennial species with propagative advantages for attaining greater abundance and naturalised status, especially in (semi-) natural communities.
In the light of a lack of qualitative data in the field of ornamental horticulture, we selected 17 nurseries located in different parts of Estonia and compiled an extensive database of herbaceous perennial species currently available on the market. We aimed to understand better the overall size and composition of a such a list, especially analysing the relationships between species status (native or alien: not escaping, casual, naturalised, invasive), abundance in the wild, year of the first recorded appearance in the wild, wholesale or retail price and number of nurseries in which the species is available, as well as its status in neighbouring countries (NOBANIS), etc.
In total, our database consists of 3967 primary entries which we have analysed at the species level to produce a list of 880 species. Of this list, 91 were native and 100 have been recorded outside cultivated areas in Estonia. Preliminary results showed that native and running wild species have a similar profile, in contrast to species, which have still confined to cultivated areas. Both were cheaper and more widely available than those which have not escaped. Our results also indicated that the abundance of alien species in an area tends to increase with residence time. Hence, supply and demand factors create propagule pressure and are an important part of the explanation for the invasiveness of ornamental species.
As an application, we also compiled a qualitative list of the more problematic species among the herbaceous perennials on the market, using data from local sources and neighbouring countries. There are urgent requirements for the regulation of the ornamental plant trade in order to diminish the risk of new introductions becoming invasive aliens. It will also be helpful if the public can be involved in finding alternatives and encourage best practices for both horticultural professionals and amateurs.

Riparian and fluvial quality loss increases water seed dispersal of the alien tree *Ailanthus altissima*

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The alien tree *Ailanthus altissima* (Miller) Swingle seems to be quickly spreading through roadsides and riparian ecosystems in the center of the Iberian Peninsula. It is known that some primarily wind-dispersed seeds, such as those of *A. Altissima*, can also be transported by water to longer distances, retaining high germination rates. *Ailanthus altissima* is characterized by its high propagule pressure and facility to establish after disturbance events. This study aims to assess whether the conservation state of fluvial and riparian ecosystems affects the downstream seed dispersal distance via water.
Fruits from different mature female trees were collected, desiccated at air temperature and spray-painted. Two upper reaches (100 m each) of the Henares River with contrasting conservation state were selected for the study: one was a meandering reach with well-preserved riparian vegetation, and the other was a rectified reach, where most of the riparian vegetation had been removed. The field experiment was conducted on February 2011. One hundred painted seeds were released at the upper part of each reach. During 90 minutes, no-retained seeds were collected with a hand net, 100 meters downstream the releasing point and their arrival times were registered. After this period, retained seeds were thoroughly searched and collected from down to upstream and their positions were recorded. The experiment was repeated three times per reach. Differences in dispersal distances between reaches were analyzed using t-test.
The most relevant result arisen from our study is that seed dispersal distance is a function of the riparian habitat status. In the degraded section 26.53 □ 3.6 % of seeds arrived 100m downstream in 90 minutes, whereas only 5.53 1.5 % did it in the well-preserved one.
This study reveals that well-preserved streams retain a higher number of seeds than degraded ones. Therefore highly disturbed rivers may act as corridors, facilitating the downstream spread of exotic species; while wilder ones are more retentive. Consequently, the maintenance of an adequate habitat structure can slow down the dispersion rate of exotic riparian plants. We can conclude that the conservation degree of riparian and fluvial habitat is a key element in the effectiveness of invasive seeds water dispersal.

Bromus carinatus Hook. & Arn. as an invader of marginal habitats in agricultural landscape of SW Poland

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Grasses have a significant share in most of the floras of the world. Many species have biological characteristics that increase their invasive capacity, which results in increased involvement of certain grasses in local floras. In assessing the abilities of little-known invasive grass species can help: identification of migration routes of the species and communities, in which they occur. The genus brome *Bromus* includes many species perceived as alien in various regions of the world. Several species have recently achieved status of noxious weeds, as California brome *Bromus carinatus*. Its first observations in Lower Silesia derive from the first half of the twentieth century. Since few years, the species is spreading rapidly in Poland and is observed at many new localities, mainly in anthropogenic habitats.

Kostomłoty Commune is an agricultural area in 86%, with no large cities, forests or rivers. Farming in this area is relatively well developed, and communal roads are in regular use. Little is known of the way seeds of *Bromus carinatus* were brought into the area. Detailed studies, conducted in 2009 proved that the species has already spread in the agricultural landscape in the mentioned area. Individuals of the species were found in 685 stands in separate patches of vegetation. Species occurred mainly along field roads, where it created dense patches adjacent to the cultivation of cereals and root crops. It occured in communities of *Artemisietea*, *Molinio-Arrhenatheretea* and *Stellarietea mediae* classes and overgrown other species, what caused significant loss of diversity in studied patches of vegetation.

So far ignored in Lower Silesia, the species turned out to be broadly distributed in the area of commune. This small case suggests that the role of the species is more significant than it was estimated, especially in the agricultural area. The species definetely requires more attention and detailed studies.

Participation of *Solidago gigantea* Aiton in plant communities of the Middle Pomerania (North Poland)

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In many European countries Giant goldenrod *Solidago gigantea* has been become common, both in ruderal and in seminatural habitats. The rate of expansion of this kenophyte in Poland seems to be less than for example in the Germany, but in fact there are no data on the actual number of its localities in Poland. Also very por are data in the types plant communities with this species.
The spread of *Solidago gigantea* in Europe started in the 1758s after introducing its seeds to botanical garden in London. In Poland the first report dates from 1853 in Wrocław (Uechtritz, *herb.* WRSL).
Solidago gigantea competes there with both native and other alien plants species like *Impatiens parviflora* and *Impatiens glandulifera.* Some individuals of *Solidago gigantea* were noted in such annual and perennial plant associations (according to Braun-Blanquet school) as: *Polygono-Bidentetum* (Koch 1926) Lohm 1950, *Phalaridetum arundinaceae* (Koch 1926 n.n) Libb. 1931, *Urtico-Calystegietum* Görs et Müller 1969 and *Phalarido-Petsitetum hybridii* Schwick. 1933. In Middle Pomerania it was found also in riverside, meadows, fallow lands, ruderal places in villages**.** The biggest and thickest stands of *Solidago gigantea* were classified as *Rudbeckio-Solidaginetum* R.Tx. et Raabe 1950. Where most significant species in the hreb layer were those of the *Artemisietea* Lohm., Prsg. Et Tx. 1950, among them *Artemisia vulgaris, Carduus crispus, Urtica dioica* and *Rumex obtusifolius.*

Alien plants on warm waters of the Pekhorka river (Moscow region)

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The Pekhorka river is the left inflow the Moscow-river, its total length is 42 km. Waters after Ljuberetsky station of aeration dumps in the river. At this station the dirty sewage of Moscow is clearing. The quality of cleaning from chemical pollutants has improved in past years, but there is a temperature pollution of river waters. Below the place of dump of warm waters of the Pekhorka doesn't freeze even in the hard frosts. It gives the chance for growth of alien water plants.

In the Pekhorka river the next alien plants are found: *Sagittaria platyphylla* (Engelm.) J.G. Sm. (for the first time was found in 2002), *Elodea densa* Caspary (1983), *Vallisneria americana* Michx. (2010), *V. spiralis* L. (2003), *Pistia stratiotes* L. (1998), *Lemna minuta* Kunth (2008), *Lemna gibba* L. (1986),*Wolffia globosa* (Roxb.) Hartog et Plas (2002). However, the status of *L. gibba* in Middle Russia isn't clear. Apparently, it is a species with extending area. At narrow understanding species in this difficult group the plants of *V. americana* possibly are to name *V. neotropicalis*. The exact definition of *L. minuta* and *W. globosa* was carried out by E.V.Martirosjan by molecular genetic methods.

Thus, in the Pekhorka 7 alien species of water plants are revealed. All species, except *P. stratiotes*, formed stable populations. The plants of *P. stratiotes* was transfered by stream to the Moscow-river where they froze in winter. Since 2006 it is not possible to find *P. stratiotes* in the Pekhorka and Moscow-river. *E. densa* and *V. americana* are the most abundant plants. *L. minuta* forms the large aggregations over *E. densa* and in places with a slow current. For all this alien plants only the vegetative propagations takes place. But *S. platyphylla* reproduce by seeds also, because the some groups of plant differs on leaf blade — from ovate to linear-lanceolate.

The basic vector of alien species introduction is the aquarium culture, whence diasporas of these plants was transfered to the Pekhorka river. At an existing hydrological regime of the river to them nothing threatens. The temperature of river water gradually goes down from warm at a place of dump of technical water to normal for our climate at a confluence with Moscow-river. This artificial temperature gradient is favorable for selection most cold resistant plants which then can grow in other reservoirs. This phenomenon is especially important at modern climate warming. Thus the regular monitoring is required under the plants population of the Pekhorka. Near river some alien plants are growing: *Reynoutria* × *bohemica*, *Parthenocissus inserta*, *Rumex triangulivalvis*, *Hippophaë rhamnoides*, *Echinocystis lobata*, *Symphyotrichum* × *salignum*, *Solidago gigantea*, *Bidens frondosa* etc. This fact does monitoring especially necessary.

Homestead abandonment and the fate of cultivated species: a special opportunity for alien plants

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Settlements, including even individual homesteads, are hotspots of alien species including horticultural, ornamental, and amenity species. Rural depopulation is a general trend in the developed world, resulting in abandoned homesteads and villages scatterred throughout the landscape. The overall objective of the study was to assess homestead abandonment and the fate of their cultivated species following abandonment in the Kiskunság, central Hungary.
We sampled 190 abandoned homesteads and recorded the presence of cultivated species. Homesteads were categorised into age groups (time of abandonment) based on historical maps and aerial photos. Number of cultivated species and frequency of each species were compared among age groups. The occurrence of cultivated species in habitats in the surrounding landscape was asessed using releves from a previous study.
Homestead density decreased from 8.1/km^2 in 1956 to 3.8/km^2 in 2005. We found a total of 77 cultivated species, and 52 of these occurred at homesteads abandoned at least 18 years ago. The number of cultivated species was similar in young (abandoned in 1989-2005) and medium-aged (1978-1989) homesteads, but was lower in old (1956-1978) homesteads. Of the 35 species, being frequent enough for species-level statistical analysis, 15 were more frequent and 1 was less frequent in the young age group than in the old one. 12 species occurred outside homesteads, in habitats they were not planted. Based on species frequencies in age groups and occurrence outside the homesteads, cultivated species were classified into „spreaders“, „persisters“, „slow-decliners“, and „fast decliners“.
We conclude that abandoned homesteads act as incubators and provide a unique opportunity for cultivated alien species. Many species can be present for decades after abandonment and become a long-term persistant, or even permanent component of the flora. Many of these species can be considered naturalised („passive naturalisation“), thus they should be included in alien species lists. The high number of homesteads scatterred throughout the landscape provide an ideal setting for the spread of potentially invasive species. Some species are already spreading and others have the potential to spread in the future. Since rural depopulation is a general trend in many developed regions, more attention should be paid to the ecological legacy of abandoned settlements and homesteads and to their role in facilitating plant invasion.

Reconstructing the history of Lantana introduction and spread in India

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Lantana camara is regarded as one of the 10 worst invasive plant species in the world. In India, it was reportedly introduced by the British in the early 19th century as an ornamental plant. Since then, the plant has invaded most of the Indian Subcontinent and has spread into farmland and forest alike. In an effort to trace the path and rate of spread of Lantana across the country, we analyzed herbaria records of Lantana from 1814 to 1995 from three of India's oldest herbaria namely Central National Herbaria in Kolkata, Forest Research Institute in Dehradun and Botanical Survey of India, Coimbatore. There are at least 14 species of Lantana recorded in India. However little is known about the taxonomic rigor of this classification. It is believed that there could be a number of synonyms. For the purpose of this study we compiled the records of all species of Lantana. We digitized the records of the year and geo-coordinates of the collections. Using a MapInfo GIS platform we analyzed the spatial and temporal spread of Lantana. The following are the salient findings of the study :a) The spread of Lantana through the last 180 years follows a geometric increase; with a burst in the spread beginning 1950's , b) GIS analysis indicated that Lantana might have been introduced at multiple sites over a period though it is not clear if these multiple introductions within country were derived from a single introduction into India from south America, c) It appears that the spread of Lantana across the country radiated from these multiple sites of introduction and d) Interestingly but not surprisingly the initial occurrence of Lantana are concentrated in areas once represented by the British Cantonments.
These results are suggestive of the spatial and temporal patterns of Lantana spread. We are currently using genetic markers to unravel the pathways and chronology of the spread of Lantana across the country.

Invasive plants in lowland Serbia – spreading and threats

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Natural habitats in the Pannonian part of Serbia are fragmented, today present almost only on the island's mountains (Fruska Gora mountain and Vrsacke planine mountains), along major rivers (Danube, Tisa and Sava) and on sands (Deliblato sand and Subotica sands). This area is the most deforestated part of Europe, with forest area presented with less than 6% of total territory. The largest proportions of this territory have been planted by mono-dominant forests and coppice forests. Network of river-channels together with nearby planted species, some of which now have the status of invasive, are threats for natural forests. Steppes, salt-marshes and sands are threatened by expanding mono-dominant agro-ecosystems (which are also one of the main directions for the introduction of invasive species in natural habitats), deforestation and spontaneous spreading of invasive species from the surrounding ruderal and anthropogenic habitats.
Alien species, invasive and potentially invasive, in this area count around 150 taxa, of which 30 are in the category of invasive species in the narrow sense (aggressively affect indigenous flora and changing the appearance of natural habitats). These species (invasive alien species in narrow sense) have been found in this region since 100 years, and in the natural habitats occurs in the last 30 years as a widespread and naturalized.
Habitat fragmentation is an intensive process, which continues on the researched area. In order to obtain an accurate picture of the expansion of its range, the most frequent invasive plant species were selected, and subjected to comparative analysis of the current state of distribution in the Pannonian part of Serbia and prediction of their range in the same area. The data were statistically analyzed using correspondence analysis software package Statistica for Windows version. 10, and prediction range with comparative analysis of geographic and climatic characteristics in the GIS software package Diva.

Tempo and mode in invasion: invasions patterns of alien plants in Norway

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In order to prioritise management efforts targeted at invasive species, it is important to obtain reliable estimates of the spread velocity of alien species. This is complicated by the fact that such prioritisation should ideally happen early in the invasion process. Otherwise, eradication of these species will become increasingly difficult. However, at this early stage, relevant data are necessarily sparse.
Based on temporal and spatial data on the spread of alien plant species in Norway, we apply and test different statistical techniques to model spread velocity. Starting with Ronald Fisher's (1937) model of spread, a number of increasingly advanced models has been proposed to model the invasion process of alien species. Even some simple models, assuming circular spread and a constant velocity of the invasion wave front, are able to predict essential features of species invasions. More advanced models have been proposed in order to take account of density dependence, leptokurtic distributions of spread distance, demographic stochasticity, and other factors.
Alien species may spread through their own dispersal ability, by means of other natural vectors (e.g., birds), or by deliberate or unintentional anthropogenic transport. In some cases, natural dispersal can be ruled out based on the distance to the nearest potential source population. However, because of data paucity, it is in many cases impossible to establish the actual vectors responsible for newly established populations. Furthermore, the detectability of local populations is normally lower than unity. This poses problems for the modelling of the invasion process, and, consequently, for the estimation of spread velocity. In the absence of detailed data, spread may be assumed to be either a homogeneous process or the result of two different processes, natural dispersal and anthropogenic spread / secondary introductions. In the former case, the process may be modelled either assuming the absence of observation error and the presence of process variance, or vice versa. In the latter case, maximum likelihood methods may be employed to estimate the number of secondary spread/introduction events. All models make simplifying assumptions that are partly mutually exclusive, and may, therefore, result in quite different estimates of spread velocity.
We tested the assumptions and properties of the different statistical models of species invasions using temporal and spatial data extracted from herbarium collections. The results help to illuminate the tempo and mode of species invasions, to parameterise models of spread, and to establish the strengths and weaknesses of the different statistical approaches. This is crucial background knowledge for estimating spread velocity and, consequently, prioritising management efforts.

The Infection of Tree of Heaven in Pécs

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The tree of heaven (*Ailanthus altissima* (MILL.) SWINGLE) has been spreading fastly and agressively. It is native to both northeast and central China and Taiwan. In Hungary it was first mentioned in the South Danubian region at the middle of the 19th century. Its spreading was helped by the attitude of that period and the lack of knowledge of this species. This has changed, it has become clear, that the tree of heaven is an invasive species, its presence is not desirable in the flora of Hungary, its ecological demands are quite well-known for today.
The industrial past, the city characteristics and the submediterranean like climate of Pécs helped this non-native species to increase in number. The city has created ideal habitats for the tree.
The method of survey was the following. The position of tree individuals and groups were set by GPS, stored and represented by means of ArcView GIS. Tree individuals and groups were selected to different classes according to the method they are coming treated (injectation or spraying). Trees that produce seeds in a larger amount are signed differently, because they have a bigger significance in the spread of the species.
According to our surveies its spread is significant at the degraded, uncared periferical and building sites oh the city. We have also worrisome data of its occurence at protected areas and downtown plots. According to our results, the chance of inhabitation is minimal at the sites of natural or semi-natural vegetation and of high closure.
The possibilities of prevention are limited, but there are some reassuring data of former treatment. The continuous survey of the trees and following up the population is necessary from the point of view of the conservational treatment in the future.

Poster Session 9 – Plant invasion in a changing world

Changes in land use and expansive plant species in the flora of the agricultural landscapes of the Białowieża Clearing

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During the last half century, significant changes in land use have taken place in the Białowieża Clearing (NE Poland). In 1970, consolidation of land plots took place and the intensity of cultivation transiently increased. The decline in agricultural use has been particularly sharp since the 1980s. The area of arable fields decreased from 56% in 1950 to 5% in 2005. Changes in agriculture and land use transformed the plant cover of agricultural areas. With the decline of ploughing, grazing and mowing the Białowieża Clearing became a mosaic of arable fields, mown meadows, secondary plantations of trees and abandoned fields in various stages of secondary succession. Based on data obtained in three periods: 1959-1965, 1990-1995 and 2006-2008, the authors analysed the occurrence of expansive species in the flora of the arable and abandoned fields of the Białowieża Clearing.
Sixteen species known as invasive in Poland and thirteen noxious weeds of arable fields were found, 17 altogether in the first period, 18 in the second period and 26 in the third. Problematic weeds are representatives of three groups: apophytes (6 species) native to the region, archaeophytes (7 species) that arrived in Poland before the end of the 15th century, and kenophytes (16 species), which were introduced after then. They are both annuals which reproduce by seed and perennials that reproduce mainly vegetatively. The distinguishing feature of the alien weeds of agricultural landscapes is their very high fecundity and wide spectrum of modes of dispersal, including different types of anthropochory. Amongst kenophytes species coming from North America prevail, whereas amongst archaeophytes species of Asiatic origin are most numerous. The most widespread problematic weeds are grasses: *Apera spica-venti*, *Echinochloa crus-galli* and *Setaria pumila*. Recently, *Echinochloa crus-galli* and *Setaria pumila* have become more widespread in agrophytocoenoses, growing abundantly also in corn crops. The occurrence of well known invasive species such as *Impatiens parviflora*, *Padus serotina*, *Robinia pseudacacia* and *Solidago gigantea* on abandoned fields, as well as the encroachment of the last species into agrophytocoenoses is raising concerns. Typical ruderal species, such as *Geranium pyrenaicum*, *Lactuca serriola* and *Tanacetum vulgare* were observed growing on arable fields for the first time. On the other hand, *Amaranthus retroflexus* and *Elsholtzia ciliata*, mentioned by earlier authors from the segetal flora of the Białowieża Clearing, were not found recently in agrophytocoenoses.

Climate change and naturalized species: can increased temperature promote a population release in non-native plant species?

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Non-native naturalized species often become invasive species after a sudden population release. In plants, population releases are most often associated with a sudden increase in successful sexual reproduction and seedling recruitment. For many plants the limiting factor in successful sexual reproduction is often temperature. Temperature is particularly crucial for species living on the climatic edges of their range, where populations are generally maintained by vegetative reproduction or low rates of sexual reproduction. However global temperatures are predicted to be significantly affected by climate change, with temperatures in temperate regions expected to rise across the globe. This increase has the potential to release the populations of numerous non-native naturalized species currently living at the edge of their climatically suitable ranges in temperate zones. It is the objective of this study to (1) determine if non-native plant species currently living on the climatic edges of their range will experience significantly greater reproductive success with increasing temperature (2) test particular biological traits for their ability to act as predictors for temperature-mediated population release in non-native naturalized species. Ten perennial species will be examined for sexual reproductive success in greenhouse conditions under three temperature treatments over two summer seasons and one winter season. The temperature treatments will consist of the seasonal temperature for the USDA Plant Hardiness Zone 5 from 2010 as a control, and the IPCC's predicted temperature increase for the USDA Plant Hardiness Zone 5 in 2050 and 2100. Six species of plants will be chosen to test particular biological traits as predictors of population release under increased temperature, while four will be chosen to test the null hypothesis. The biological traits will include successful sexual reproduction in the native range, existing at their northern climatic limit in the USDA Plant Hardiness Zone 5, demonstrating limited sexual reproduction in the invaded range, and not being considered yet an invasive species at the northern climatic limit of their introduced range. It is hypothesized that as temperature increases (1) the test species will demonstrate greater seed production (2) there will be greater seed survival over winter conditions (3) there will be greater germination success in spring conditions (4) biological traits will be identified for increased risk of undergoing population release from climate change. There is a significant lack of research investigating the causes of population release in naturalized species, and correspondingly very little done to directly test the potential of climate change to affect naturalized species. This study can draw attention to a neglected area of invasion ecology, and simultaneously help determine methods for detecting naturalized species which may become invasive species with climate change.

Will alien species retain their competitive superiority following climate change?

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In addition to specific habitat requirements, competition is considered to be a key factor affecting both the distribution and abundance of plant species. Several studies on the competitive ability of alien plants have concluded that many invasive species are superior competitors. Therefore alien plants suppress native species, spread quickly and build dense stands, which aggravate their impact.
It is highly likely that climate change will alter the competitive abilities of both native and invasive plants. This could be either advantageous or disadvantageous to alien species. From theoretical considerations it is expected that most alien species will cope better with environmental changes than will native species. Experimental studies have shown conflicting results.
Gaining deeper insights into processes and driving factors regulating the competition among plants is necessary for a better understanding of invasions already in process and those that are going to be initiated or assisted by climate change.
In a glasshouse experiment we study the performance of alien and native species in monoculture and in direct competition under ambient and altered climate conditions. As extreme events are supposed to have major impacts on the community structure and species responses, climate change treatments include a severe drought and heat phase. We investigate the reaction of different species sets, each a combination of native and invasive species of comparable functional traits and with comparable habitat requirements. Since species are supposed to show different vulnerabilities during different stages in their life cycle we especially focus on life-stages and phenology.

Alien C_4 Grasses Grown Under Elevated CO_2 Exhibit Increased Tolerance To Herbicide

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The increasing level of atmospheric CO_2 will influence the growth of many invasive alien plants. However, it is not well-documented, how these growth responses will alter the effectiveness of the world's most widely used herbicide, glyphosate. We aimed to address this question by carrying out a series of glasshouse experiments to determine if tolerance to glyphosate is increased in four C_4 invasive alien grasses, grown under elevated CO_2 in nonlimiting water conditions. The four C_4 grasses examined were *Chloris gayana* Kunth, *Eragostis curvula* (Schrad.) Nees, *Paspalum dilatatum* Poir., and *Sporobolus indicus* (L.) R. Br. Species were selected based on being: (1) invasive aliens within Australia, and (2) chemically controlled with glyphosate. Traits including specific leaf area, leaf weight ratio, leaf area ratio, root: shoot ratio, total leaf area, and total biomass were measured to assess their contribution to glyphosate response under ambient and elevated CO_2 levels. Three of the four mature grasses treated with the recommended concentration of glyphosate displayed increased tolerance to glyphosate under elevated CO_2. This was due to increased biomass production resulting in a dilution effect on the glyphosate within the plant. From this study, we conclude that as atmospheric CO_2 levels increase, application rates of glyphosate might need to be increased to counteract the growth stimulation of invasive alien plants. Based on these results we are now examining a range of other alien plants (eg herbaceous species, woody shrubs, and vines) to determine if this trend holds for other alien plants grown under elevated CO_2

Changes of 70 years in the non-native and native flora of three Hungarian county seats (Pécs, Győr, Salgótarján): three different cases?

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In spite of the fact that urban floras are being studied worldwide, this topic has been rather neglected in Hungary. Research into longer-term temporal changes of the flora is also scarce and the two topics are even more rarely combined.
Urbanization in Hungary was most intense in the 1950s and 1960s. In the case of three county seats (Pécs, Győr, Salgótarján), previous flora and other data are available, which were recorded in the 1940s and can be considered more or less precise. We compared these reference data and the flora lists surveyed in the past few years in order to detect changes in the non-native and native flora of the three cities at the levels of species, ecological indicator values, geographical distribution types and Borhidi's social behaviour types as functions of climate (precipitation, temperature), human population, urban area and topography.
In the three cities, which lie rather far apart, we recorded nearly 2000 naturalised species (30% of which are non-native, 15% are neophytes), which represent more than 70% of the Hungarian flora. In each of the cities, the ratio of species number to city area exceeds the values typical in Europe. In Győr, which has the largest areal extent, the total number of species ranks only second among the studied settlements and its present-day flora is the smallest. The species density, calculated from the total flora and the areal extent of the city, increases with the relief: it is highest in Salgótarján (10.5 species/km^2), which has the highest relief, and is the lowest in Győr (7.5 species/km^2), which lies on a plain. Compared to the early 1940s, population, urban area and temperature has increased in all three cities, while precipitation has decreased. Turnover was considerable in all cities (35-40%); however, the flora of Salgótarján and Pécs has increased (by 37% and 3%, respectively), while that of Győr has decreased (by 22%). The majority of the newly arrived species (Győr 41%, Pécs 60%) are introduced, except for Salgótarján, where 75% of the newly recorded species are native, indicating the incompleteness of the 1941 survey. Most of the extinct species (50-80%) are native. After examining the frequency of numerous plant characteristics, we found no significant difference between the lists of extinct species and the total city floras.

Poster Session 10 – Invasion patterns and invasibility

On equal terms: do species similar in weapons to an invader limit its colonization?

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Several studies emphasized the importance of species identity in the native community for explaining biotic resistance to invasion. The so-called Limiting similarity hypothesis is based on similarity of functional traits, and makes the assumption that the functional similarity between native species and introduced species decreases the availability of suitable niches for invasive species, and the invasibility of the ecosystem. However, determining the relevant traits remains a difficult challenge. Besides, very few studies experimentally examined the consequences of species interactions for invasibility. Here, we tested the Limiting Similarity hypothesis in the context of invasion by the genus *Fallopia* in France. We experimentally investigated whether the performances of propagules of *F.* x *bohemica* are limited by adult plants of species showing similar weapons than the invasive species. The species chosen were: *Sambucus ebulus* (two types of similar competitive weapons: growth form and allelopathic secondary metabolites), *Rhamnus frangula* (similar allelopathic secondary metabolites), and *Rubus caesius* (no identified similar weapon). The survival, two-months growth, and biomass allocation of either seeds or rhizomes of *Fallopia* planted in competition with the three species or without any competitor were compared using 5 replicates per propagule type and per treatment (either one rhizome or 30 seeds per pot). Seed survival was reduced by the presence of the competing species, but not rhizome survival. Whatever the propagule type, the growth of plantlets was affected by the competitors. Aboveground dry weight was strongly reduced, together with plant height and number of leaves. Overall, we demonstrated an increasing negative effect of the competitor on *Fallopia* growth when similarity between both increased (*i.e.* competitive effect of *S. ebulus* > *R. frangula* > *R. caesius*). This study highlights the need for examining species interactions in addition to community composition when testing invasibility. The interest of taking into account the similarity of competitive weapons when measuring the resistance to biotic ecosystem is clearly outlined.

Which factors are important for plant invasion in the river floodplains?

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Riparian areas play an important role in the plant invasion across European landscape. Stands adjacent to the running water exhibit one of the highest proportions of aliens in their species composition compared to the surrounding vegetation. Several possible explanation involving frequent fluvial disturbances, high propagule pressure and long-term human impact have been proposed. However, few studies have concentrated on the finer-scale pattern of the level of invasion among particular riparian habitat types although it could improve our understanding of the underlying mechanisms.
The aim of our study was to determine patterns of plant invasion in the different habitat types in riparian corridors. Floodplains along 90 km long river stretches of the Morava and Dyje Rivers in the southeastern part of the Czech Republic were chosen as a model riparian system. Stratified random sampling was used with stratification according to habitat types from the Natura 2000 habitat mapping and maps of the areas flooded once in 20 and 100 years. Species lists of vascular plants were recorded for 135 plots and the area of the main vegetation types and occurrence of invasive species was recorded within 100 m circles around the plots. Intersects of the circles with roads and water bodies were also recorded.
The highest level of invasion was found in ruderal vegetation and forests clearing, i.e. habitats with the most frequent man-induced disturbances and propagule input. Archaeophytes (pre-1500 AD aliens) were also common in semi-natural grasslands, whereas neophytes (post-1500 AD aliens) showed a strong affinity to woodlands and forestry plantations of deciduous trees. Despite the differences in habitat preferences, there was a positive correlation between numbers of species from these two groups across all habitats. For all habitats, the numbers of aliens in the plots were also increasing if there were more invaders in the surrounding vegetation. Regression trees assessing the numbers of both groups of aliens revealed that the most important factor determining the observed level of invasion was habitat type. Moreover, number of achaeophytes increased with the proximity to roads and number of neophytes was higher in the frequently inundated areas near watercourses indicating the importance of propagule transport and disturbance regime for the invasion success of species.

Post-fire invasion of *Robinia pseudoacacia* L. (*Fabaceae*) in dunes of the Curonian Spit (West Lithuania)

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Curoninan Spit is a peninsula lying between the Baltic Sea and the Curonian Lagoon (West Lithuania and Kaliningrad region of Russia). Formation of a small and narrow sand strip between the Baltic Sea and the Curonian Lagoon started around 5 thousand years ago. The Curonian Spit National Park occupies the whole area (9761 ha of land) of the Lithuanian territory of Curonian Spit as well as adjacent areas of the Baltic Sea (12500 ha) and Curonian Lagoon (4200 ha). In 2000, the Curonian Spit National Park was inscribed on the UNESCO World Heritage List.

In 2006, at the beginning of May a huge forest fire swept over the northern part of the Curonian Spit. In total 235.6 ha of artificial *Pinus mugo* plantations were destroyed by the fire. Within a few months after the fire, burned trunks of trees were removed, and intense invasion of *Robinia pseudoacacia* was noted.

At the end of September 2006, four sampling sites for investigation of *R. pseudoacacia* population dynamics were selected in the burned area. Additionally, for a reference purposes, one sampling site was selected in an area planted with *R. pseudoacacia* but not affected by the fire. In each sampling site 50 permanent sampling plots of 1 m^2 were arranged in two crossing transects. Investigations of *R. pseudoacacia* populations were repeated in 2007, 2008 and 2010. Areas occupied by *R. pseudoacacia* were mapped each year of the investigation.

In the autumn of the first year after the fire, mean density of *R. pseudoacacia* shoots in the sampling sites varied from 1.87±1.19 to 2.91±2.35 shoots/m^2. During the second year, the number of shoots in all sampling sites significantly increased, and their mean density already varied from 1.94±1.38 to 4.01±2.65 shoots/m^2, whereas in the reference site shoot density increased insignificantly, i.e. up to 0.20±0.40 shoots/m^2. In the autumn of 2010, the density of shoots in the sites affected by fire reached from 4.46±2.92 to 6.78±5.43 shoots/m^2 in different sites.

The density of shoots in the reference site was significantly lower during the entire period of investigation. In the autumn of 2006 the density of *R. pseudoacacia* was 0.12±0.33 shoots/m^2, in 2007 – 0.20±0.40 shoots/m^2, in 2010 – 0.26±0.56 shoots/m^2.

In the fifth year after the fire, a part of young *R. pseudoacacia* individuals grown from roots of dead trees reached generative stage and produced seeds. Therefore, further spread of this species in the fire-affected area is possible both by root suckers and seeds. Urgent measures for eradication of *R. pseudoacacia* should be taken in order to prevent its further spread and formation of dense groves on dunes in the northern part of the Curoninan Spit.

Spreading of invasive woody species in Eastern Transylvania

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Beside the recent evaluation on the distribution of the main herbaceous invasive alien species stands in the area of E-Transylvania (Kovács 2006), it was observed that this region is affected by the invasive woody species also. During the last few years our investigations have been concentrated on studying and mapping the most aggressive woody invasive species like: *Robinia speudoacacia, Acer negundo, Ailanthus altissima, Amorpha fruticosa, Lycium barbarum, Hippophäe rhamnoides*, which became dangerous for the native vegetation, altering the landscape processes, so they can be considered as 'problem plants' or a kind of indicators against the biodiversity. *Robinia pseudoacacia* (Black locust) is one of the oldest woody invasive alien species in this region, recorded from the 19. century. It was cultivated in various breeds, naturalized earlier, propagating well in vegetative way by its root suckers and stump sprouts. The populations and stands have a high fequency and massive concentration of sites in the area of the Transylvanian Plain, followed by the valley of Mures, the hilly region of Târmava Mica, Târnava Mare and hills of Homorod. The recent climate changes influenced the rapidly spreading from Central Transylvania to the East Carpathian area (like Frumoasa, Potiond, Belin, Araci, Ilieni etc.). *Acer negundo* (Box elder) considered long time only as a cultivated adventive species, recently arrived to be an aggressively woody alien plant in the studied area. Their stands and populations are distributed mainly near localities, abandoned fields, near railways and roads and, very often in riparian habitats. The most aggressive stands we recorded from the valleys of Târnava rivers (ex. Vânători, Beteşti, Mugeni, Odorhei etc.). *Ailanthus altissima* (Tree of heaven) is a recently spreading taxon in Eastern Transylvania. The main propagule sources are found in the lower Mureş valley (SW-Transylvania, Sebeş-Deva-Arad), from which the species propagated to E, occurring especially the Târnava valleys. *Amorpha fruticosa* (False indigo) cultivated as ornamental plant, which realize characteristic spontaneous stands in the valley of Târnava and Homorod. *Lycium barbarum* (Teaplant) naturalized and grown as hedging mostly in the Transylvanian Plain area (Band, Şincai, Lechincioara etc.). *Hippophäe rhamnoide*s (Sea-buckthorn) native in Europe but absent in wide areas (ex Transylvania, Simonkai) with secondary spreading. In the second part of the 20th century after the massive plantations for landslide stabilization in central Transylvania, were started the spontaneous spreadings, so presently the plant occurring considerable surfaces, contributing to the really habitat transformation of large hilly areas (Ercea, Band, Culpiu, Toldal, Viforoasa, Bezid, Eliseni, Jacu etc.). For all species recorded, the invasibility of different habitats is influenced by the propagule pressure and the climate conditions.

"Habitat and land use types as factors determining the invasibility of small lowland river valleys in Central Eastern Poland"

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River valleys are important dispersal corridors for plants both native and non-native. The aim of this study is to identify such habitat and land use types which promote the spreading of selected invasive plant species in small lowland river valleys. We studied the distribution of four naturalized neophytes (i.e. species introduced after 1500 A.D.): *Acer negundo*, *Echinocystis lobata*, *Impatiens parviflora* and *Solidago gigantea* in three river valleys located in Central Eastern Poland. The field study was conducted on regularly disposed transects crossing perpendicularly the river beds. Each transect was made up of a series of plots located on both sides of the rivers: in the river banks and in the floodplain. For every plot the area covered by each plant species was estimated. The plots (N=310) were further divided into classes regarding habitat and land use types. By distinguishing particular land use types additionally the time of exploitation and the kind of benefits for the users were taken into account. The analyzed invasive species display high habitat and land use preferences. The preferences measured by abundance rates are species specific. *Solidago gigantea* appears to be the most ubiquitous and *Echinocystis lobata* is most closely related to the communities located in the river banks. The forest communities, leisure sites and pine plantations have appeared to be the most susceptible to invasion.

Long-term studies of invasion process on local level: an European deciduos forest community case

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Invasion of a temperate forest community by aliens have been studied since beginning of 80´s years in the Bab forest, ca 25 km from Nitra, SW Slovakia, Central Europe, where the former I.B.P. Forest Research Area at Bab, now ILTER Site was/is located. Local/Regional pool of alien species is represented by flora of the casle park of Bab-Alexandrov Dvor in the border of the forest. Introduction of aliens by long-distance transport is also considered. Invasive behaviour of aliens as well as expansion of local species in the forest have been studied, using permanent plots and forestry sections. Annual Impatiens parviflora invaded forest understorey, and some woody plants from the park colonized gaps in the forest canopy. Forestry management, esp. harvest, support evidently the process of invasion (and also expansion of some native species), forming open habitats for the plants. The results are discussed in relation to the hypotheses of the invasion process.

Land use practices and plant invasions in the Sava River floodplain in Serbia

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Sava River Basin Floodplain hosts the largest complex of alluvial floodplain wetlands and lowland forests in the Danube basin. The relevance of land use practices on the plant invasions was investigated within the scope of the LIFE project Protection of Biodiversity of the Sava River Basin Floodplain, on 9 selected areas of high biodiversity in Serbia with the total area of 47 821 ha. The land use data were gathered through field work at 196 survey spots. The field form containing 13 land use categories and 4 categories of land use intensity has been prepared for the purpose of the project. The developed GIS database also includes maps, satellite images and nature conservation status of the project sites.
Invasive plant species are most frequent in poplar plantations and in the rural mosaics. Forest roads are proved to be an important pathway of plant invasions, making possible upstream invasions on floodplains and neigbouring terrestric habitats. Flooded areas, regardless the land use intensity, show a higher level of invasiveness than areas of the same land use categories behind the dyke. Absence of the investigated species was recorded only on sites deeply embeded in forest matrix of low to moderate intesively managed areas. Protected areas are invasible as well as the other sites.

Listing of aliens species by their invasiveness: differencies in approaches

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Published lists of invasive species in the world were analysed and large differences were found in approaches to assess invasivness of aliens, including impacts. Four types of lists were distinguished: (i) worst invasive species lists (top „ten“, dirty, „the most invasive“, „the most important“ species etc.), (ii) „scientific“ lists based on field studies of invasive behaviour of aliens on global, regional, national as well as local level, (iii) quarantine pests lists (black, white, watch, alert=alarm lists, etc.), and (iv) lists as annexes of national and international specific legislation (used as official documents for management activities in a country/region/globe). The large differences in the lists, not only in number of listed species, can be caused by differences in definitions (concepts) and criteria used for identification and categorisation of the invasive non-native species, by different levels of knowledge on the status and distribution of non-native species, ways of list preparation as well as subjectivity of experts opinion.

Occurrences of adventive plant species and their coenological states in plant communities in four sample areas in Hungary

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In the framework of „Genetic researches and risk analysis of invasive animal and plant species in the region of West and North Transdanubia" project (TÁMOP-4.2.1.B-09/1/KONV), four sample areas have been being examined (Tétényi-fennsík, Cserhát, Tolnai-dombság, Pannonhalmi-dombság) in Hungary from 2010 to 2012. Our aims are to detect the most dangerous invasive species in the region, and to examine their importance in plant communities. Sample quadrates have been marked out in each microregion, we made coenological surveys with the method of Braun Blanquet in each quadrates and collected soil samples from two different soil strata for study the soil seed bank. The soil seed bank has been investigated by greenhouse assay. Through the seed bank examination we can draw the inference about the long term processes of vegetation change, the regeneration potential of grasslands, the changes of the dominance and future prediction of invasive species. The method is suitable for seed bank type classification of species which occur in the sample area.
The most frequent and multitudinous invasive species have occurred in the quadrates were the the giant goldenrod (*Solidago gigantea* AIT) and the Canadian goldenrod (*Solidago canadensis* L.). Another common invasive species of dry grasslands is *Ailanthus altissima* (MILL.) SWINGLE, which was found en masse in Tétényi-fennsík, but it presented in other sample areas too. The high abundance of *Asclepias syriaca* L. has been found in fallow habitat inhibiting the process of natural succession. The following invasive species spread considerably in the sample areas too: *Celtis occidentalis* L., *Juglans regia* L. (Tolnai-dombság), *Aster lanceolatus* WILLD. (Pannonhalmi-dombság), *Robinia pseudoacacia* L., *Erigeron annuus* L. (PERS.) (Cserhát), *Syringa vulgaris* L. and *Rhus typhina* L. (Tétényi-fennsík).

„Rich get richer" or „poor get richer": diversity pattern of the urban flora in Pécs (Hungary)

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The spread of introduced species in urban environment is a long known phenomenon. Various case studies have proved the validity of both the „rich get richer" and the „Eltonian theory". The key question of these theories is whether the alien species prefer the areas originally rich in native species, or conversely, they colonise less diverse areas more efficiently. In this paper we examine which of the above two theories are valid for Pécs, a city of approx. 160 thousand inhabitants, and which biotic and abiotic factors the pattern of non-native species can be related to. For this we used the flora database of a relatively high-resolution raster built up of 100 cells 2.2 km^2 each, surveyed in 2009-2010. The database is comprised of data of naturalised vascular plants. From the background factors we considered parameters like forest area, urban area, elevation above sea level, aspect, slope gradient, all calculated for each raster cell. We also examined which category of the examined species groups (e.g. flora element, lifeform, Borhidi's indicator values and social behaviour types, endangered species) shows the best spatial overlap with the pattern of the non-native species.

Habitat preferences of alien aquatic plants in Hungary

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More than 2,000 relevés of the Hungarian fresh water aquatic vegetation are stored in a phytosociological database called CoenoDat-Aqua. The relevés cover a whole area of the country. Most of them (>75%) have been recently recorded (within the last 10 years), the rest originate from Hungarian botanical literature. 29 alien aquatic species occur in 262 relevés in the database. In our study we try to answer the following questions:
1. Which native species are positively or negatively associated with the alien aquatic plants?
2. What type of vegetation units do the alien aquatic plants prefer?
3. Are there any geographical differences in their phytosociological/textural preference?
For answering these questions vegetation units were defined by numerical classification of the dataset. Both habitat preference and interspecific association of alien species are characterised by fidelity values.

Wood species with high invasive ability in Kharkiv urban flora

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In Kharkiv urban dendroflora is represented by 112 species, of which 63 species are adventives; among them 2 species with high invasive ability: *Acer negundo* L. and *Robinia pseudoacacia* L.

Acer negundo has been introduced in Ukraine for the first time in 1809 Osnovyansky Acclimatization Garden near Kharkiv. It is characterized by a high viability of seeds and grows rapidly is reproduced by self-sowing. It is distributed sporadically across the city. The species occurs mainly in residential habitats and rarely occur in the second tier in the forest parks. It forms monodominant colonies or solitary specimens occur in both types of. It is also a member of temporary unstable synanthropic plant communities, grows along highways and railways, along rivers Uda, Lopan and Kharkiv, in parks and gardens, ruderal habitats and cemeteries. It grows in open areas (heliophyte). Forming a dense crown, it changes lighting conditions that cause depression of renewal and growth of native species.

Robinia pseudoacacia is known in Ukraine since the 19th century, as shelterbelt planting, and to consolidate the ravines. The plant is tolerant to conditions of growth, and easily escapes cultivation. It is widespread throughout the city in small populations on rather dry saline soils with a high degree of insolation. On the territory of Kharkiv it is found predominantly in the area of the private sector, as well in new residential areas, along the road and rail links, on wasteland, city cemeteries as part of synanthropic plant communities of the classes *Galio-Urticitea* Pass. 1967 em. Kopecky 1969*, Artemisietea vulgaris* Lochm., Prsg. et R. Tx. in R. Tx., 1950*, Querco-Fagetea* Br.-Bl. et Vlieg, 1937*.*

The distribution of the studied species in the city is mapped.

The realized niche of *Ambrosia artemisiifolia* in relation to its potential distribution in Europe

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One of the measures of the success of invasive species is the degree of its naturalization. As a first step many invaders establish themselves in anthropogenic habitats, realizing only a part of their fundamental niche. This group includes *Ambrosia artemisiifolia*, a species native to North America and an invasive neophyte in Europe.
The aim of the study was to compare the realized niche of *A. artemisiifolia* in Europe with its natural range in N America, and to estimate the potential geographic distribution of this species in Europe. We used the Maximum Entropy algorithm to model the potential distribution of *A. artemisiifolia* and to identify the most suitable habitat conditions conducive to its occurrence. The model was based on over 3000 records of occurrence, from both Europe and N America, combined with topographic, climatic, and land use predictors.
The results are two maps of the potential distribution of the species. The first represents the niche Maxent jackknife test of the importance of the variables indicates a strong association of European populations with artificial surfaces, cultivated areas and also linear, human-made topographic features, such as roads and railways, used by this species as a pathway of spreading. In contrast, the distribution of the American populations is more related to bioclimatic variables.

Poster Session 11 – Mapping, inventories, databases

Progress on DAISIE: ALIEN species inventories in Europe updated

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In Europe, a unique alien species inventory with more than 11,000 alien species has been produced by the DAISIE project (DAISIE 2009). First analyses based on DAISIE data revealed alarming trends of increasing numbers of newly naturalized species across all groups of organisms. These data also enabled us to analyse the socio-economic aspects of invasions at European scale, the habitat-specific invasion patterns on the level of individual taxon groups, and the increasing loss of European uniqueness due to invasions of alien and extinctions of native species. The strength of such an inventory is its completeness in terms of a wide range of organisms covered; however, for obvious reasons such amount of data requires regular updates should it not be soon outdated.
The ALIEN project (Analysing Large-scale Invasion patterns using European Inventories - Update and Analysis of European Database of Alien Species; supported by CRUS-SCIEX) was initiated in 2010 to keep the DAISIE database up-to-date, by including additional species lists from some understudied regions of Europe where regional lists of aliens started to be developed during the DAISIE project.
The ALIEN project has three main goals: (1) updating the DAISIE database by using new regional species inventories, (2) populating the database with information on selected species traits, and (3) analysing the updated database, with focus on the role of species traits and their residence times in determining the distribution patterns and invasion success of alien plants and animals in Europe.

Comparison between the alien flora of Crete and Greece

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The island of Crete lying between Greece and Libya, is the most southerly region of Greece and Europe. Crete is the largest island in Greece, an 8.729 km² area spanning 254 km from west to east and between 12 km and 56 km from north to south. The climate is typically Mediterranean. Greece occupies the southernmost part of the Balkan Peninsula and has a total land territory of approx. 132.000 km^2.
The vascular Flora of Crete consists approximately of 1.742 native taxa. Its special interest lies in the very considerable number of species, which are endemic or have an eastern Mediterranean or Anatolian restricted distribution. The agricultural land is cultivated mostly with olive trees, grapes, citrus, fruits trees, corns and vegetables. The non-cultivated land and hills are dominates by a semi-natural scrub vegetation (*phrygana*) shaped by grazing and recurrent wild fires. It consists of a rich assemblage of drought-resistant shrubs, frequently aromatic, spiny, or with small leathery leaves. The coastal habitats of maritime sands and coastal wetlands are particularly threatened by human activities and tourism.
The inventory of the alien flora of Crete, started in 2005, is presently in progress (with monitoring and updating activities). Literature data (herbarium specimens, bibliographic records, and local floras) and original field observations (2005-2010), assisted by handy GPS surveys, are being stored in a geo-database dedicated to the inventory of the alien flora of Crete, including, so far, information on 290 alien taxa.
For each species the following information has been collected: origin, status, distribution, life form, phenology, habitat preferences, altitudinal range and introduction pathway.
We compare the data-set available for Crete with the general inventory of Greece published in 2010 by Margarita Arianoutsou et al. on Biological Invasions. The Greek dataset consists of a total of 343 alien taxa, with 294 neophytes and 49 archaeophytes. The dataset analysed for Greece by M. Arianoutsou et al. originates from the database ''Alien'', an upgraded version of the one compiled for the DAISIE project (http://www.europe-aliens.org/), complemented with additional and updated information.
The aim of the paper is to report the present composition of the alien flora of Crete compared to the whole alien flora of Greece, taking into account diversity of invasive species, their status and distribution across different habitats.

What we know about the alien flora of the Slovak Republic?

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National or regional lists of alien species are of key importance, as they not only serve as reference guide for other analyses, but they have also numerous practical applications, e. g. for the purposes of nature conservation, agriculture and forestry. The paper provides preliminary results of the study of non-native flora of Slovakia, based on the analysis of the database of alien species, together with their characteristics, prepared for the publication of the Checklist of the alien flora of the Slovak Republic (in prep.). For the purposes of the publication, all accessible botanical literature has been studied since the 18th century. Archeobotanical findings and our own recent field experience have been considered as well. Slovak vegetation database (in total 51,523 relevés) has been used as source of data on geographical distribution and invaded syntaxa. The analysed characteristics are: invasive status (invasive, naturalised, and casual), residence time (archaeophyte, neophyte), origin, abundance, life form, year of introduction (or 1st recorded occurrence), introduction mode (deliberate, accidental, both), type of land use invaded, syntaxa invaded, dispersal mode and planting purpose. Deliberately cultivated alien species, which proved to escape from culture and survive in wild for some period of time, were included as well. So far we have found 146 archaeophytes, 530 neophytes and 300 species need further expert evaluation. Among the most invaded syntaxa are representatives of anthropogenic vegetation: *Stellarietea mediae*, *Artemisietea vulgaris*, *Galio-Urticetea* and *Polygono arenastri-Poetea annuae*. Classes *Epilobietea angustifolii*, *Bidentetea tripartitae*, *Rhamno-Prunetea*, *Franguletea*, *Robinietea*, *Salicetea purpureae*, *Festuco-Puccinelietea*, *Thlaspietea rotundifolii* and *Thero-Suaedetea* are the most invaded among natural/seminatural vegetation. *Vaccinio uliginosi-Pinetea sylvestris*, *Oxycocco-Sphagnetea*, *Roso pendulinae-Pinetea mugo*, *Loiseleurio-Vaccinietea*, *Betulo carpaticae-Alnetea viridis*, *Molinio-Betuletea pubescentis*, *Vaccinio-Picetea*, *Nardetea strictae*, *Elyno-Seslerietea*, *Caricetea curvulae*, *Salicetea herbaceae*, *Carici rupestris-Kobresietea bellardii* are not invaded.
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Distribution of the invasive tree *Ailanthus altissima* in the riverside of the Henares River, Central Spain

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The alien tree *Ailanthus altissima* was introduced in Spain about two centuries ago. Since then, it has been spreading mostly along roadsides, crop-sides and degraded environments. Nevertheless, studies made in Europe and North America reveal that its presence cannot be excluded in natural ecosystems. The current distribution of this species in Spain is not adequately reflected either in the literature or in the cartography. The objective of this contribution is to establish which factors determine *Ailanthus altissima* presence in a riparian environment in central Spain.
From November 2010 to March 2011 we covered covered a band of c.a. 500 m wide on each side of the Henares river (160 Km long, central Spain) searching for patches of *Ailanthus altissima*. Patches features such as length, width, density of stems and origin (natural/planted) as well as abiotic factors including altitude, land uses, distances to railways, roadsides, urban cores and distance to the river were measured for each patch. All information was processed in ArcGIS.
Our results show that *Ailanthus altissima* is rather common in the Henares riverside, with more than one hundred patches covering an altitudinal range from 580 to 995 masl. Most patches were located within 200 meters from the river, close to paths, or relatively near roads, railways, highways and/or town. The fact that at least, half of them were planted, explains their proximity to such kind of infrastructures or urban environments. In spite of this, the majority of these patches have naturalized and some of them are even invading natural areas of riparian vegetation. A high density of stems was observed in both naturalized and natural *Ailanthus altissima* patches.
We conclude that, although *Ailanthus altissima* is currently restricted to disturbed areas, it may spread in the near future into well-preserved riparian forest, as occurred in other countries, due to its high propagule pressure. Therefore action should be taken to protect the natural riparian forest of central Spain.

Invasive, naturalized and casual neophytes in the Hungarian flora

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A number of national and international alien plant inventories have been prepared worldwide during the last decades. The main task of these compilations is to give up-to-date lists on alien species, including information on relevant species traits and invasive status. National expert lists, which constitute a special type of basic databases, provide information for official lists of the national strategies on invasive plants, as well as for international databases (e.g. DAISIE, NOBANIS, EPPO). The document titled „Actual list of neophytes in Hungary and their classification according to their success" was published in 2004 by the authors of this poster (in Hungarian language). This list provided up-to-date information on the neophytes (post-1492 aliens) from Hungary. In this poster we present an actualized version of this compilation. Updates in this new version are based on recent literature sources, as well as field experiences of the authors. In addition to invasive and naturalised species, casual alien species with at least one documented example for temporary occurrences are also presented. The database in its present state gives the following attributes for each species: Taxonomic position: scientific name, synonyms, family; Source of information: floras, important detailed papers; Date of the first record; Invasive status: invasive, naturalised, casual; Type of invaded habitats: natural, seminatural, man-made; Category: transformer, weed, not harmful; Altitudinal distribution: lowland, colline, montane; Origin; Biological and ecological attributes: life form, maximum height, type of reproduction, ploidy level, chromosome number, pollination mode, dispersal mode; Human health relations.

Surveying the invasive environmental weeds along the natural reach of Rába River, Western Hungary

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The banks and flood plains of watercourses constitute important dispersal corridors for invasive weeds threatening natural and semi-natural habitats. The control for invasive species in such situations should be based on the detailed knowledge of their distribution in the affected regions. Between 1998 and 2002 the first author prepared a map of the 122 km long unregulated reach of Rába River in County Vas, Western Hungary. During the field survey, the range of the invasive plant species, coverage and habitat conditions were determined. The data have been processed in a GIS system. The most widespread herbaceous invasive species along the Rába River in order of their coverage (indicating their typical mode of dispersal and the invaded habitats): *Solidago gigantea* (by fruits and stolons, anemochoria; floodplain meadows), *Impatiens glandulifera* (by fruits, hydrochoria; soft wood galleries), *Fallopia ×bohemica* (by stolons, hydrochoria; banks, soft wood galleries), *Helianthus tuberosus* (by tubers, hydrochoria; sand-banks). Less abundant, but characteristic species are *Aster lanceolatus* (by fruits and stolons, anemochoria, hydrochoria; soft wood galleries) and *Echinocystis lobata* (by fruits, hydrochoria; soft wood galleries, willow scrub). The most frequent woody invasive species are *Robinia pseudacacia* (by fruits and roots, anemochoria, hydrochoria; riverine galleries) and *Acer negundo* (by fruits, anemochoria, hydrochoria; soft wood galleries). These environmental weeds generally form monodominant stands overwhelming and transforming native vegetation. In addition some of them (e.g. *Fallopia ×bohemica*) cause maintenance problems on the riparian banks. The results of this mapping could serve as a basis for repeated surveys, making it possible to detect changes with special regard to land use and management practices.

North American Invasive Species Network – A consortium that uses a coordinated network to advance science-based understanding of, and effective response to, non-native invasive species in North America

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Over the last decades North American government agencies and non-profit organizations have attended different aspects of the invasive species issue, and a great effort has been made to solve the coordination needs in their respective countries. There are signs of progress within each country such as the creation of the National Invasive Species Council in the US, the collaboration of different Canadian governmental agencies under the umbrella of the Alien Invasive Species Strategy for Canada, and the recent publication of the Mexican Invasive Species Strategy. However, the different efforts and organizations lack the infrastructure, support, resources, and mechanisms to synchronize the diverse aspects of prevention and management programs that exist within the different countries and with their neighbors. This situation led, in 2010, to an initiative to integrate and create synergies between existing regional invasive species databases, education campaigns under the umbrella of a North American Invasive Species Network (NAISN), with the aim of creating a trilateral forum to identify common invasive species concerns among the US, Canada, Mexico and collaboration opportunities. The idea for this initiative was born in the USA. During 2010, a group of scientists, policy makers, resource managers, NGO representatives, educators and information specialists from Canada, Mexico, and the USA, along with the heads or representatives from invasive species centers, institutes, labs and networks, met to develop the scope, fundamental and enabling objectives for the new network and to determine the structure of the organization. NAISN is now composed by a series of thematic hubs from the three countries and governed by a Board of Directors with an elected Chair, Vice-Chair, and Secretary-Treasurer. Advisory Boards for Science, Information Technology, and Commerce along with boards representing governmental interests in Canada, Mexico, and the U.S. have also been established. The poster will present the aims the consortium strives for, the services provided and activities planned for the future.

Evaluate of invasive weed species based on airborne hyperspectral imagery (AISA) in the Mid-Ipoly-Valley

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Remote sensing is becoming more widely studied as a method of mapping and monitoring invasive species. Airborne hyperspectral remote sensing technology might be one of the best technique to map invasive species, because images can cover large area quickly with relative high ground and radiometric resolution. The primary goal of this study was to investigate the utility of high ground (1 m) and spectral (253bands) resolution airborne hyperspectral imagery and several classification approaches for detecting the most problematic invasive plant species in the Mid-Ipoly-Valley. AISA Eagle II airborne sensor was applied to map a NATURA-2000 site on the Hungarian-Slovak cross-border area. This study focused on mapping of goldenrod (*Solidago sp.*), milkweed (*Asclepias syriaca*) and Devil's beggarticks (*Bidens frondosa)* species in two selected study areas. Different land cover types and various phenophases of plants have to be taken into consideration. During the image analysis, SAM classification method was used by selected dataset. Further classification methods were applied on MNF dataset. Feature selection was used to identify relevant feature from original MNF dataset. Maximum likelihood classification applied on the selected MNF dataset provided more accurate result than other methods. Devil's beggarticks (*Bidens frondosa)* occurred mostly in mixed association in case of linear spectral unmixing method was applied. The primary outcome of this study was a comparison of different image classification methods to evaluate invasive species.

The South African Invasive Alien Plant Survey

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The negative impact of Invasive Alien Plant (IAP) species on natural areas, as well as other areas such as agricultural land, has been extensively researched. Certain mitigation strategies and programmes have been put in place such as the internationally recognized Working for Water Programme of the Department of Water Affairs, South Africa. Such an initiative requires objectively determined spatial distribution data of IAP species at the required scale to allow for effective planning, implementation and future monitoring of IAP spatial changes. The National Invasive Alien Plant Survey project was initiated by the Working for Water Programme and implemented by the Agricultural Research Council. The aim was to establish and implement a cost effective, objective and statistically sound IAP monitoring system for South Africa, Lesotho and Swaziland at a quaternary catchment level. A complete inventory and a standard sampling approach both have limitations, mainly due to the size of the study area (127 million hectares) and variation in the natural environment, leading to high associated costs. An innovative sampling approach was therefore required. Sampling orientated along an environmental gradient, that contributes the most to species occurrence, would detect the maximum variation in an area, therefore resulting in a stratified proportional approach. A further riparian sample layer was allocated. A third regular grid point layer was created for selected quaternary catchments to serve as an independent source of verification. Different field survey approaches were simulated and the most suitable was an aerial approach. An extensive field survey was conducted of the sample points. Field data was analyzed and the relevant IAP maps were produced.

Creating tools for citizen scientists to support early detection of Invasive Alien Plants

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The South African Early Detection and Rapid Response Programme worked with Cybertracker to develop a tool to support two key objectives: the co-ordination of surveillance through an early detection programme and the development of effective information management systems. A Software application was developed for handheld computers (Smart phones) with the following capabilities:

1. A Taxonomic Filter which enables the user to identify plant species using a number of simple diagnostic keys (described using icons and pictures). The filter calculates the number of possible species after each filter operation and allows the user to skip to a set of photographs at any stage of the operation in order to confirm identity of specimen.
2. GPS capture application feature includes automatic GPS capture using NMEA protocol support and capture of: date, time, latitude, longitude, altitude, accuracy, speed and heading.
3. Photo capture application feature uses the integrated camera to capture photos attached to GPS position and attribute data.
4. The size of area infested is captured using GPS timer track data that can be used to create lines and polygons to plot areas of alien vegetation infestation.

These and other features were built on the foundation of Cybertracker software which includes data visualization with mapping, data queries, automatic Effort-and-Index of Abundance calculations. Data can also be exported to a variety of data formats. Free CyberTracker software has been downloaded more than 40 000 times.
The software and its capabilities as well as preliminary results from the software testing phase are discussed in this paper.

Object-Based Image Analysis for Detection of Japanese Knotweed s.l. taxa (Polygonaceae) in Wales (UK)

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Japanese Knotweed s.l. taxa are amongst the most aggressive vascular plant Invasive Alien Species (IAS) in the world. These taxa form dense, suppressive monocultures and are persistent, pervasive invaders throughout the more economically developed countries (MEDCs) of the world. The current paper utilises the Object-Based Image Analysis (OBIA) approach of Definiens Imaging Developer software, in combination with very high spatial resolution (VHSR) colour infra-red (CIR) and visible-band (RGB) aerial photography in order to detect Japanese Knotweed s.l. taxa in Wales (UK). An algorithm was created using Definiens in order to detect these taxa, using variables found to effectively distinguish them from landscape and vegetation features. The results of the detection algorithm were accurate, as confirmed by field validation and desk-based studies. Further, these results may be incorporated into Geographical Information Systems (GIS) research as they are readily transferable as vector polygons (shapefiles). The successful detection results developed within the Definiens software should enable greater management and control efficacy. Further to this, the basic principles of the detection process could enable detection of these taxa worldwide, given the (relatively) limited technical requirements necessary to conduct further analyses.

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