EMAPi
2013

PROGRAM

12TH REUNION ON ECOLOGY AND MANAGEMENT OF ALIEN PLANT INVASIONS

22-26 September, 2013

Pirenópolis, Goiás, Brazil.

WELCOME LETTER

It is our great pleasure to welcome you in the 12th Reunion on Ecology and Management of Alien Plant Invasions (EMAPi), held on 22-26 September, 2013 at the Pousada dos Pirenéus, Pirenópolis, Goiás, Brazil.

We are confident that all participants in this meeting will be satisfied with the scientific program, field excursion and social program.

We also hope that all participants will return to their institutes or places of origin with new ideas and new contacts, both national and international.

We wish you a productive and memorable experience during your attendance of EMAPi 12, including the discovery of new friends and your enjoyment of Brazilian culture, hospitality and cuisine.

John Hay
Chairman,
Local Organizing Committee
EMAPi 12
Universidade de Brasilia

LOCAL ORGANIZING COMMITTE

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Dra. Heloisa Sinatora Miranda, *Departamento de Ecologia, Universidade de Brasilia*
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Carla D'Antonio .... *University of California, Santa Barbara, CA, USA*
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Jaco le Roux .... *Centre for Invasion Biology, Stellenbosch University, South Africa*
José L. Hierro .... *Universidad Nacional de la Pampa, Santa Rosa, Argentina*
Lara A. Souza .... *Oklahoma State University, USA*
Marcel Rejmanek .... *University of California, Davis, CA, USA*
Petr Pysek .... *Department of Invasion Biology, Institute of Botany, Academy of Sciences of the Czech Republic, Pruhonice, Czech Republic*
Ramiro Bustamante ..... *Universidad de Chile, Santiago, Chile*
Thomas Dudley .... *University of California, Berkeley, USA*
Zoltan Botta-Dukat .... *Institute of Ecology and Botany Hungarian Academy of Sciences, Hungary*

CONGRESS SECRETARIAT

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PROGRAM - SEPTEMBER 22

14h00 – 18h00

REGISTRATION

19h00

OPENING CEREMONY AND WELCOME RECEPTION

PROGRAM - SEPTEMBER 23

ROOM NOEMI E BONIFÁCIO

08h00 – 09H00

PLENARY 1 - MONSERRAT VILÀ

IMPACTS OF NON-NATIVE PLANTS ON BIODIVERSITY AND ECOSYSTEM SERVICES

Vilà M[1], Espinar JM[2], Hulme PE[3], Pergl J[4], Pyšek P[4], Rohr RP[2], Schaffner U[5], Sixtová Z - [1]IEstación Biológica de Doñana, [2]Estación Biológica de Doñana, [3]Lincoln University, New Zealand, [4]Academy of Sciences of the Czech Republic, [5]CABI- Switzerland

ROOM NOEMI E BONIFÁCIO

09h00 – 10h00

PLENARY 2 - GUISEPPE BRUNDU

PLANT INVADERS IN EUROPEAN AND MEDITERRANEAN INLAND WATERS: PROFILES, DISTRIBUTION, AND THREATS.

Brundu[1] - [1]University of Sassari - Science for Nature and Environmental Resources

10h00 – 10h30 | COFFEE BREAK

ROOM NOEMI E BONIFÁCIO

10h30

SPECIAL SESSION 1
INCORPORATING IMPACT IN RISK ASSESSMENT FOR ALIEN PLANTS
Chairs: Sabrina Kumschick

10h30 – 10h50

SS1.1
IMPACT IN RISK ASSESSMENT: STATE OF THE ART AND FUTURE
Kumschick Sabrina[1], Richardson DM[1] - [1]Stellenbosch University - Centre for Invasion Biology

10h50 – 11h10

SS1.2
DOES INVASIVENESS OF PLANT INVADERS ALSO PREDICT THEIR IMPACT?
Pyšek Petr[2, 1], Horackova J[1], Jurickova L[3], Jarošík V[1, 2] - [1]Faculty of Science, Charles University in Prague, Czech Republic - Department of Ecology, [2]Institute of Botany, Academy of Sciences of the Czech Republic, CZ-252 43 Průhonice, Czech Republic - Department of Invasion Ecology, [3]Faculty of Science, Charles University in Prague, Czech Republic - Department of Zoology

11h10 – 11h30

David Richardson

11h30 – 12h30

DISCUSSION

ROOM JOSÉ BONIFÁCIO

THEME 1 - INVASIVE PLANTS IN FLORAS AND CONSERVATION UNIT

Chair: Ingolf Kuhn

10h30 – 10h50

OC1.01

EXPLORING ABIOTIC AND ANTHROPOGENIC DRIVERS OF ALIEN PLANT SPECIES DISTRIBUTION IN THE ALPS: BIOCLIMATIC ORIGIN MATTERS!

Dainese M[1], Kühn I[2], Bragazza L[3] - [1]University of Padova - Department of Land, Environment, Agriculture and Forestry, [2]Helmholtz Centre for Environmental Research ? UFZ - Community Ecology, [3]WSL ? Swiss Federal Institute for Forest, Snow and Landscape Research - Site Lausanne

10h50 – 11h10

OC1.02

AFRICAN INVASIVE GRASSES EXPANSION IN BRASILIA NATIONAL PARK – A 10 YEARS INTERVAL

Sampaio AB[1, 2], Horowitz C[3], Fraga LP[4], Maximiano MR[4], Vieira DLM[4], Silva IS[5] - [1]ICMBio - CECAT, [2]PEQUI - Pesquisa e Conservação do Cerrado, [3]ICMBio - Parque Nacional de Brasília, [4]Católica University of Brasília, [5]University of Brasília

11h10 – 11h30

OC1.03

WILL NON-NATIVE PLANTS BECOME A RESTORATION CHALLENGE IN SOUTHERN BRAZILIAN GRASSLANDS?

Koch C[1], Hermann J-M[1], Overbeck GE[2], Jeschke JM[1], Kollmann J[1] - [1]Restoration Ecology, Technische Universität München, Freising-Weihenstephan, Germany, [2]Department of Botany, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil

THEME 5 - HOW TO PREDICT, DETECT AND MAP PLANT INVASIONS

Chair: John Wilson

10h30 – 10h50

OC5.01

ASSESSING FUTURE INVASIVE ALIEN PLANT THREATS UNDER CLIMATE CHANGE

Downey PO[1], Duursma DE[2], Gallagher RV[2], Hughes L[2], Johnson SB[3], Leishman MR[2], Roger E[2], Smith P[4], Steele J[5] - [1]Institute for Applied Ecology - University of Canberra, ACT 2601, Australia, [2]Macquarie University - Department of Biological Sciences, NSW 2109, Australia, [3]NSW Department of Primary Industries, Orange, NSW 2800, Australia, [4]NSW Office of Environment & Heritage, Sydney South, NSW 1232, Australia, [5]Victorian Department of Primary Industries, Frankston, Vic 3199, Australia

10h50 – 11h10

OC5.02

A STANDARDIZED SET OF METRICS TO ASSESS AND MONITOR TREE INVASIONS

Wilson JR, Caplat P, Dickie IA, Cang H, Maxwell BD, Nuñez MA, Pauchard A, Rejmánek M, Richardson DM, Robertson MP, Spear D, Webber BL, Van Wilgen BW, Zenni RD

11h10 – 11h30

OC5.03

HANDLING HETEROGENEOUS SURVEY SOURCES AND ESTIMATING TRUE INVASION PROGRESS IN AN IMPERFECTLY OBSERVED, PAN-EUROPEAN INVASION

Mang T[1], Essl F[2], Moser D[1], Kleinbauer I[1], Dullinger S[3] - [1]Vienna Institute for Nature Conservation & Analyses (VINCA), [2]Federal Environment Agency Austria, [3]University of Vienna - Dept. of Conservation Biology, Vegetation and Landscape Ecology

11h30 – 11h50

OC5.04

A SIMPLE METHOD TO DEVELOP "WATCH LISTS" FOR INVASIVE SPECIES

Faulkner KT[1], Robertson MP[2], Rouget M[3], Wilson JR[4] - [1]Invasive Species Programme, South African National Biodiversity Institute, Private Bag X7, Claremont, 7735, South Africa - Centre for Invasion Biology, Department of Zoology and Entomology, University of Pretoria, Hatfield, 0028, South Africa, [2]Centre for Invasion Biology, Department of Zoology and Entomology, University of Pretoria, Hatfield, 0028, South Africa, [3]Centre for Invasion Biology, School of Agricultural, Earth and Environmental Sciences, University of KwaZulu Natal, Pietermaritzburg, 3209, South Africa, [4]Invasive Species Programme, South African National Biodiversity Institute, Private Bag X7, Claremont, 7735, South Africa - Centre for Invasion Biology, Private Bag X1, Stellenbosch University, Matieland 7602, South Africa

12h 30 – 14h00 | LUNCH

ROOM NOEMI E BONIFACIO

14h00 – 15h40

SPECIAL SESSION 2

INVASIVE PLANTS IN LATIN AMERICA: HOW THEY INTERACT WITH NATIVE BIOTA AND PRODUCE IMPACTS ON THE ECOSYSTEMS

Chairs: Ileana Herrera and Ramiro Bustamante

14h00 – 14h20

INTRODUCTION
Ramiro Bustamante

14h20 – 14h40

SS2.1

IMPACT OF NINE INVASIVE PLANT SPECIES IN SOME ECOSYSTEMS IN VENEZUELA

Herrera Ileana[1], Torres N[1], González E[1], Flores S[1], Fernández A[1], Lozano V[1], Fajardo L[1], Hernández-Rosas JI[2], Ferrer-París JR[3] - [1]Instituto Venezolano de Investigaciones Científicas - Centro de Ecología, [2]Universidad Central de Venezuela - Escuela de Biología, Facultad de Ciencias, [3]Instituto Venezolano de Investigaciones Científicas - Centro de Estudios Botanicos y Agroforestales ***Ileana Herrera***

14h40 – 15h00

SS2.2

INVASIVE ALIEN SPECIES: A MAJOR THREAT FOR THE LAST REMNANTS OF SOUTH AMERICAN GRASSLANDS

Zalba Sergio M[1], Cuevas YA[1], de Villalobos AE[1], Sanhueza CC[1], Germain P[1], Amodeo MR[1], Baccini AM[1], Dispigno LA[1] - [1]Gekko, Grupo de Estudios en Conservación y Manejo - Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur

15h00 – 15h20

SS2.3

EXOTIC TREE PLANTATIONS IN MEXICO: THE WAR THAT OUR OAK ARMY MAY LOSE BECAUSE OF NOVEL WEAPONS

Badano Ernesto I[1] - [1]Instituto Potosino de Investigación Científica y Tecnológica, A.C. - División de Ciencias Ambientales

15h20 – 15h40 | Sílvia Ziller

14h00 – 15h40

THEME 6 - BIOLOGICAL, CHEMICAL AND INTEGRATED CONTROL METHODS

Chair: John Brock

14h00 – 14h20

OC6.01

BEST MANAGEMENT PRACTICES FOR SELECTED INVASIVE PLANTS IN THE SOUTHWESTERN UNITED STATES

Brock JH[1] - [1]Arizona State University Polytechnic, Mesa, AZ 85212, USA - Applied Biological Sciences

14h40 – 15h00

OC6.02

DENSE WILDING CONIFER CONTROL WITH AERIAL BOOM SPRAYED HERBICIDES IN NEW ZEALAND.

Gous S[1], Raal PA[2] - [1]Scion, [2]DoC, NZ

15h00 – 15h20

OC6.03

THE IMPLEMENTATION OF A LANDSCAPE SCALE WOODY WEED HERBICIDE CONTROL SYSTEM USING *PINUS CONTORTA* AS A CASE STUDY

Raal PA[1], Gous S[2] - [1]Department of Conservation, Otago Conservancy, PO Box 5244, Dunedin, New Zealand., [2]SCION, Private Bag 3020, Rotorua, New Zealand

15h20 – 15h40

OC6.04

AERIAL SPOT HERBICIDE TREATMENTS TO CONTROL WILDING CONIFERS IN NEW ZEALAND

Gous S[1], Raal PA[2] - [1]SCION, Forest Biosecurity and Protection, Private Bag 3020, Rotorua, New Zealand, [2]Department of Conservation, Otago Conservancy, PO Box 5244, Dunedin, New Zealand

ROOM ITA E ALAOR

THEME 5 - HOW TO PREDICT, DETECT AND MAP PLANT INVASIONS

Chair: Marcelo Vitorino

14h00 – 14h20

OC5.05

UNLOCKING THE POTENTIAL OF GOOGLE EARTH AS A TOOL IN INVASION SCIENCE

Visser V[1], Langdon B[2], Pauchard A[3], Richardson DM[1] - [1]Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, [2]Bioforest S.A., Coronel, Chile, [3]Facultad de Ciencias Forestales, Universidad de Concepción & Institute of Ecology and Biodiversity (IEB), Chile

14h20 – 14h40

OC5.06

ESTIMATE OF *PINUS TAEDA* DISPERSION IN THE MIDDLE WEST OF SANTA CATARINA, BRAZIL

Vitorino MD[1], Marquardt RT[2], Fenilli TAB[3], Schorn LA[3] - [1]Universidade Regional de Blumenau, FURB, Blumenau, SC, Brasil - Departamento de Engenharia Florestal, [2]Universidade Regional de Blumenau - FURB - Programa de Pós-graduação em Engenharia Florestal - PPGEF, [3]Universidade Regional de Blumenau - FURB, Blumenau, SC, Brasil - Departamento de Engenharia Florestal

14h40 – 15h00

OC5.07

OCCURRENCE AND REPRODUCTIVE GROWTH OF *Melinis minutiflora* AND *Urochloa decumbens* IN SITES OF CERRADO SUBJECT TO CONTRASTING WATER AVAILABILITY REGIMES

Xavier RO[1], Leite MB[1], Matos DMS[1] - [1]Universidade Federal de São Carlos - Departamento de Hidrobiologia

15h00 – 15h20

OC5.08

TESTING GEOSPATIAL MODELING METHODS FOR MANAGEMENT OF INVASION OF UNDERSTOREY SHRUB *LANTANA CAMARA* IN TROPICAL FORESTS OF WESTERN GHATS, INDIA

Niphadkar M[1], Ficetola GF[2], Bonardi A[2], Nagendara H[1], Padoa-Schioppa E[2], Adamo M[3], Tarantino C[3], Hiremath A[1] - [1]Ashoka Trust for Research in Ecology and the Environment - ATREE, India, [2]RULE - Research Unit of Landscape Ecology, Department of Earth and Environmental Sciences - University of Milano-Bicocca, Italy, [3]Remote Sensing Group, Consiglio Nazionale delle Richerche-ISSIA - Italy

15h40 – 16h00 | COFFEE BREAK

ROOM NOEMI E BONIFACIO

16h00 – 17h00

PLENARY 3

SUSTAINABLE MANAGEMENT OF INVASIVE WEEDS THROUGH CLASSICAL BIOLOGICAL CONTROL: CONCEPTS, OPPORTUNITIES AND EXAMPLES FROM THE USE OF FUNGAL NATURAL ENEMIES
Robert Weingart Barreto, Departamento de Fitopatologia, Universidade Federal de Viçosa

17h00 – 18h30

POSTER SESSION I

PT1.01

DISTRIBUTION AND SOCIOLOGICAL CHARACTER OF A GARDEN ESCAPEE, INDIAN STRAWBERRY (POTENTILLA INDICA) IN HUNGARY
Balogh L[1], Csiky J[2], Dancza I[3], Jeney E, Kulcsár M[2], Pal RW[2], Wirth T[2] - [1]Savaria Museum, Szombathely - Natural History Department, [2]University of Pecs, Pecs - Institute of Biology, [3]Hímzöu. I. VII/38, H-1039, Budapest

PT1.02

PLANT INVASION OF A GRAVEL MINE REVEGETATED WITH SEWAGE SLUDGE IN THE CERRADO REGION OF BRAZIL
Balduino APC, Corrêa RS[1], Chacon RC[2], Oliveira MS[2] - [1]Universidade Católica de Brasília, [2]Jardim Botânico de Brasília

PT1.03

NOT ALL INVASIVES ARE EQUAL - THE CASE OF *PSIDIUM GUAJAVA* AND *UROCHLOA MAXIMA* IN STATE OF SÃO PAULO
Mendonça AH[1], Marinez FS[2], Durigan G[3] - [1]Universidade de São Paulo - Escola de Engenharia de São Carlos, [2]Jardim Botânico do Rio de Janeiro, [3]Instituto Florestal de São Paulo

PT1.04

DETERMINING THE INVASIVE POTENTIAL OF *CROTALARIA AGATIFLORA* (CROTALARIEAE, FABACEAE) IN SOUTH AFRICA
Phago T[1,2], Van Wyk BE[3], Boatwright SJ[4] - [1]University of Johannesburg - Botany and Plant Biotechnology, [2]South African national Biodiversity Institute - Invasive species programme, [3]Univesity of Johannesburg - Botany and Plant Biotechnology, [4]University of the Western Cape - Biodiversity and Conservation Biology

PT1.05

GERMINATION BIOLOGY OF INVASIVE POTAMOGETON NODOSUS: PREDICTING GERMINATION RESPONSE OF RHIZOME SPROUTS TO TEMPERATURE
Mashhadi HR[1], Fanouschi M[1], Oveisi M[1], Yaghoubi B[2] - [1]University of Tehran, [2]Rice Research Ins.

PT1.06

PLANT INVASIONS IN PRIVATE NATURAL FORESTS SURROUNDED BY *Eucalyptus globulus* PLANTATIONS

García RA[1, 2], Pauchard A[2, 1], Bravo P[1, 2], Sánchez P[1, 2], Esquivel J[1, 2], Jiménez A[1, 2] - [1]Instituto de Ecología y Biodiversidad (IEB), Chile., [2]Laboratorio de Invasiones Biológicas (LIB). - Facultad de Ciencias Forestales, Universidad de Concepción, Concepción, Chile.

PT1.07

HOW DOES AN INVASIVE GRASS AFFECT THE NATIVE VEGETATION BIOMASS OF CERRADO?

Castillioni K[1, 2], Gorgone-Barbosa E[1], Fidelis A[1] - [1]Universidade Estadual Paulista, Brazil - Departamento de Botânica, [2]karen.castillioni@gmail.com

PT1.08

CLIMATIC NICHE AND POTENTIAL DISTRIBUTION OF PINUS CONTORTA AN INVASIVE PINE IN SOUTH AMERICA: DO DIFFERENCES EXIST AMONG VARIETIES?

Bizama G[1, 2], Esquivel J[3, 2], Pauchard A[3, 2], Bustamante RO[1, 2] - [1]Universidad de Chile Departamento de Ciencias Ecológicas, [2]Instituto de Ecología y Biodiversidad, [3]Universidad de Concepción Laboratorio de Invasiones Biólogicas

PT1.09

DO THE REMOVAL OF NEEDLES ENHANCE THE INITIAL REGENERATION OF THE CERRADO VEGETATION IN A FORMER PINE PLANTATION?

Galdi JR[1], Fidelis A[1] - [1]Universidade Estadual Paulista, Brazil. - Departamento de Botânica.

PT1.10

SYMPHYTUM (BORAGINACEAE) IS A GENUS OF NOMADIC SPECIES

Majorov S[1] - [1]Moscow Stste University - Biological Faculty

PT1.11

BIOLOGICAL INVASION OF THE ASIATIC TREE *SYSYGIUM JAMBOS* L. (ALSTON) (MYRTACEAE) IN URBAN FORESTS OF SOUTHEAST BRAZIL.

Ribeiro JHC[1], Fonseca CR[1], Carvalho FA[2] - [1]Universidade Federal de Juiz de Fora - Pós-graduação em Ecologia, [2]Universidade Federal de Juiz de Fora - Departamento de Botânica

PT1.12

DENSITY DEPENDENT MORTALITY IN AN URBAN FOREST INVADED BY THE ASIATIC TREE SYSYGIUM JAMBOS L. (ALSTON) (MYRTACEAE).

Fonseca CR[1], Santiago DS[1], Ribeiro JHC[1], Carvalho FA[2] - [1]Universidade Federal de Juiz de Fora - Pós Graduação em Ecologia, [2]Universidade Federal de Juiz de Fora - Departamento de Botânica

PT1.13

PINUS CONTORTA INVASION IN PATAGONIAN CHILEAN STEPPES: SPATIAL PATTERNS AND INTERACTIONS AT A STAND SCALE

Esquivel J[1, 2], Pauchard C[1, 2], Jiménez A[1] - [1]Universidad de Concepción, Concepción, Chile - Laboratorio de Invasiones Biológicas (LIB), [2]Instituto de Ecología y Biodiversidad (IEB), Santiago, Chile.

PT1.14

NATIVE AND NON NATIVE SPECIES IN A CHRONOSEQUENCE OF FOREST RESTORATION

Assis GB[1], Suganuma MS, Durigan G[2] - [1]Botanical Garden Research Institute of Rio de Janeiro, [2]Forestry Institute of São Paulo State

PT1.15

WHAT DETERMINES THE INVASIBILITY OF GRASSLANDS IN THE PAMPA BIOME, IN SOUTHERN BRAZIL?

Torchelsen FP[1], Overbeck GE[2], Oliveira JM[3] - [1]Universidade Federal do Rio Grande do Sul - Programa de Pós-Graduação em Botânica, [2]Universidade Federal do Rio Grande do Sul - Programa de Pós-Graduação em Botânica, , [3]Universidade do Vale do Rio dos Sinos - Programa de Pós-Graduação em Biologia

PT1.16

CONTROL OF *PTERIDIUM ARACHNOIDEUM* (KAULF.) MAXON INVASION AND SECONDARY SUCCESSION OF GALLERY FOREST AFTER FIRE IN THE IBGE RESERVE (RECOR), BRAZIL.

Motta CP[1], Sampaio AB[1, 2] - [1]ICMBio - CECAT - Research Center for Cerrado and Caatinga Conservation, [2]PEQUI - Pesquisa e Conservação do Cerrado

PT1.17

INVASIVE ALIEN TREE SPECIES IN CONSERVATION AREAS: MONITORING AND MANAGEMENT

Negrelle R[1], Mielke E[2], Scholz I[3] - [1]UFPR - PhD associated teacher at the Federal University of Paraná, [2]Municipal Secretary of Environment, Curitiba City - PhD agronomist Municipal Secretary of Environment, [3]UFPR - Undergraduate in Biological Sciences of Federal University of Paraná.

PT1.18

FORMATION OF SECONDARY DISTRIBUTION RANGE AND INTRASPECIFIC VARIABILITY OF BIDENS CONNATA

Mayorov S[1], Vinogradova Y[2] - [1]Moscow State University, [2]Main botanical garden

PT1.19

FORMATION OF SECONDARY DISTRIBUTION RANGE AND INTRASPECIFIC VARIABILITY OF BIDENS FRONDOSA

Vinogradova Y[1], Mayorov S[2] - [1]Main botanical garden, [2]Moscow state University

PT2.01

HOW INVASIVE SILVER WATTLE IS CHANGING THE SOIL CHEMICAL PATTERN AND ABOVE- AND BELOWGROUND DIVERSITY IN THE ISLAND OF ELBA (ITALY)?

Giuliani C[1], Lazzaro L[1], Calamassi R[1], Lagomarsino A[2], Fabiani A[2], Agnelli A[2], Pastorelli R[2], Foggi B[1] - [1]University of Florence - Department of Biology, Florence, Italy, [2]Consiglio per la Ricerca e la Sperimentazione in Agricoltura - CRA-ABP, Florence, Italy

PT2.02

MEGATHYRSUS MAXIMUS IN RESTORATION SITES ON ATLANTIC FOREST, BRAZIL: LIMITATIONS ON SEEDLING REGENERATION

Dias J[1], Mantoani MC[1], Pereira LCSM[1], Surian T[1], Torezan JMD[1] - [1]Universidade Estadual de Londrina

PT2.03

GLOBAL ANALYSIS OF IMPACTS OF NON-NATIVE PLANTS ON BIODIVERSITY

Vilà M, Rohr R, Espinar JL, Schaffner U, Pyšek P

PT2.04

IMPACTS OF JERUSALEM ARTICHOKE (HELIANTHUS TUBEROSUS S. L.) INVASION IN NORTHEASTERN HUNGARY

Filep R[1], Gál K[2], Farkas Á[3], Pal RW[1] - [1]University of Pécs - Faculty of Natural Sciences, Institute of Biology, [2]University of West Hungary - Faculty of Agricultural and Food Sciences, Department of Botany, [3]University of Pécs - Medical School, Department of Pharmacognosy

PT2.05

IMPACT OF *LEUCANTHEMUM VULGARE* ON RESIDENT PLANT COMMUNITIES ASSOCIATED WITH INTRODUCTION TO NOVEL ENVIRONMENT

Stajerova K[1], Pyšek P[1], Jarošík V[1], Hejda M[2], Blumenthal D[3], Callaway RM[4], Larson DL[5], Kotanen P[6], Schaffner U[7] - [1]Institute of Botany ASCR and Charles University in Prague, [2]Institute of Botany ASCR, [3]USDA-ARS, [4]University of Montana, [5]USGS Northern Prairie Wildlife Research Center, [6]University of Toronto, [7]CABI

PT2.06

COMPARISON OF ALLELOPATHIC EFFECTS OF THREE *TYPHA* SPECIES ON PLANTS FROM THEIR NEW AND ORIGINAL RANGES

Silveira PC[1], Cook B[2], Liao H[3], Callaway RM[4] - [1]1. CAPES Foundation, Ministry of Education of Brazil, Brasilia, Distrito Federal, 70.040-020, Brazil Proc. n. 6260/12-8, [2]Minnesota State University - Department of Biological Sciences, Mankato, MN 56001, USA, [3]Sun Yat-sen University - School of Life Sciences, Guangzhou, Guangdong 510006, China, [4]The University of Montana - Division of Biological Sciences, Missoula, MT 59812, USA

PT2.07

EFFECT OF INVASIVE SPECIES ON THE ENZYME ACTIVITY IN THE RHIZOSFERIC AND NON-RHIZOSFERIC SOIL IN DIFFERENT ECOSYSTEMS, VENEZUELA

Flores S[1], Herrera I[1], González E[1], Lozano V[1], Ochoa R[1], Pérez M[1] - [1]Instituto Venezolano de Investigaciones Científicas - Laboratorio de Ecología de Suelos

PT2.08

IMPACT BY PTERIDIUM AQUILINUM INVASION ON BIOLOGICAL AND PHYSICO-CHEMICAL PROPERTIES OF SOILS IN TROPICAL MONTANE FORESTS

González E[1], Herrera IT[1], Torres N[1], Lozano V[1], Ochoa R[1], Flores S[1] - [1]Instituto Venezolano de Investigaciones Científicas - Centro de Ecología

PT2.09

THE IMPACT OF INVASION BY AN ALIEN TREE ON RANGE CONDITION AND LIVESTOCK PRODUCTION IN A GRASSLAND ECOSYSTEM

Yapi TS[2,1], O'Farrell PJ[2], Dziba LE[2], Esler KJE[1] - [1]Stellenbosch University - Department of Conservation Ecology and Entomology, [2]Council for Scientific and Industrial Research - Natural Resources and the Environment

PT2.10

EFFECTS OF *Pinus contorta* Doug. ex Loud INVASION ON FUEL IN THE NATIONAL RESERVE MALALCAHUELLO, CHILE

Cóbar-Carranza AJ[2,1], García RA[1], Pauchard A[2,1], Peña E[2] - [1]Instituto de Ecología y Biodiversidad, Chile, [2]Universidad de Concepcion, Chile - Laboratorio de Invasiones Biológicas (LIB), Facultad de Ciencias Forestales

PT2.11

INVASIVE AQUATIC PLANTS IN CHILE: CURRENT DISTRIBUTION AND POTENTIAL IMPACTS

Urrutia J[1], Pauchard A[1], Sánchez P[1] - [1]Laboratorio de Invasiones Biológicas, Facultad de Ciencias Forestales, Universidad de Concepción, Casilla 160-C, Concepción, Chile. - Institute of Ecology and Biodiversity (IEB)

PT2.12

NATIONAL INVENTORIES OF ALIEN PLANTS SPECIES IN DEVELOPING COUNTRIES: ADVANTAGES AND DISADVANTAGES OF USING HERBARIUM RECORDS

Fuentes N[1], Pauchard A[1], Sánchez P[1], Esquivel J[1], Marticorena A[2] - [1]Laboratorio de Invasiones Biológicas, Facultad de Ciencias Forestales, Universidad de Concepción, Casilla 160-C, Concepción, Chile. - Institute of Ecology and Biodiversity (IEB), [2]Departamento de Botánica, Universidad de Concepción. Casilla 160-C Concepción, Chile.

PT2.13

IMPACT OF ALIEN PLANT INVASIONS ON NUTRIENT AND REPRODUCTIVE ALLOCATIONS OF NATIVE PLANT SPECIES IN NIGERIA

Agboola OO[1], Muoghalu JI[2] - [1]THE POLYTECHNIC, IBADAN - BIOLOGY, [2]OBAFEMI AWOLOWO UNIVERSITY - BOTANY

ROOM NOEMI E BONIFÁCIO

08h00 – 09h00

PLENARY 4

INVASIBILITY OF AQUATIC ECOSYSTEMS BY NON-NATIVE MACROPHYTES AND THEIR IMPACT ON NATIVE COMMUNITIES: A TROPICAL PERSPECTIVE

Sidinei Magela Thomaz, Universidade Estadual de Maringá

ROOM NOEMI E BONIFÁCIO

09h00 – 10h00

PLENARY 5 - LARS ANDERSON

KEY COMPONENTS OF A SUCCESSFUL MANAGEMENT PROGRAM FOR AQUATIC INVASIVE MACROPHYTES

Anderson L[1] - [1]USDA-ARS, USA

10h00 – 10h30 | COFFEE BREAK

ROOM NOEMI E BONIFÁCIO

10h30 – 11h30

SPECIAL SESSION 3

Chair: Robert Barreto

Rubbervine infestation in the Brazilian northeast: the problem and a biocontrol solution

10h30 – 10h50

INTRODUCTION: Robert Barreto

10h50 – 11h10

SS3.1

PRIORITIZING WEED TARGETS FOR CLASSICAL BIOLOGICAL CONTROL: A CASE STUDY ON BRAZIL

Tanner Robert A[1], Shaw RH[1], Trivellato G[2] - [1]CABI, [2]UNESP

11h10 – 11h30

SS3.2

PRIORITIZING WEED TARGETS FOR CLASSICAL BIOLOGICAL CONTROL: A CASE STUDY FOR BRAZIL

Tanner RA[1], Trivellato G, Shaw Richard H[1] - [1]CABI - Invasive Species

10h30 – 11h30

THEME 4

Chair: Helena de Godoy Bergallo

10h30 – 10h50

OC4.01

LATITUDINAL CLINES IN DAMAGE TO INVASIVE PLANTS BY THEIR NATURAL ENEMIES

Kotanen P[1] - [1]University of Toronto - Ecology and Evolutionary Biology

10h50 – 11h10

OC4.02

THE CONTROL OF THE INVASIVE JACKFRUIT TREE (MORACEAE) AT ILHA GRANDE AND ITS EFFECTS ON SMALL MAMMAL COMMUNITY, SEED RAIN AND SEED DISPERSAL.

Bergallo HG[1], Mello JHF[1], Raíces DSL[2], Ferreira PM[3], Moura CJR[4], Lacerda ACM[1] - [1]Universidade do Estado do Rio de Janeiro - Depto. Ecologia, [2]Instituto Chico Mendes de Conservação da Biodiversidade, [3]Universidade do Estado do Rio de Janeiro - PG Ecologia e Evolução, [4]Signus Vitae Projetos Ambientais

ROOM ITA E ALAOR

10h30 – 12h00

THEME 2 - ECOLOGICAL IMPACTS OF INVASIVE PLANTS

Chair: Vania Pivello

10h30 – 10h50

OC2.01

THE BOTTOM LINE: IMPACTS OF ALIEN PLANT INVASIONS IN PROTECTED AREAS

Foxcroft LC[1, 2], Pyšek P[3, 4], Richardson DM[1], Pergl J[3], Hulme PE[5] - [1]Centre for Invasion Biology, Stellenbosch University, South Africa, [2]South African National Parks, South Africa, [3]Academy of Sciences of the Czech Republic - Institute of Botany, Department of Invasion Ecology, [4]Charles University, Czech Republic - Department of Ecology, [5]Lincoln University, New Zealand - The Bio-Protection Research Centre

10h50 – 11h10

OC2.02

IMPACT OF INVASIVE ALIEN PLANTS ON SOIL SEED BANKS

Gioria M[1], Jarošík V[2], Pyšek P[3] - [1]Justus-Liebig University Giessen - Institute of Plant Ecology, [2]Charles University in Prague - Department of Ecology, [3]Academy of Sciences of the Czech Republic - Institute of Botany

11h10 – 11h30

OC2.03

DOES AN INVASIVE PLANT ACT AS AN ENVIRONMENTAL FILTER IN NATIVE GRASSLANDS?

Dresseno AP[1], Molz M[1], Overbeck GE[2] - [1]Universidade Federal do Rio Grande do Sul/UFRGS - Departamento de Ecologia, [2]Universidade Federal do Rio Grande do Sul/UFRGS - Departamento de Botânica

11h30 – 11h50

OC2.04

SUBSIDIES TO MANAGE AN INVASIVE PALM TREE IN THE ATLANTIC FOREST (SÃO PAULO, BRAZIL)

Pivello VR[1], Mengardo ALT[1] - [1]Universidade de São Paulo - Dept. Ecologia

11h50 – 12h10

OC2.05

BIODIVERSITY LOSSES DUE TO SLASH PINE INVASION IN THE BRAZILIAN SAVANNA

Abreu RCR[1], Bruna EM[2], Durigan G[3] - [1]Universidade de São Paulo - Centro de Recursos Hídricos e Ecologia Aplicada, Escola de Engenharia de São Carlos, SP, Brazil., [2]University of Florida - Department of Wildlife Ecology and Conservation, Gainesville, Florida, USA., [3]Instituto Florestal - Floresta Estadual de Assis, SP, Brazil.

12h10 – 12h30

OC2.06

IS IMPACT OF ALIEN SPECIES RELATED TO PATHWAY OF INTRODUCTION?

Pergl J, Pyšek P, Jarošík V, Nentwing W, Bacher S, Essl F, Genovesi P, Harrower CA, Hulme PE, Kenis M, Kühn I, Rabitsch W, Roques A, Roy D, Vilà M, Winter M, Roy H

12h30 – 14h00 | LUNCH

ROOM NOEMI E BONIFÁCIO

14h00 – 15h00

SPECIAL SESSION 4 - MARCELO VITORINO

14h00 – 14h20

SS4.1

ECOLOGICAL IMPACT, DISTRIBUTION AND BIOLOGICAL CONTROL OF INVASIVE ALIEN *TECOMA STANS* IN SOUTH AFRICA AND BRAZIL

Vitorino Marcelo D[1], Madire LG[2], Wood AR[3] - [1]Universidade de Blumenau - FURB - Programa de Pós-graduação em Engenharia Florestal - FURB, [2]ARC-PPRI Quenswood, [3]ARC - PPRI Stellenbosch

14h20 – 14h40

SS4.2

THE LONGHORN BEETLE *RECCHIA PARVULA*: A SUITABLE BIOLOGICAL CONTROL AGENT FOR *CHROMOLAENA ODORATA* IN SOUTH AFRICA?

Zachariades Costas [1, 2] - [1]Agricultural Research Council - Plant Protection Research Institute, [2]University of KwaZulu-Natal - School of Life Sciences

14h40 – 15h00

SS4.3

A BRAZILIAN INSECT COULD BE THE SOLUTION TO AN INVASIVE WEED IN SOUTH AFRICA

Paterson Ian D[1], Hill MP[1], Mdodana LA[1], de Cristo SC[2], Vitorino MD[2] - [1]Rhodes University - Zoology and Entomology, [2]Blumenau Regional University - Forestry Master Course

14h00 – 16h00

THEME 2 - ECOLOGICAL IMPACTS OF INVASIVE PLANTS

Chair: Anibal Pauchard

14h00 – 14h20

OC2.07

LEARNING FROM THE PINUS CONTORTA INVASION IN THE CHILEAN PATAGONIA: WHAT PINES CAN TELL US ABOUT INVASION MECHANISMS AND IMPACTS?

Pauchard A[1, 2] - [1]Laboratorio de Invasiones Biológicas, Facultad de Ciencias Forestales, Universidad de Concepción, Casilla 160-C, Concepción, Chile., [2]Institute of Ecology and Biodiversity (IEB), Chile.

14h20 – 14h40

OC2.08

THE SPATIAL INFLUENCE OF THE INVASIVE LEGUME *A. LONGIFOLIA* ON THE NUTRITION STATUS AND DYNAMICS OF THE SURROUNDING VEGETATION: THE ROLE OF RHIZOSPHERE

UlmF[1], HellmannC[2], Cruz C[1], Máguas C[1] - [1]Faculty of Science, University of Lisbon, Portugal - Centre for Environmental Biology, [2]University of Bielefeld, Bielefeld, Germany - Experimental and Systems Ecology

14h40 – 15h00

OC2.09

INVASIVE PLANTS: DIFFERENT BUT THE SAME

González L[1], Lorenzo P[2], Novoa A[3], Souza-Alonso P[1] - [1]Universidade de Vigo - Bioloxía Vexetal e Ciencia do Solo, [2]Universidade de Coimbra - Centro de Ecologia Funcional, [3]Stellenbosch University - Centre for Invasion Biology

15h00 – 15h20

OC2.10

ORIGIN MATTERS - IMPACT OF THE INVASIVE SOLIDAGO GIGANTEA ON CO-OCCURRING PLANT SPECIES AT HOME AND AWAY

Pal RW[1, 2], Chen S[3], Nagy DU[2], Callaway RM[1] - [1]The University of Montana, Missoula - Division of Biological Sciences, [2]University of Pecs, Pecs - Institute of Biology, [3]Lanzhou University, Lanzhou - School of Life Science, Key Laboratory of Arid and Grassland Agroecology

15h20 – 15h40

OC2.11

Changes in mutualistic networks – the influence of invasive acacias on nitrogen-fixing symbiont diversity and its impact on native ecosystems.

Mavengere NR[1], Le Roux JJ[1], Ellis AC[2] - [1]Center for Invasion Biology - Stellenbosch University, [2]Stellenbosch University - Botany and Zoology

16h00 – 16h30 | COFFEE BREAK

ROOM NOEMI E BONIFÁCIO

16h30 – 17h30

PLENARY 6 - CURTIS DAEHLER

FAIL: WHY DO MOST INTRODUCED PLANTS SEEM TO BE NON-INVASIVE?

Daehler CC[1] - [1]University of Hawaii at Manoa - Department of Botany

17h30 – 19h00

POSTER SESSION 2

PT2.14

IMPACT OF INVASION OF PINUS CONTORTA ON THE RESIDENT PLANT COMMUNITY OF THE PATAGONIAN STEPPE.

Bravo P[1, 2], Pauchard A[1, 2], Fajardo A[3] - [1]Laboratorio de Invasiones biológicas (LIB) - Universidad de Concepción, [2]Instituto de Ecología y Biodiversidad (IEB), - Universidad de Chile, [3]Centro de investigación en Ecosistemas de la Patagonia (CIEP) - Universidad Austral de Chile

PT2.15

COMPARATIVE STUDY OF GERMINATION FROM SEEDS OF GREEN AND MATURE FRUITS OF *Cryptostegia madagascariensis* Bojer Ex Decne, AN INVADER IN CEARA

Bonilla OH[1], Major I[1] - [1]Universidade Estadual do Ceará - UECE - Labaoratório de Ecologia - LABOECO

PT2.16

INFLUENCE OF TEMPERATURE AND LIGHT ON GERMINATION OF THE INVASIVE *Cryptostegia grandiflora*

Brito SF[1], Matos DS[2], Medeiros Filho S[1] - [1]Universidade Federal do Ceará, [2]Universidade Federal de São Carlos

PT2.17

IMPACT OF PTERIDIUM AQUILINUM ON THE SPECIES RICHNESS, DIVERSITY AND COMPOSITION ON PLANT COMMUNITIES IN NORTHERN VENEZUELA

Torres N[1], Herrera I[1], Lozano V[2], Fernández A[1], Gonto R[2], González E[2] - [1]Instituto Venezolano de Investigaciones Científicas IVIC, [2]Instituto Venezolano de Investigaciones Científicas IVIC

PT3.01

GENETIC VARIATION IN LITTER QUALITY INFLUENCES THE SPREAD OF AN INVASIVE WETLAND PLANT: A THEORETICAL EXPLORATION

Molofsky J[1], Eppinga MB[2] - [1]University of Vermont - Plant Biology, [2]University of Utrecht - Department of Environmental Sciences

PT3.02

FACTORS PROMOTING DOMINANCE OF THE INVASIVE NEOPHYTE *IMPATIENS GLANDULIFERA* WITHIN INVADED COMMUNITIES

Markova Z[1, 2], Hejda M[1] - [1]Institute of Botany, Academy of Sciences of the Czech Republic, CZ-252 43 Průhonice, Czech Republic - Department of Invasion Ecology, [2]Department of Ecology, Charles University, CZ-128 43 Viničná 7, Prague, Czech Republic - Department of Ecology

PT3.03

THE EFFECT OF TEMPERATURE AND NUTRIENT LEVEL ON THE GROWTH OF THE SEEDLINGS OF *AMBROSIA ARTEMISIIFOLIA L.*

Moravcova L[1], Skálová H[1], Jarošík V[2], Pyšek P[1] - [1]Institute of Botany, Academy of Sciences of the Czech Republic - Ecology of Invasions, [2]Faculty of Sciences, Charles University, Prague - Department of Ecology

PT3.04

DIFFERENTIATION IN GERMINATION TIMING AND FROST RESISTANCE IN INVASIVE AND NATIVE IMPATIENS SPECIES

Skálová H[1], Dvořáčková S[1], Pyšek P[1, 2] - [1]Institute of Botany, Academy of Sciences of the Czech Republic, CZ-252 43 Průhonice, Czech Republic, [2]Department of Ecology, Faculty of Sciences, Charles University, Viničná 7, CZ-128 01 Praha 2, Czech Republic

PT3.05

ANALYSIS OF GENETIC AND ECOLOGICAL SEGREGATION OF THE INVASIVE *SOLIDAGO GIGANTEA* IN THE NATIVE AND NON-NATIVE RANGE

Nagy DU[1], Stranczinger S[1], Krízsik V[2], Godi A[1], Pal RW[1] - [1]University of Pécs, Faculty of Natural Sciences, Institute of Biology - Department of Plant Systematics and Geobotany, [2]Hungarian Natural History Museum - Molecular Taxonomic Laboratory

PT3.06

IS NICHE CONSERVATISM THE GENERAL RULE DURING INTERCONTINENTAL PLANT INVASION OF *LANTANA CAMARA*?

Goncalves E[1, 2], Duarte M[4, 3], Herrera I[1], Bustamante RO[4, 3], Velasquez G[1], Lampo M[1], Sharma GP[3, 5], García S[2] - [1]Instituto Venezolano de Investigaciones Científicas IVIC, Caracas, Venezuela - Centro de Ecología, [2]Universidad Simón Bolívar, Caracas, Venezuela - Departamento de Estudios Ambientales, [3]Instituto de Ecología y Biodiversidad, Chile, [4]Universidad de Chile, Santiago, Chile - Facultad de Ciencias, [5]University of Delhi, Delhi, India - Department of Environmental Studies

PT3.07

A COMBINED ANALYSIS OF DNA BARCODES AND ECOLOGY OF INVASIVE FRESHWATER AQUATIC PLANTS IN SOUTH AFRICA.

Hoveka LN[1] - [1]University of Johannesburg - Botany and Plant Biotechnology

PT3.08

VARIATION IN GERMINATION CHARACTER OF BLACK LOCUST SEEDS AT DIFFERENT THERMAL REGIMES AND MOISTURE STRESS

Giuliani C[1], Foggi B[1], Calamassi R[1], Lazzaro L[1], Benesperi R[1], Bini LM[1], Lippi MM[1] - [1]University of Florence - Department of Biology, Florence, Italy

PT3.09

COMPARING NATIVE AND INVASIVE GRASSES RESPONSES TO ENVIRONMENTAL FACTORS.

Musso C[1], Oliveira R[1], Pinto G[1], Loureiro S[1], Soares AMVM[1] - [1]Universidade de Aveiro - CESAM & Departamento de Biologia

PT3.10

MICROSATELLITE LOCI PECULIARITIES OF IMPATIENS GLANDULIFERA POPULATIONS FROM BALTIC REGION

Zybartaite L[1], Baniulis D[2], Paulauskas A[1], Durka W[3], Kupcinskiene E[1] - [1]Vytautas Magnus University, Faculty of Natural Sciences, Kaunas, LT-44404, Lithuania - Department of Biology, [2]Lithuania Research Centre for Agriculture and Forestry, Institute of Horticulture, Agriculture Sciences - Department of Orchard Plant Genetics and Biotechnology, [3]Helmholtz-Centre for Environmental Research-UFZ, 06120 Halle, Germany - Dept. Community Ecology

PT3.11

BIOMASS ESTIMATION OF *ARUNDO DONAX* L. (GIANT REED) IN THE FEDERAL DISTRICT, BRAZIL

Simões KCC[1], Hay JD[1], Andrade CO[1] - [1]University of Brasilia - Ecology

PT3.12

ON THE RESPECTIVE ROLE OF DISPERSAL AND THE COMPLEX LANDSCAPE IN THE INVASION PROCESS: THE CASE OF THE ESCHSCHOLZIA CALIFORNICA IN CHILE

Castillo MLC[1], Véliz D[1], Bustamante RO[1] - [1]Universidad de Chile - Departamento de Ciencias Ecológicas and Instituto de Ecología y Biodiversidad

PT4.01

POLLINATOR SPILL-OVER FROM NON-NATIVE TO NATIVE PLANTS?

Vilà M[1], Montero-Castaño A[1] - [1]Estación Biológica de Doñana (EBD-CSIC)

PT5.01

DELIBERATE AND ACCIDENTAL INTRODUCTION OF ALIEN PLANTS IN THE CAATINGA, NORTHEASTERN BRAZIL

Almeida WR[1], Lopes AV[1], Leal IR[1], Tabarelli M[1] - [1]Universidade Federal de Pernambuco - Departamento de Botânica

PT5.02

MICRO-EXHIBITION OF INVASIVE PLANT SPECIES IN THE MAIN BOTANICAL GARDEN (MOSCOW)

Vinogradova Y[1] - [1]Main Botanical Garden Russian Academy of Scienses

PT5.03

ESTIMATING ALIEN PLANT INVASION RISK IN SPACE AND TIME USING A DYNAMIC BAYESIAN NETWORK

Smith C[1], Brundu G[2] - [1]School of Agriculture and Food Sciences, The University of Queensland, Australia, [2]Department of Science for Nature and Environmental Resources, University of Sassari, Italy

PT5.04

AUSTRALIAN ACACIAS IN BRAZIL: ARE THEY HERE TO STAY?

Attias N[1], Siqueira M[2], Bergallo HG[3] - [1]UFMS - Pós-Graduação em Ecologia e Conservação, [2]JBRJ - Instituto de Pesquisas Jardim Botânico, [3]Universidade do Estado do Rio de Janeiro - Depto. Ecologia

PT5.05

ASSESSING THE RISK OF INVASIVE ALIEN PLANTS IN THE TUSCAN ARCHIPELAGO (CENTRAL MEDITERRANEAN): THE EPPO PRIORITIZATION OR THE AUSTRALIAN WRA?

Lazzaro L[1], Brundu G[2], Benesperi R[1], Ferretti G[1], Foggi B[1] - [1]Department of Evolutionary Biology, University of Florence, Italy, [2]Department of Science for Nature and Environmental Resources, University of Sassari, Italy

PT5.06

DEMOGRAPHIC RESPONSES OF *ESCHSCHOLZIA CALIFORNICA* (PAPAVERACEAE) ALONG ALTITUDINAL GRADIENT, AN INVASIVE PLANT OF CENTRAL CHILE.

Peña-Gómez FT[1,2], Castillo MLC[1,2], Morales JD[1], Bustamante RO[1,2] - [1]Universidad de Chile - Depto. de Cs. Ecológicas, [2]Instituto de Ecología y Biodiversidad

PT5.07

NATURAL EXPANSION OF EUCALYPTUS GLOBULUS IN COMPARISON TO THE NATIVE SPECIES PINUS PINASTER: DO WE HAVE A POTENTIALLY INVASIVE SPECIES?

Fernandes P[1], Máguas C[1], Correia O[1] - [1]Faculty of Science, University of Lisbon - Centre for Environmental Biology

PT5.08

MISMATCHES BETWEEN CLIMATIC NICHE AND GEOGRAPHIC DISTRIBUTION: THE ROLE OF CUSHION PLANTS ON THE ALTITUDINAL SPREAD OF TARAXACUM OFFICINALE, ACROSS ANDEAN ECOSYSTEMS

Duarte M[1], Gómez FTP[1], Bizama G[2], PC Guerrero[3], Bustamante RO[1] - [1]IEB-Chile, Universidad de Chile., [2]Universidad de Chile, IEB-Chile, [3]IEB-CHILE

PT5.09

DEVELOPMENT OF AN ‘INVASIVE ALIEN SPECIES PATHWAY MANAGEMENT TOOLBOX’

Burgos LA[1,2], Pagad S[3] - [1]University of Chile - Ecology and Biodiversity Institute, [2]National Museum of Natural History - Department of Botany, [3]University of Auckland - Invasive Species Information Management

PT6.01

PL@NTINVASIVE-KRUGER: COMPUTER-BASED IDENTIFICATION AND INFORMATION TOOLS TO MANAGE ALIEN INVASIVE PLANTS THE KRUGER NATIONAL PARK, SOUTH AFRICA

Le Bourgeois T[1], Foxcroft LC[2,3], Thompson DI[4,5], Guezou A[1], Grard P[6], Taylor RW[4], Marshall T[4], Carrara A[1] - [1]Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France, [2]South African National Parks, South Africa, [3]Centre for Invasion Biology, Stellenbosch University, South Africa, [4]South African Environmental Observation Network, South Africa - Ndlovu Node, [5]University of KwaZulu-Natal Pietermaritzburg, South Africa - School of Life Sciences, [6]French Institute of Pondicherry, India

PT6.02

NATURAL REGENERATION IN A 20-Y REFORESTATION AFTER FOUR YEARS OF *Megathyrsus maximus* MANUAL REMOVAL

Mantoani MC[1], Dias J[1], Azevedo JB[1], Andrade GR[1], Torezan JMD[1] - [1]Universidade Estadual de Londrina-PR

PT6.03

PROSPECTS FOR INITIATING A BIOLOGICAL CONTROL PROGRAMME AGAINST GIANT REED, ARUNDO DONAX (POACEAE) IN SOUTH AFRICA

Bownes A[1] - [1]Agricultural Research Council - Plant Protection Research Institute

PT6.04

LESSONS LEARNED ERADICATING INVASIVE ALIEN PLANTS IN KWA-ZULU NATAL, SOUTH AFRICA

Mthimkhulu N[1] - [1]South African National Biodiversity Institute

PT6.05

BEASTS FOR THE BEAUTY - PROGRESS ON THE BATTLE TO TAME WILD GINGERS

Djeddour DH[1], Pratt C[1], Shaw RH[1] - [1]CABI - Invasive Species

PT7.01

ACTIONS OF THE STATE OF BAHIA ENVIRONMENTAL AGENCY TO INVASIVE ALIEN SPECIE'S MANAGEMENT.

Souza PMM[1], Alves SMB[2], Pinho MS[2], Anjos-Duarte CS[2] - [1]Instituto do Meio Ambiente e Recursos Hídricos-INEMA - Diretoria de Biodiversidade, [2]Instituto do Meio Ambiente e Recursos Hídricos - INEMA - Diretoria de Biodiversidade

PROGRAM - SEPTEMBER 25

08h30 – 18h00

MID-CONGRESS EXCURSION TO THE NATIONAL PARK OF BRASILIA

PROGRAM - SEPTEMBER 26

ROOM NOEMI E BONIFÁCIO

08h00 – 09h00

PLENARY 7 - JACO LE ROUX

FROM MOLECULES TO LANDSCAPES: WHAT CAN GENES TELL US ABOUT BIOLOGICAL INVASIONS? AUSTRALIAN ACACIAS AS AN EXAMPLE.

Le Roux JJ[1] - [1]Stellenbosch University, South Africa - Center for Invasion Biology, Botany and Zoology

ROOM NOEMI E BONIFÁCIO

09h00 – 10h00

PLENARY 8 - CARLA D´ANTONIO

FRAMEWORKS FOR ASSESSING THE LONG-TERM PERSISTENCE OF PLANT INVADERS

D'Antonio CM[1] - [1]University of California Santa Barbara, CA, USA 93106

10h00 – 10h30 | COFFEE BREAK

ROOM NOEMI E BONIFÁCIO

SPECIAL SESSION 5

ECOLOGY AND MANAGEMENTO OF ARUNDO DONAX (GIANT REED) AND LARGE INVASIVE GRASSES
Chair: Thomas Dudley

10h30 – 10h50

SS5.1

COMMUNITY AND ECOSYSTEM ECOLOGY AND IMPACTS OF ARUNDO DONAX
Dudley Thomas[1], Lambert A[2] - [1]University of California, Santa Barbara - Marine Science Institute, [2]University of California, Santa Barbara - Cheadle Center for Biodiversity and Ecological Restoration

10h50 – 11h10

SS5.2

IS ARUNDO DONAX AN INVASION RISK IN THE FEDERAL DISTRICT OF BRAZIL?
Simões KCC[1], Hay JD[2] - [1]Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis, [2]University of Brasília - Ecology

11h10 – 11h30

SS5.3

REPRODUCTION AND GENETIC DIVERSITY OF ARUNDO DONAX AND PHRAGMITES AUSTRALIS
Lambert Adam[1], Saltonstall K[2], Dudley T[1] - [1]University of California - Marine Science Institute, [2]Smithsonian Tropical Research Institute

11h30 – 11h50

SS5.4

A JOINT CFIA-USDA WEED RISK ASSESSMENT OF *ARUNDO DONAX*
Castro K[1] - [1]Canadian Food Inspection Agency - Plant and Biotechnology Risk Assessment Unit

11h50 – 12h10

SS5.5

THE POTENTIAL FOR BIOLOGICAL CONTROL OF THE GIANT REED, ARUNDO DONAX IN SOUTH AFRICA.
Pillay KC[1], Paterson I[1] - [1]Rhodes University - Department of Zoology and Entomology

THEME 7

GOVERNMENTAL REGULATIONS AND ACTIONS ON INVASIVE PLANTS

Chair: Yolanda Barrios

10h30 – 10h50

OC7.01

A NEW NATIONAL UNIT FOR INVASIVE SPECIES DETECTION, POST-BORDER RISK ASSESSMENT, AND ERADICATION PLANNING IN SOUTH AFRICA

Nanni I[1], Wilson JRU[1, 2], Ivey P[1], Manyama P[1] - [1]South African National Biodiversity Institute, [2]Centre for Invasion Biology, Stellenbosch University, South Africa

10h50 – 11h10

OC7.02

RAPID INVASIVENESS ASSESSMENT TOOL FOR EXOTIC SPECIES IN MEXICO

Barrios Y[1], Born-Schmidt G[1], Golubov J[2], González AI[1], Koleff P[1], Mendoza R[3] - [1]CONABIO - Dirección General de Análisis y Prioridades, [2]Departamento El Hombre y Su Ambiente - Universidad Autónoma Metropolitana Xochimilco, [3]Universidad Autónoma de Nuevo León

ROOM ITA E ALAOR

THEME 3

ECOLOGICAL AND GENETIC STUDIES OF INVASIVE PLANTS
Chair: Claudia Jacobi

10h30 – 10h50

OC3.11

WILDFIRES AND PRESCRIBED FIRES DIFFER IN THEIR EFFECTS ON NATIVE AND INTRODUCED VEGETATION: A GLOBAL META-ANALYSIS

Alba C[1], Skálová H[1], McGregor K[1], Pyšek P[1] - [1]Academy of Sciences of the Czech Republic - Institute of Botany

10h50 – 11h10

OC3.02

SEEDLING PERFORMANCE OF Leucaena leucocephala (LAM.) de WIT IN MIXED CULTURES WITH TWO OTHER LEGUMES, UNDER DIFFERENT DENSITY AND WATER REGIME CONDITIONS

Jacobi CM[1], Fonseca NG[2] - [1]Universidade Federal de Minas Gerais - Biologia Geral, ICB, [2]Universidade Federal de Minas Gerais - Programa de Pós- graduação em Ecologia, Conservação e Manejo de Vida Silvestre

11h10 – 11h30

OC3.03

COEXISTENCE OR COMPETITION AMONG NATIVE AND INVASIVE SPECIES? A CASE STUDY OF CENTRAL-EUROPEAN *IMPATIENS* CONGENERS

Cuda J[1], Skálová H[1], Janovsky Z[2], Pyšek P[1] - [1]Institute of Botany, Academy of Sciences of the Czech Republic - Department of Invasion Ecology, [2]Charles University - Department of Botany

11h30 – 11h50

OC3.04

APPETITE OF ALIEN IMPATIENS SPP. GROWING IN THE BALTIC REGION

Kupcinskiene E[1], Sliumpaite I[1], Zybartaite L[1], Janulioniene R[1], Paulauskas A[1] - [1]Vytautas Magnus University, Faculty of Natural Sciences, Kaunas, LT-44404, Lithuania - Department of Biology

11h50 – 12h10

OC3.05

THE REPRODUCTIVE INVESTMENT OF AN INVASIVE SPECIES (ACACIA LONGIFOLIA) IS DEPENDENT ON CLIMATE AND PLANT COMMUNITY STRUCTURE?

Fernandes P[1], AntunesC[1], Correia O[1], Máguas C[1] - [1]Faculty of Science, University of Lisbon - Centre for Environmental Biology

12h30 – 14h00 | Lunch

ROOM JOSÉ BONIFÁCIO

14h00 – 14h40

THEME 8

HUMAN INFLUENCE ON SPREAD OF INVASIVE PLANTS

Chair: Elizabeth Gorgone

14h00 – 14h20

OC8.01

INTRODUCTION HISTORY OF INVASIVE PLANTS IN BRAZIL: PATTERNS OF ASSOCIATION BETWEEN BIOGREOGRAPHICAL ORIGIN AND REASON FOR INTRODUCTION

Zenni RD[1] - [1]The University of Tennessee - Department of Ecology and Evolutionary Biology

14h20 – 14h40

OC8.02

HOW DOES DISTURBANCE INFLUENCE THE GERMINATION OF AN INVASIVE GRASS IN CERRADO?

Gorgone-Barbosa E[1], Baeza J[2], Ayache F[2], Pivello VR[3], Fidelis A[1] - [1]Universidade Estadual Paulista - Botânica, [2]Fundación Centro de Estudios Ambientales del Mediterraneo (CEAM), [3]Universidade de São Paulo - Ecologia

ROOM ITA E ALAOR

14h00 – 16h00

THEME 3
ECOLOGICAL AND GENETIC STUDIES OF INVASIVE PLANTS
Chair: Paul Downey

14h00 – 14h20

OC3.06
NEW EVIDENCES FOR ALLELOPATHY IN BRACKEN FERN
Jatobá LJ[1], Varela RM[2], Gonzalez JM[2], Gualtieri SCJ[3], Macías FA[2] - [1]CAPES Foundation, Ministry of Education of Brazil, [2]Cádiz University - Department of Organic Chemistry, [3]São Carlos Federal University - Department of Botany

14h20 – 14h40

OC3.07
THE IMPACT OF FOREST MANAGEMENT AND CLIMATE CHANGE ON THE PHYSIOLOGICAL PERFORMANCE OF THE INVASIVE ACACIA LONGIFOLIA
Fernandes P[1], Cristina A[1], Correia O[1], Máguas C[1] - [1]Faculty of Science, University of Lisbon, Portugal - Centre for Environmental Biology

14h40 – 15h00

OC3.08
26 YEARS OF INVASION DEMOGRAPHY FOR THE ALIEN SHRUB SCOTCH BROOM (CYTISUS SCOPARIUS) – ECOLOGICAL INSIGHTS FOR MANAGEMENT
Downey PO[1], Gruber B[1], Sea WB[1] - [1]Institute for Applied Ecology - University of Canberra, ACT 2601, Australia

15h00 – 15h20

OC3.09

THE ELEPHANT IN THE ROOM: THE ROLE OF FAILED INVASIONS IN UNDERSTANDING INVASION BIOLOGY

Zenni RD[1], Nuñez MA[2] - [1]The University of Tennessee - Department of Ecology and Evolutionary Biology, [2]INIBIOMA, CONICET, Universidad Nacional del Comahue - Laboratorio Ecotono

15h20 – 15h40

OC3.10

HOME SWEET HOME: RESOLVING NATIVE PROVENANCES WITHIN THE GENUS *CARDIOSPERMUM* USING PHYLOGENY

Gildenhuys E[1], Ellis AG[2], Carroll SP[3], Le Roux JJ[1] - [1]Stellenbosch University - Centre of Excellence for Invasion Biology, Department of Botany and Zoology, [2]Stellenbosch University - Department of Botany and Zoology, [3]University of California, Davis and Institute for Contemporary Evolution - Department of Entomology

15h40 – 16h00

OC3.01

ALIEN MACROPHYTES IN THE GREAT LAKES: SURVIVAL OF *EICHHORNIA CRASSIPES* AND *PISTIA STRATIOTES*

Eyraud A[1], MacIsaac HJ[1] - [1]University of Windsor - Great Lakes Institute for Environmental Research

16h00 | CLOSING CEREMONY

PL1

IMPACTS OF NON-NATIVE PLANTS ON BIODIVERSITY AND ECOSYSTEM SERVICES

Vilà M[1], Espinar JM[2], Hulme PE[3], Pergl J[4], Pyšek P[4], Rohr RP[2], Schaffner U[5], Sixtová Z - [1]Estación Biológica de Doñana, [2]Estación Biológica de Doñana, [3]Lincoln University, New Zealand, [4]Academy of Sciences of the Czech Republic, [5]CABI- Switzerland

Studies on plant impacts have increased exponentially in the last two decades. However, it is unclear whether there are strong patterns in terms of their major effects, how the vulnerability of different ecosystems varies, and which ecosystem services are at greatest risk. A global meta-analysis of more than 1000 field studies has shown that non-native plants had a significant effect in 11 out of 24 different types of ecological impacts. However, these studies focus on a few plant species (i.e. 9 species account for 1/3 of studies). Moreover, the frequency for which an impact has been assessed is biased towards certain regions and certain plant life-forms. Recent analysis has shown that regardless of the particular ecosystem and geographical region invaded, there is a phylogenetic signal on the magnitude of the impact indicating that even once taken into account some plant traits, species relatedness plays a key role in determining their impact, i.e., two closely related invasive plant species tend to have a similar impact. These quantitative analysis provide the basis for scoring non-native species by their impact, and therefore are crucial to set priorities for management actions and for policy guidance such as selection of species for black-lists or alert-lists.

To the memory of Vojtěch Jarošík (1958-2013)

PL2

PLANT INVADERS IN EUROPEAN AND MEDITERRANEAN INLAND WATERS: PROFILES, DISTRIBUTION, AND THREATS.

Brundu[1] - [1]University of Sassari - Science for Nature and Environmental Resources

INTRODUCTION

Since freshwaters are delimited by tract of lands it could be expected that aquatic native and non-native plants would tend to be locally distributed within a particular area and that the seas and the oceans would provide insurmountable barriers to dispersion. In contrast, only 25-30% of the known aquatic plants are considered to be truly endemics and several families and species of aquatic plants are so widely distributed that they can be described as cosmopolitan. Their geographic origin might, in many cases, remain unresolved (Ashton & Mitchell 1989). At the European level, at least 6.6% of the native aquatic species (26 species over ca. 400) are considered threatened with extinction, with at least 1.3% of them being Critically Endangered, 2% Endangered and 3.3% Vulnerable (Bilz et al. 2011). Hussner (2012: Weed Research 52, 297–306) reports 96 aquatic species from 30 families, as aliens from at least one European country (in 46 European countries), while Pyšek et al., (2009: DAISIE Handbook) estimated that at least 260 species of plants not native to any part of Europe are established in inland waterways. Water bodies most vulnerable to biological invasions are often subject to multiple pressures for which the key drivers are agricultural intensification and urbanization. These pressures include high or fluctuating nutrient loading, water level or flow regime alteration, presence of industrial contaminants and morphological modification leading to physical habitat disturbance and simplification. Thus, biological invasions could be seen as one of a syndrome of traits that characterize degraded aquatic ecosystems (Willby, 2007).

KEY SPECIES AND PATHWAYS FOR INTRODUCTION AND SECONDARY RELEASE

Pathways of plant dispersal vary conspicuously with time and at different spatial scales and so does the underlying human motivation (Kowarik & von der Lippe, 2007). Anyway most current aquatic weeds were at one time deliberately imported for ornamental or for other purposes (e.g., *Eichhornia crassipes*, *Pistia stratiotes* etc.).

RISK ASSESSMENT AND MANAGEMENT OPTIONS

Successful management of invasive species depends on a number of activities, such as, e.g. prevention, habitat restoration, dedicated risk assessment, prioritisation, awareness raising and legislation, collaboration between different stakeholders, development of codes of conduct with the horticultural sector and prohibiting the sale, purchase and intentional release of these species in the wild (Champion et al., 2010: Hydrobiologia 656:167–172).

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PL3

SUSTAINABLE MANAGEMENT OF INVASIVE WEEDS THROUGH CLASSICAL BIOLOGICAL CONTROL: CONCEPTS, OPPORTUNITIES AND EXAMPLES FROM THE USE OF FUNGAL NATURAL ENEMIES

Barreto RW[1] - [1]Universidade Federal de Viçosa - Departamento de Fitopatologia

There are two approaches to biological control of weeds – inoculative (classical) and inundative (bioherbicide) – the classical strategy is based on the concepts and principles established by entomologists over more than a century of exploiting herbivorous arthropods for the management of invasive alien weeds. Essentially, the premise is that exotic plants become invasive and weedy due, in part, to increased fitness in the absence of their coevolved natural enemies (enemy-release hypothesis). Thus, surveys for and subsequent screening of these natural enemies from the centre of origin or diversity of the target plant species underpin this approach. The over-riding principle is that any candidate agent must show a high or rigid specificity to the weed target, in addition to having a significant impact on its growth and fecundity. After these pest risk assessments agents are released into the target region or country. The successes have been spectacular and, when available, economic data on cost/benefit demonstrates that this is a viable, highly cost-effective and environmentally benign strategy for the long-term management of intractable alien weed problems. Conversely, bioherbicides were developed by plant pathologists and lead to the development of herbicide-like products based on propagules of pathogens (mostly fungal spores) used as benign substitutes for chemicals as active ingredients. Their target is usually agricultural weeds and not environmental weeds. Here examples of classical biocontrol at work, mostly based on our experience with fungi, and opportunities for dealing with weed invasions in Brazil and abroad through this strategy will be discussed.

PL4

INVASIBILITY OF AQUATIC ECOSYSTEMS BY NON-NATIVE MACROPHYTES AND THEIR IMPACT ON NATIVE COMMUNITIES: A TROPICAL PERSPECTIVE

Thomaz SM[1] - [1]Universidade Estadual de Maringá - Departamento de Biologia, Nupélia

Freshwater ecosystems have the greatest biodiversity per surface area compared to the terrestrial and marine ones. However, they also suffer the greatest extinction rates, what stimulated limnologists to assess the effects of biological invasions on communities and ecosystems structure and functioning. Several species of aquatic macrophytes are easily dispersed and have fast growth rates, asexual reproduction and high ability to recover from disturbances, what make them successful invaders. Examples using tropical aquatic ecosystems show that nutrients, turbidity and organic matter in sediment are important abiotic filters decreasing invasibility by macrophytes. Similarly to terrestrial plants, invasion success of macrophytes decreases with biotic resistance (offered by both native richness and density) and increases with enemy release. However, the relationship between invasion success and native diversity of macrophytes depends on spatial scale in tropical aquatic ecosystems (the "invasion paradox"). Despite biotic and abiotic resistance, some species of macrophytes cause serious impacts in tropical freshwater ecosystems. There are species that may function as an ecological engineering, reducing aquatic biodiversity and changing ecosystem structure and functioning. Although data are scarce, there is indication that tropical ecosystems are more resistant to invasions than temperate ones. Maybe the peculiarity of these ecosystems, which favor specialist, competitively superior species (Dobshanski hypothesis), make them more resistant to invasions than the temperate ones. In conclusion, it seems that freshwater tropical ecosystems parallel the terrestrial ones in terms of hypothesis used to explain invasibility by macrophytes and their impacts on native diversity and ecosystem structure and functioning. Tropical ecosystems may be also more resistant than temperate ones; however, this hypothesis has still to be tested.

PL5
KEY COMPONENTS OF A SUCCESSFUL MANAGEMENT PROGRAM FOR AQUATIC INVASIVE MACROPHYTES

Anderson L[1] - [1]USDA-ARS, USA

Over the past 50 years, Invasive aquatic macrophytes have increasingly impaired ecosystem services and affected species diversity due to their spread through numerous uncontrolled pathways and associated vectors. The three commonly recognized stages of infestation: transport to introduction, establishment and "naturalization" (continued successful sustainable spread in the newly infested area) require different but integrated management approaches. On a global scale, effective trade prohibitions, inspections and related "incentives" (e.g. fines) have been developed at some level by the most impacted countries. The recent EU plans for responding to "alien species" as well as the effective approaches in New Zealand and Australia illustrate the importance of such "security" plans, particularly "transport prevention". However difficulties arise when competing trade motives (i.e. "commercial retail sales") are not addressed carefully. Once infestations are detected, only a complete and well-designed eradication program can prevent eventual the "naturalization" phase. This requires a rapid (few weeks to a month) consensus on the most efficacious methods coupled with public (stakeholder) meetings, clear goals and an agreement by the scientific community on metrics so that results can be evaluated objectively. The most critical issue is to understand that short-term "perturbations" and "risks" associated with eradication actions have to be weighed against the long-term consequences of "doing nothing" or acting too slowly. For naturalized populations, containment and reduced impacts are the major goals. In these cases, methods and metrics must be tailored to account for some more subtle impacts (e.g. diversity of native fish, invertebrate, water fowl and native plants and ecosystem system services). Depending upon propagule banks, longevity of propagules and phenology of the target plants and pathway containment, some naturalized populations can eventually be reduced to areal scales that may be amenable to complete eradication. For actions in all targeted "stages", monitoring and adaptive management must be included in the project. Regardless of the targeted "stage" of infestation, management actions must comply with local, regional and national environmental protection statues. However, this also requires that laws and regulations designed to protect the environment must acknowledge and accommodate the fact that aquatic invasive species, if un-managed, impair the environment.

PL6

FAIL: WHY DO MOST INTRODUCED PLANTS SEEM TO BE NON-INVASIVE?

Daehler CC[1] - [1]University of Hawaii at Manoa - Department of Botany

Plants have been deliberately introduced around the world for horticulture, food and forestry, but most of them have failed to become invasive in spite of their frequent planting. Successful invasion after deliberate planting can be conceptualized as process that requires overcoming a series of barriers to propagule production, propagule dispersal, or plant successful establishment/ growth. Abiotic stressors and/or biotic factors in a new geographic range can effect these barriers, thereby preventing invasion. Although many studies have examined the biology of invasive plants, studies on the biology of introduced non-invasive plants are few. Considering common non-invasive ornamental plants in the tropics, barriers to propagule production appear to be common, although cases of dispersal barriers were found and slow intrinsic growth rate may also prevent invasion by some popular ornamental plants. Specific barriers may be more likely in certain plant families. Studies of barriers to invasion can improve our conceptual and empirical understanding of distribution limits of plants, while an understanding of the most common limiting factors can be used to improve risk assessments for new plant introductions.

PL7

FROM MOLECULES TO LANDSCAPES: WHAT CAN GENES TELL US ABOUT BIOLOGICAL INVASIONS? AUSTRALIAN ACACIAS AS AN EXAMPLE.

Le Roux JJ[1] - [1]Stellenbosch University, South Africa - Center for Invasion Biology, Botany and Zoology

Ever-increasing numbers of invasive alien species provide biogeographers and ecologists with opportunities to study processes that mediate range limits of organisms, the composition of communities, and how they interact. Australian *Acacia* species have been extensively moved around the globe by humans over the past 250 years. Currently, nearly 40% of the species pool (ca. 1012 species) is known to have been moved outside Australia, 71 species have been described as naturalized or weedy, and 23 are invasive. About a third of the world's land-surface is climatically suitable for Australian acacias, and where they have established they have greatly altered interactions with and between resident biota in many ways. Some have even argued that current distributions of extra-Australian species, e.g. endemics to Hawaii and La Reunion, reflect past historic anthropogenic dispersal (< 7000 years ago), implicating acacias as some of the world's oldest non-native species.

Here, I review research carried out at the Centre for Invasion Biology on historical biogeography, population genetic structure and introduction histories of the sometimes impressive and large scale propagule movements of acacias, both contemporarily (within the past 250 years) and presumed historically (>7000 years ago). While genetic structure provides valuable clues on the histories of natural and human-aided species movements it also sheds light on the adaptive potential of species in novel ranges. I will demonstrate that the relationship between propagule pressure associated with contemporary movements and genetic diversity is not always clear, as is commonly assumed, and that acacia introductions are often characterised by genetic bottlenecks. For some acacias these genetic bottlenecks seem to have little impact on fitness related traits in their invaded ranges. I will also show that population genetic structure can be highly informative in an ecological sense, e.g. climatic ranges. Interestingly, anthropogenic processes such as restoration and cultivation in the native ranges of acacias often changed the genetic makeup of introduced populations prior to their introduction elsewhere. I will also shed light on extremely peculiar biogeographic patterns of some extra-Australian acacias, and show that these are not due to historical anthropogenic movements as was previously thought and therefore truly reflect astounding examples of natural long-distance dispersal.

I will furthermore discuss the role of below-ground interactions between acacias and their mutualistic nitrogen-fixing bacteria during invasion by drawing insights from comparative studies between native and introduced ranges. I will demonstrate how, in some instances, human-mediated movements also affected these interactions and what their consequences are for native legume species diversity in the recipient environment.

In conclusion, the impressive movement of Australian acacias globally represents a fascinating experiment in biogeography and a promising system for studying the ecology and evolutionary biology of plant invasions.

KEYWORDS: acacia, genetic, introduction history, phylogeographic, phylogeny, South Africa

PL8

FRAMEWORKS FOR ASSESSING THE LONG-TERM PERSISTENCE OF PLANT INVADERS

D'Antonio CM[1] - [1]University of California Santa Barbara, CA, USA 93106

Many plant invaders appear to create dense monotypic or low diversity stands in sites that previously supported more diverse native plant assemblages. This common observation has supported the recent application of alternative stable state models to invaded ecosystems. Such models suggest that the self-reinforcing effects of invaders, or altered ecosystem parameters must be changed in order to return the system to its prior condition. Yet in many cases we do not know the long-term outcome of invasion or the time frame over which invaders will be persistent. Dominant invaders may be simply part of a successional sequence, may be transitional to other dominants, or may decline in abundance with climate change. In this talk I will evaluate the application of alternative state models to invader dominance using a long-term study I have been conducting in Hawaii where I found that invader dominance and impacts can change dramatically and unpredictably with climate change. I conclude that invader persistence should be evaluated based on the strength of changes associated with invasion and that alternative state models may be over-applied to invaded ecosystems particularly given the on-going nature of climate change.

OC1.01

EXPLORING ABIOTIC AND ANTHROPOGENIC DRIVERS OF ALIEN PLANT SPECIES DISTRIBUTION IN THE ALPS: BIOCLIMATIC ORIGIN MATTERS!

Dainese M[1], Kühn I[2], Bragazza L[3] - [1]University of Padova - Department of Land, Environment, Agriculture and Forestry, [2]Helmholtz Centre for Environmental Research ? UFZ - Community Ecology, [3]WSL ? Swiss Federal Institute for Forest, Snow and Landscape Research - Site Lausanne

Plant invasions into mountain ecosystems are influenced by interacting abiotic and biotic processes. In order to establish and spread in a new area, alien plants must be able to tolerate the prevailing climatic conditions, i.e., the greater the degree of climate matching between the invaded region and the species' native region, the higher is the likelihood of establishment. In this study, we assess the role of abiotic and anthropogenic variables driving both alien plant species richness and composition in mountain regions. In addition, we assess whether the climatic pre-adaptation of alien plant species determine different responses to environmental processes. The two questions are examined using the alien flora of the European Alps. Area was the most important predictor of alien plants distribution, followed by anthropogenic disturbance. Climatic conditions had a smaller direct effect on species richness, while temperature appeared as a key driver in determining community differentiation. Considering the bioclimatic origin, both temperature and urban elements showed a significant interaction with bioclimatic origin. Only Holarctic species show a significant negative relationship with temperature, while the effect of human pressure was strongest for tropical species. Our results show that abiotic and anthropogenic processes affect the distribution of alien plants in mountain ecosystems, but differently for species of different bioclimatic origin. In particular, we showed that the climatic pre-adaptation of Holarctic species in association with anthropogenic disturbance can increase the level of invasion of alien plants in mountain areas. Our results also reveal a strong influence of human pressure on tropical species, despite their low adaptability to urban conditions.

KEYWORDS: Climate matching, community differentiation, disturbance, mountain ecosystems, urbanization, temperature.

OC1.02

AFRICAN INVASIVE GRASSES EXPANSION IN BRASILIA NATIONAL PARK – A 10 YEARS INTERVAL

Sampaio AB[1,2], Horowitz C[3], Fraga LP[4], Maximiano MR[4], Vieira DLM[4], Silva IS[5] - [1]ICMBio - CECAT, [2]PEQUI - Pesquisa e Conservação do Cerrado, [3]ICMBio - Parque Nacional de Brasília, [4]Católica University of Brasília, [5]University of Brasília

INTRODUCTION. African grasses are among the main invaders of open vegetation around the tropics. These grasses grow much faster and reproduce more efficiently than native species. They are able to replace the native vegetation and disrupt the disturbance regime, for example by intensifying disturbance regimes such as grass-fire cycle. **OBJECTIVES.** This study aimed to map the distribution of invasive grasses along all the roads in Brasília National Park (Brazil), in 2012, and compare this mapping with a similar mapping done 10 years before (Costa 2002, PhD. Thesis, University of Brasília, Ecology Department). In both studies, only the Park original area (established in 1961 with 30,000 ha – Site 1) was considered (a new area incorporated in 2006 increased the Park to 42,389 ha). **METHODS.** We surveyed all roads in the Site 1 (276 km) by car or walking (for the abandoned roads) and checked for the presence of the three most common invasive African grass species in the area: *Andropogon gayanus* (AG), *Urochloa decumbens* (UD) and *Melinis minutiflora* (MM). We measured the lenght of all areas surrounding the roads infested by invasive grasses and classified the areas into six classes to describe the abundance, continuity and shape, ranging from isolated individuals to mono-dominant sections. **RESULTS.** We found 30.3 km of roads with AG, mostly forming a line along the roads, but in some stretches (5.4 km) this species is forming mono-dominant stands spreading beyond the roads (> 50 m). UD occupied 9.3 km, mostly in mono-dominant stands (5.4 km). MM occupied 79.9 km along the roads, forming mono-dominant stands along 23.7 km. In 2002 the invasive grasses were sampled along the most accessible roads, totalizing 146 km. At that time it was not found AG or it was mistaken for *Pennisetum setaceum* (PS), species that is nowadays rare in the Park, only found in four isolated points far from the roads previously indicated for its presence. In 2002, the grass identified as PS was mapped as rare along 9.7 km of roads on the Park edge. UD was mapped as rare along 16 km and as abundant along 9.8 km of roads. MM was found on 15.7 km as rare and 109.8 km as abundant. Considering the same 146 km of roads studied in 2012 we found 23.3 km with AG, 5.8 km with UD and 35.3 km with MM. **CONCLUSIONS.** In 2002 the extent of the infestation was not measured, the whole road section was classified based on sample points, therefore the only strong conclusion we can take from this comparison is that AG was not found, or maybe it was rare if mistaken for PS, in 2002. In contrast, in 2012 AG was abundant in a considerable extent of the Park's roads and it is invading native vegetation beyond the road edges. Roads are the main dispersal route for these invasive grasses and urgently need to be managed in order to prevent major impacts on biodiversity conservation. **ACKNOWLEDGMENTS.** Thanks to all the park personnel that contributed with the data collection.

KEYWORDS: African Grasses, Biological Invasion, Protected Areas, Road Ecology

OC1.03

WILL NON-NATIVE PLANTS BECOME A RESTORATION CHALLENGE IN SOUTHERN BRAZILIAN GRASSLANDS?

Koch C[1], Hermann J-M[1], Overbeck GE[2], Jeschke JM[1], Kollmann J[1] - [1]Restoration Ecology, Technische Universität München, Freising-Weihenstephan, Germany, [2]Department of Botany, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil

INTRODUCTION: Non-native species are one of the main threats to global biodiversity and ecosystem functions. For the restoration of ecosystems, it is not only important to assess how many and which non-native species are present but also what impacts these species have. For nature conservationists, it is furthermore important to know whether management of non-native species is a realistic option. These issues have been addressed by a number of studies in Australia, Europe and North America, but little is known about non-native species and their impacts in South America. This is particularly true for the South Brazilian grasslands.

OBJECTIVES: The aim of the project is to assess the magnitude of species invasions and their effects in different degradation stages of grasslands in the highlands of southern Brazil ("Campos de Cima da Serra" in Rio Grande do Sul). Abandoned plantations of exotic *Pinus* species, areas that have undergone a period of agricultural use, and non-managed grasslands were chosen to represent different degradation stages, and traditionally managed grasslands as reference systems.
METHODS: Vegetation relevees in the four different grassland types provide information on the number and abundance of non-native species. Together with information on plant traits, this information will allow an assessment which of the non-native species might become invasive. At the same time it can be evaluated which of the grassland types will be more restorable in terms of species composition. In a further step, potential positive (higher forage value) and negative (reduced native species richness) impacts of these species will also be assessed.

RESULTS: The first results from vegetation sampling show that grasslands of the Campos de Cima da Serra that are traditionally managed with cattle and burning rarely contain non-native plant species. Non-native herbaceous plants are mostly associated with areas under some form of agricultural use. Besides non-natives that are intentionally added as commercial seed mixtures, like *Holcus lanatus* or *Trifolium repens*, other non-natives probably arrived as seed contaminants. In the case of former plantations, an emergence of the non-native woody species *Ulex europaeus* and *Pinus* spp. can be observed in some areas. Both areas under agricultural and silvicultural use may thus act as a propagule source for non-native plant species.

CONCLUSIONS: In the grasslands of southern Brazil, some non-native plants occur in areas that have been under a different form of land use. Whether these species may prevent or rather delay the re-establishment of native plants if the agricultural or silvicultural use is given up is not yet known. It has to be considered that these areas might also act as the starting point of a species invasion into the surrounding native grasslands. The findings of our project will thus contribute to an improved protection and sustainable management of the grasslands of southern Brazil.

ACKNOWLEDGEMENTS: C. Koch is funded by the Evangelisches Studienwerk Villigst e.V.

KEYWORDS: Non-native plants, Brazilian grasslands, degradation, restoration

OC2.01

THE BOTTOM LINE: IMPACTS OF ALIEN PLANT INVASIONS IN PROTECTED AREAS

Foxcroft LC[1,2], Pyšek P[3,4], Richardson DM[1], Pergl J[3], Hulme PE[5] - [1]Centre for Invasion Biology, Stellenbosch University, South Africa, [2]South African National Parks, South Africa, [3]Academy of Sciences of the Czech Republic - Institute of Botany, Department of Invasion Ecology, [4]Charles University, Czech Republic - Department of Ecology, [5]Lincoln University, New Zealand - The Bio-Protection Research Centre

INTRODUCTION

Phrases like "invasive species pose significant threats to biodiversity…" are often used to justify studying and managing biological invasions. Most biologists agree that this is true and quantitative studies support this assertion. Protected areas (PA) are the foundation of conservation initiatives in many parts of the world, and are an essential component of an integrated approach to conserving biodiversity and the associated ecosystem services. The invasion of alien plants constitutes a substantial and growing threat to the ability of PAs to provide this service. The last international research programme to focus specifically on invasive species in PAs was a working group on invasions in nature reserves, initiated under the SCOPE programme on biological invasions in the 1980s. Since then a large body of literature has accumulated, describing a range of impacts, but this has not been assessed within the context of PAs.

OBJECTIVES

We conducted a review of work that has been carried out in PAs to identify important patterns, trends and generalities (Foxcroft et al. 2013). We discuss the range of impacts under five broad headings: (i) species and communities; (ii) ecosystem properties; (iii) biogeochemistry and ecosystem dynamics; (iv) ecosystem services; and (v) economic impacts.

CONCLUSIONS

The range and severity of impacts of invasive plants in PAs is, in many areas, only starting to be realised. Examples of well documented impacts come from a few PAs. The extent of impacts are well documented for some of the best-studied PAs (e.g. Everglades NP and Hawai'i Volcanoes NP, USA; Kakadu NP, Australia; Table Mountain NP, South Africa) offer dire warnings that many types of invasive plants can cause many types of dramatic impacts. There is growing evidence that many other types of impacts are increasing in severity and extent in many other PAs; these include impacts that are driving the displacement of wildlife and changes to fire regimes which undermine the justification for the existence of the PAs. More subtle effects of altered nutrient cycles and pollination and seed-dispersal networks are emerging more slowly, but will most likely result in significant and irreversible impacts.

Foxcroft LC, Pyšek P, Richardson et al. (2013) Impacts of alien plant invasions in protected areas. In: Foxcroft LC, Pyšek P, Richardson DM, Genovesi P (eds) Plant invasions in protected areas: patterns, problems and challenges. Springer, Dortrecht

KEYWORDS: Biodiversity, biogeochemistry, biological invasions, conservation, economic impact, economic, impact, management, nature reserve

OC2.02
IMPACT OF INVASIVE ALIEN PLANTS ON SOIL SEED BANKS

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Introduction
Much of our current understanding of the effects of invasive species on plant communities is based on patterns occurring in the above-ground vegetation, while comparatively few studies have examined the changes in the soil seed bank associated with plant invasions, despite this being a major component of plant community dynamics and diversity.

Objectives
We used a meta-analysis approach to provide a quantitative synthesis of the literature on the impact of plant invasions on the seed bank. Specifically, (1) we quantified the impact of invasive alien plants on (a) species richness and (b) density (per square metre) of the seed bank of invaded plant communities; (2) we identified the taxa that are responsible for the largest changes in the seed bank; and we (3) identified the habitats whose seed banks are most affected by plant invasions. Meta-analyses were conducted separately for the seed banks of all species, regardless of their alien/native status (total seed bank), and for native species only (native seed bank).

Methods
A systematic search of the literature allowed us identifying 18 studies (57 case studies) comparing directly seed banks in invaded and uninvaded vegetation. We used mixed effect meta-analytical models and 95% bias-corrected bootstrap confidence intervals.

Results
In relation to the total seed bank, 31 out of 53 case studies showed significant decreases in species richness in invaded plots, while the remaining studies showed no significant effects, and only one study showed an increase in species richness. As for total seed bank density, 25 out of 57 studies reported significant lower density associated with invasions, and one study only showed increases in density. Similar results were reported for native seed banks, with 32 out of 47 case studies showing a significant lower species richness, while the rest reported non-significant results; results for native seed bank density were comparable to those for total seed banks. *Heracleum mantegazzianum*, *Fallopia japonica*, and *Gunnera tinctoria* reduced species richness and density of all species in the seed bank, while *Acacia saligna* significantly reduced species richness and density of native species, while increasing seed bank density for alien species.

Conclusions
We show for the first time that invasions by alien plant species tend to reduce the richness and density of native species' seed banks in invaded plant communities, with the strength of this reduction differing among invaded habitats and invading taxa. Our study reveals that plots designated as uninvaded by original authors already contain alien seed banks of varying richness and density that is further modified by plant invasions. The knowledge yielded by this study is central to the development of sound restoration strategies and to the control of the seed bank of alien species, which could potentially become invasive after the accumulation of large seed banks and the depletion of native species' seed banks.

KEYWORDS: density, invasibility, invasiveness, plant community, resilience, restoration, species richness

OC2.03

DOES AN INVASIVE PLANT ACT AS AN ENVIRONMENTAL FILTER IN NATIVE GRASSLANDS?

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Introduction

Mechanistic explanations of community assembly state that community membership is constrained to those species that possess the appropriate functional traits to reach a site and establish under the circumstances set by the environment and other organisms (Lebrija-Trejos et al. 2010). Species as invasive *Eragrostis plana* Nees, a C4 African tussock grass avoided by cattle, can exert strong influence on the vegetation community by causing overgrazing of native plant community (Medeiros et al. 2007), thus indirectly acting as a filter and selecting specific traits and species of the native species pool.

Objectives

Identify if *E. plana* is acting as biotic filter to the establishment of other plants in grasslands communities under grazing.

Methods

Location: Our data collection was conducted in three sites in Rio Grande do Sul state, Brazil, all of them composed by native pastures under cattle grazing, with no recent history of burning, fertilization or mowing.

Data sampling: We conducted a stratified sampling to encompass a gradient of cover of *E. plana.* We identified and estimated cover of all vascular plants in 1 X 1m plots (n=40) at each site. The trait data set comes from a database compiled by our lab team. All traits used (Leaf Form, LF, Leaf Tension, LT, Specific Leaf Area, SLA, and Leaf Dry Matter Content, LDMC) are quantitative continuous variables and we included most important species regarding cover values (31 species of 148 species found and fully identified, 93% of all cover) in the analysis.

Analysis: We used the method developed by Pillar et al. 2009 (see also Pillar et al. 2013) that consists of scaling up the data on species functional traits to the community level. We used average functional trait values for each species, rather than individual-based traits. We interpreted the correlation between *E. plana* cover and the community weighted means for the traits in each plot as a measure of trait-convergence pattern related to the gradient of occupied by *E. plana*.

Results

We found no clear pattern between any combination of the traits, weighted by the community composition, and *E. plana*.

Conclusions

The result shows that *Eragostis plana* is not acting as a filter in the studied areas, even though increasing cover by *E. plana* does indeed reduce plant species richness on the plot scale. However, this result may also due to the fact that up to now only a small part of all the plants present in the studied areas has measured traits.

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Acknowledgments
We would like to thank all coworkers at Laboratório de Ecologia Quantitativa (ECOQUA) and the Laboratório de Estudos em Vegetação Campestre (LEVCAMP) for the assistance in all stages of this work, and to CNPq/CAPES for the financial support.
KEYWORDS: Eragrostis plana, trait-convergence, plant cover gradient

OC2.04

SUBSIDIES TO MANAGE AN INVASIVE PALM TREE IN THE ATLANTIC FOREST (SÃO PAULO, BRAZIL)

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INTRODUCTION

Despite being a threat to global biodiversity biological invasions are still poorly studied in the megadiverse tropical environments. The Australian palm tree *Archontophoenix cunninghamiana,* initially introduced for ornamental purposes, became an invader of urban and suburban Atlantic forest patches in São Paulo state, as it does in other parts of Brazil and also in other countries (Global Invasive Species Database 2005, Zenni & Ziller 2011). In Brazil, the substitution of *A. cunninghamiana* by the native palm *Euterpe edulis* has been proposed as a management action (Mengardo & Pivello 2012).

OBJECTIVE

The main objective of this study was to compare the first demographic stages of *A. cunninghamiana* and *E. edulis* by evaluating the regeneration potential of *E. edulis*. The aim was to subsidize *A. cunninghamiana* replacement by *E. edulis* in the invaded Atlantic forest remnants where both species occur.

MATERIALS AND METHODS

We performed experiments inside an Atlantic forest patch (Reserva Florestal do Instituto de Biociências, São Paulo/SP) heavily impacted by *A. cunninghamiana* invasion. We compared seedling establishment and seed longevity of both species through seed sowing, and also measured the contribution of *A. cunninghamiana* to the local seed rain and to seed bank.
At laboratory we tested both direct and indirect effects of *A. cunninghamiana* over *E. edulis* germination through reciprocal experiments, and by testing for the release of allelopathic substances from leachate solutions of *A. cunninghamiana* leaves and fruits.

RESULTS

Nearly half of the non-anemochoric diaspores collected in the forest seed rain belonged to *A. cunninghamiana*, a high propagule pressure. Seed abundance in the seed rain correlated with the distribution of nearby young and adult palm individuals in the forest. None of the palm species showed persistent seed banks what is advantageous for controlling the invader but not for re-introducing the native palm through seed sowing. Seedling survival experiments suggested much better performance of *A. cunninghamiana* compared to *E. edulis*, whose survival rates were respectively about 30% and 3.5%. Still, under controlled laboratory conditions the native palm showed lower performance at first stages evidencing a demographic bottleneck, whereas the invasive palm did not show any effect on *E. edulis* germination and seedling formation.

CONCLUSION

The invasive palm shows advantages in the initial demographic stages suggesting higher regeneration capacity over the native species when co-occurring in the forest. Management actions should focus on enhancing *E. edulis* performance and restricting *A. cunninghamiana* spread, however do not need to consider allelopathic effects over the native species. First actions should focus primarily on *A. cunninghamiana* reproductive individuals as they provide high amounts of seeds that quickly establish.

Financial support by FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo, 2008/56015-8).

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KEYWORDS: allelopathy, Archontophoenix cunninghamiana, Atlantic forest, Euterpe edulis, germination, seed rain, seedling establishment

OC2.05

BIODIVERSITY LOSSES DUE TO SLASH PINE INVASION IN THE BRAZILIAN SAVANNA

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Damages caused by invasive species in natural or semi-natural environments have been noticed for at least six decades in different parts of the world. In Brazil, the studies about invasive species started recently. This study aimed at the diagnose of biodiversity losses in the Cerrado vegetation (Brazilian savanna) when invaded by *Pinus elliottii* – the slash pine. The study took place at Santa Bárbara Ecological Station, state of São Paulo, Brazil. We sampled native plants from 50 cm height in five blocks of 10 plots (plot area = 10 x 10 m), and smaller plants in five 1 x 1 m subplots placed inside each plot. Plots in each block were placed in order to represent the whole range of the invasion gradient (0% to 100% of area covered by slash pine). Native species were grouped according to their life form, and their density and richness were considered as response variables to the invasion process. Basal area and canopy openness of the invasive species and pine needles depth were considered as explanatory variables for biodiversity losses. Generalized Additive Mixed Models (GAMMs) were performed to model biodiversity losses due to the invasion process. The increase of the pine needle layer thickness has arisen as the main driver of the disappearance of grasses, sedges and forbs. The canopy closure by the invasive trees over the open savanna environment was responsible for the decrease of shrubs. None of the explanatory variables influenced the tree species regeneration. This study described in details the invasion by slash pine over the Cerrado vegetation, identifying the factors and describing the quick processes that cause biodiversity losses in this ecosystem.

Acknowledgements
We would like to thank the staff of SBES for logistical facilities. RCRA thanks CNPq (Brazilian Council for Scientific Research) and CAPES-FULBRIGHT 2011 for Ph.D. scholarships. GD thanks CNPq for a productivity grant. Research permit # 260108 – 013.650/2009 (SMA-SP/IF).

KEYWORDS: Cerrado, Pinus elliottii, GAMM, pine needles, canopy openness

OC2.06

IS IMPACT OF ALIEN SPECIES RELATED TO PATHWAY OF INTRODUCTION?

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Introduction

The understanding of general causes and consequences of biological invasions has significantly improved in the last years. The development of national lists of alien species with information on their origins and pathways of introduction allowed for performing first large-scale robust analyses on the role of these factors. Unfortunately, the link between the pathways of introduction and the impact of alien species remains understudied.

Objectives

The aims of the study are to (i) explore whether different pathways of alien species introductions to Europe differ in terms of the risk they impose, (ii) whether the patterns differ for ecological and economic impacts, and (ii) identify which pathways impose greatest threat from biological invasions in Europe.

Methods

We used updated DAISIE data and GISD database to extract information on the pathways and impact of naturalized/established alien species in Europe. The analysed groups of taxa covered (i) plants (gymnosperms, pteridophytes and angiosperms), (ii) terrestrial invertebrates (insects, arthropods), (iii) fish (freshwater and saline), (iv) birds and (v) mammals. Pathways were classified according to the standardized scheme of Hulme et al. (2008) to allow for comparison across taxonomic groups. Species from the above taxonomic groups in DAISIE database with at least one identified pathway of introduction to Europe were considered, and information on their documented ecological and/or economic impact in any of the regions covered by DAISIE was recorded. To test whether there are differences between impact for different pathways and taxa, species counts were analysed by generalized linear models. To ascertain for which pathways are counts lower or higher than expected by chance, adjusted standardized residuals of G-tests were compared with critical values of normal distribution.

Results

Overall, the ecological and economic impacts highly significantly differed among pathways and taxa, and within the individual taxa. There were significant differences among pathways of intentional and unintentional introductions. Some groups of taxa appeared to have impact more often than expected by chance, while other groups were underrepresented. Preliminary analysis suggests that accidental pathways cause impact more often, while intentional less often than expected by chance. For the majority of taxonomic groups multiple pathways result in greater ecological impact than introductions by a single pathway.

Conclusions

Pathways of introduction of alien species to Europe deliver species that differ in their impacts. The patterns also differ with respect to taxonomic groups and the type of impact (ecological or economic). Our data based on updated DAISIE database provide a robust overview of the link between pathways and impact at the continental scale of Europe, with results applicable to pathway management and regulation.

KEYWORDS: DAISIE, exotic plants, impacts, introduction, pathways

OC2.07

LEARNING FROM THE PINUS CONTORTA INVASION IN THE CHILEAN PATAGONIA: WHAT PINES CAN TELL US ABOUT INVASION MECHANISMS AND IMPACTS?

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Tree invasions can completely modify naturally treeless landscapes, causing impacts in biodiversity and ecosystem services. *Pinus contorta*, with a native range in North America, has been registered as invasive in many parts of the world. Its invasiveness, as in other pine species, is given by a short juvenile period, short time period between large sees crops and the small size of the seeds. Because of the wide range of ecosystems where it has been introduced, *P. contorta* is a good model to study tree invasions.

Here I review the work we have conducted over more than 10 years in two sties in Chile, where *P. contorta* has been recorded as invasive: in Araucanía Region (38°S) and in the Aysén Region (45°S). Invasions are relatively new (ca. 10-20 years for oldest individuals) and occur in anthropogenic grasslands, the Patagonian steppe and alpine environments. This pine invasion provides a unique opportunity to test several basic assumptions about tree invasions such as their dispersal spatial array and the existence of positive or negative spatial interactions with native plant species.
We have measured the extent of the invasion, the spatial arrangement of the invading pines at multiple scales and the association between pines and native plants. We have also started to record the impacts of this pine on resident vegetation and fire regimes (i.e. fuel and biomass).
We have found that dispersal and seed rain is the most important determinant of pine establishment. Positive associations to native cushion plants can be observed at very small scales (grain of 25 cm), but tend to disappear at higher scales (5 m). Experiments also show some positive effects of native vegetation compared to bare ground, but that effect is reduced as seedling develop. Pines reduce species richness diversity underneath their canopies and in dense stands in both the Araucanía and Aysén. Fuel accumulation is relatively low in young invasions but fuel continuity increases with invasion. Further research is needed to understand impact temporal dynamics associated to pine invasions, especially in South America where pines have only recently become invasive.

Acknowledgements: To the LIB group, Adrián Escudero and Marcelino de la Cruz for their collaboration. This work was funded by Fondecyt 1100792 and the Institute of Ecology and Biodiversity (IEB), Grants ICM P05-002 and PFB-23.

KEYWORDS: tree invasions, spatial patterns, biotic interactions

OC2.08

THE SPATIAL INFLUENCE OF THE INVASIVE LEGUME *A. LONGIFOLIA* ON THE NUTRITION STATUS AND DYNAMICS OF THE SURROUNDING VEGETATION: THE ROLE OF RHIZOSPHERE

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Some of the most aggressive invading plant species in Portugal belong to the genus *Acacia*. As leguminous species they are able to fix large amounts of nitrogen and therefore have a major impact on the nutrient cycle in Mediterranean soils, especially in the extremely poor primary dune system. As shown by Hellmann et al. (2011), these changes are elevating both foliar nitrogen and ^{15}N content of the native endemic shrub *Corema album* close to the invasive species *Acacia longifolia,* an effect that can also be traced in a spatial manner (Rascher et al., 2012). This effect was not observed in the native leguminous *Stauracanthus spectabilis*, which could be explained by a higher litter production and superior litter quality of *A. longifolia* (Hellmann et al., 2011; Rascher et al., 2012). However, there is no direct comparison between both species available and it is unclear which soil processes drive the flux of nitrogen between the invasive and the native species.

The objective of this work was to compare, at soil level, the different contribution of the invasive A. *longifolia* and the native *S. spectabilis* on the foliar of N and P content of the surrounding vegetation.

Basic soil properties (soil respiration and humidity as well as root, rhizosphere and litter mass, soil pH and concentration of nitrate, nitrite, ammonium and phosphorous) were measured on 3 spots within the canopy of 5 species each. Extracellular enzyme activity (EEA) for enzymes related to the major nutrient fluxes (C,N,P) were measured in the rhizosphere and litter. C,N and P content was measured in leaves of the surrounding *C. album* vegetation along 3 transects starting at each leguminous. All C and N measurements also included isotopic analysis.

In contrast to *S. spectabilis* that showed no effects on the surrounding vegetation, *A. longifolia* showed a slowly decreasing effect on the ^{15}N values of surrounding *C. album* leaves and an exponentially decreasing effect on their nitrogen content. There were no differences in litter quantity or quality detectable, but *A. longifolia* soil showed higher root and rhizosphere mass per area. The EEA pattern did not differ between both species, but the mass related potential nutrient turnover was significantly higher underneath *A. longifolia*.

The invasive *A. longifolia* has a different effect on the leaf nitrogen status of the surrounding *C. album* vegetation than the native *S. spectabilis*. The litter mass per area does not differ significantly between both species. The microbial community associated to either species show similar degradation mechanisms, however, due to an increased rhizosphere layer present underneath the invasive species, the potential nutrient turnover is increased. This layer could be a putative source for the nitrogen flux to the surrounding vegetation, and thus may contribute to the spatial patterns observed and the changes in N within the native community.

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KEYWORDS: Acacia longifolia, Corema album, N-cycle, EEA, 15N isotopes

OC2.09

INVASIVE PLANTS: DIFFERENT BUT THE SAME

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INTRODUCTION: All invasive plants, belonging to different taxonomic groups, have in common that they threat native ecosystems in new ranges. *Carpobrotus edulis* (L.) N.E.Br. (chamaephyte) and *Acacia dealbata* Link (woody leguminous tree) are invasive plants in the Iberian Peninsula coming from South Africa and Australia. They have different ecophysiological traits that improve their invasive characteristics but they affect the same ecosystem compartments on invaded areas.
OBJECTIVES: To determine the impact of those species on soil characteristics, soil microorganisms communities and flora of the Iberian Peninsula.
METHODS: Physicochemical properties of soil, soil enzymatic activities (biochemical analysis), community structure of soil microorganisms (PCR-DGGE), functional diversity of soil bacteria (Biolog®) and plant community structure (richness, cover and diversity) were evaluated in invaded and non-invaded areas.
RESULTS: *C. edulis* reduces soil pH, Ca and Na content and increases organic content, salinity and nitrogen and phosphorus concentration. *A. dealbata* consistently increases soil N, C, organic matter and exchangeable P content. The invaders effect on physicochemical properties of native soils is consistent along different ecosystems and dunes for *A. dealbata* and *C. edulis* respectively. These species also affect the activity and composition of soil microorganisms. However, this effect depends on the ecosystem or dune type invaded.
The negative effect of *C. edulis* on the early stages of native plants development is very strong decreasing total germination and plant survival. In addition, A*. dealbata* reduces native species richness, plant density and total plant cover. Invasion by *C. edulis* and *A. dealbata* is also associated with changes in species composition.
Allelopathic effect of natural leachates is found for both alien species. The intensity of allelopathic impacts on native flora largely depends on the species affected. Interestingly, stimulatory effects of natural leachates on the radical growth of *A. dealbata* are detected, suggesting a positive autoallelopathic effect. Accumulated leaf litter of *C. edulis* benefits this invasive plant against native species by a slow release of allelochemicals.
Our results reveal that when *C. edulis* and *A. dealbata* invade a different dune type or ecosystem, they significantly modify soil characteristics but also soil microbes and soil enzymatic activities, depending on the initial characteristics of the invaded ecosystem. These changes alter the establishment process of native plants and contribute to the invasion of these alien species.
CONCLUSIONS: Although *C. edulis* and *A. dealbata* represented a serious threat to all the study communities, the severity of the impact depended on the community type. Changes on soil structure and biochemical properties alter the germination process and early growth of native and invasive plants in different ways. These changes illustrate a mechanism that explain how *C. edulis* and *A. dealbata* compete at an early stage and break the initial biotic and abiotic resistance of newly invaded landscapes.

KEYWORDS: Plant invasion, Carpobrotus edulis, Acacia dealbata, allelopathy, soil characteristics, soil microorganisms

OC2.10

ORIGIN MATTERS - IMPACT OF THE INVASIVE SOLIDAGO GIGANTEA ON CO-OCCURRING PLANT SPECIES AT HOME AND AWAY

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Much attention has been paid to the ecological impacts of invasive plants in their non-native ranges, but few studies have compared these impacts to those in the native ranges of invaders. This is important because such biogeographical differences in species interactions would suggest that evolutionary history affects community assembly.
The aim of our research was to find out whether increasing stem density of *Solidago gigantea,* native to North America but highly invasive in Europe, corresponds with larger decreases in the abundance of other species in its non-native range than in its native range, and whether leachates produced from *S. gigantea* shoots and roots have stronger negative effects on European natives than North American natives.
We correlated stem densities of *S. gigantea*, with associated plant species richness in plots measured over large areas of the north western USA and Hungary. We also compared the effects of *S. gigantea* shoot and root leachates on the germination and growth of plant species native to Europe and North America and that were common in our field sampling in each region.
Increasing stem density of *S. gigantea* correlated with significant decreases in total species diversity and native species diversity in Europe. In contrast, increasing stem density of *S. gigantea* did not correlate with changes in either total species diversity or native species diversity in North America. Leachates made from *S. gigantea* roots suppressed the germination and aspects of growth of suite of European species, as a group, that co-occurred in Europe with *S. gigantea*, but did not have a significant effect on co-occurring North American species. Leachates made from *S. gigantea* shoots had substantially weaker effects.
Our results are consistent with the novel weapons hypothesis and a growing body of quantitative results demonstrating a strong biogeographic context to exotic plant invasions. This body of work indicates that the biogeographic origin of species can matter and that communities with a common evolutionary history can function differently.

Acknowledgements
The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement number 300639 (R.W.P.). This research was also supported by the Fulbright Commission (R.W.P.), the Provost's Office of The University of Montana (R.M.C.; R.W.P.), the U.S. National Science Foundation DEB 0614406 (R.M.C.), the National Natural Science Foundation of China, Grant Numbers 31000178, 31000203, 31230014 (S.C.).

KEYWORDS: allelopathy, biogeography, impact, invasion, plant community, species diversity, stem density, transcontinental study

OC2.11

CHANGES IN MUTUALISTIC NETWORKS – THE INFLUENCE OF INVASIVE ACACIAS ON NITROGEN-FIXING SYMBIONT DIVERSITY AND ITS IMPACT ON NATIVE ECOSYSTEMS.

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INTRODUCTION South Africa's Cape Floristic Region (CFR) is recognised as one of the most botanically diverse areas on the planet. *Fabaceae* is the second largest family in the CFR. Coincidently, legumes are also over-represented among invasive plants in the region. The ability of legumes to fix atmospheric nitrogen through rhizobial mutualisms contributes to their success as invasive species and can lead to rapid modification of soil microbial communities.. Like many other interactions, rhizobial-legume mutualisms can be general or highly specific. Community dominance by invasive legumes may therefore lead to a decline in the relative abundance and even absence of native rhizobia essential for the nodulation of native legumes. Several studies have evaluated the impact of plant invasions on above ground interactions such as pollination networks, however, to date, the consequences of the integration of alien plants into plant-rhizobial networks remains poorly understood. This study aims to understand the effect invasive legumes have on the mutualistic networks between native legumes and their symbiotic rhizobia.
OBJECTIVES (i) To investigate the changes in soil microbial communities as a result of *Acacia* invasions. (ii) To investigate the effects of *Acacia* invasions on the native legume biodiversity and legume rhizobial networks.
METHODS Root nodules from both invasive and native legume species were sampled across an invasion gradient representing un-invaded, moderately invaded and heavily invaded sites, and kept on silica gel until bacterial isolations. To isolate rhizobia, root nodules were rehydrated, surface sterilised and bacteria were cultured following standard procedures until pure isolates were obtained. Genomic DNA was extracted from rhizobial isolates and subsequently identified using the bacterial 16SrRNA DNA barcoding gene. Changes in network structures cross the invasion gradient were analysed in R. To investigate the changes in rhizospheric bacterial community, a metagenomic approach using PCR DGGE was employed.
RESULTS Native legumes investigated in this study were preferentially nodulated by *Burkholderia* and/or *Mesorhizobium* rhizobial species, while the invasive acacias were primarily nodulated by *Bradyrhizobium* species. Network analysis results showed that only generalist native legumes persisted in invaded sites whilst those showing less symbiotic promiscuity were absent from invaded sites. Preliminary DGGE results suggest a change in the rhizospheric bacterial community composition across the invasion gradient. Results also indicate the dominance of *Bradyrhizobium* species in invaded soil, which were absent in uninvaded soils.
CONCLUSIONS Although lower native legume species diversity in Acacia-invaded sites could not be conclusively attributed to the loss of symbiotic bacteria, the results from this study show changes in legume bacterial networks and soil microbial communities consistent with this hypothesis. These changes could impact negatively on the ability of native legumes to nodulate, most adversely affecting native legumes with narrow rhizobial associations.

KEYWORDS: Acacia, legumes, rhizobia, symbiosis, nitrogen fixation, networks

OC3.01
ALIEN MACROPHYTES IN THE GREAT LAKES: SURVIVAL OF *EICHHORNIA CRASSIPES* AND *PISTIA STRATIOTES*

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Introduction
There are over 180 nonindigenous species (NIS) currently reported in the Great Lakes alone. Today, ballast water and hull fouling are still viewed as the leading cause of NIS introductions, though the poorly regulated pond and aquarium trade should also be noted as a contributor for fresh water and marine plants and animals in Canada. Some of the most recent introductions to the Great Lakes region of Ontario can be attributed to this latter vector, namely water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*), both of which are known to be invasive in many countries around the world. These tropical natives were not previously viewed as a threat to Canadian waters due to their lack of resilience in cold temperatures, yet they have been reported in the Great Lakes and their tributaries in consecutive years.

Objectives: We observed both species in consecutive years at numerous locations in the southern Great Lakes. As a result we investigated three hypotheses that may account for the macrophytes' continued presence in any given area: 1) adult plants survive winter exposure; 2) adult plants perish during winter, but produce viable seeds that germinate the following spring; and 3) adult plants die each year and do not reproduce, but are reintroduced annually.

Methods: A series of cages were deployed in Lake St. Clair and the Detroit River to assess survival of adult plants throughout the winters of 2011-2012 and 2012-2013. Plants were visited weekly and assessed for health and survival. We also collected seeds directly from a local population and extracted others from local sediment. Germination experiments were carried out in growth chambers with collected seeds to determine viability at optimal and locally appropriate temperatures. Seeds extracted from sediment were Sanger sequenced using the rbcL gene to for identification.

Results: During the winters of 2011-2012 and 2012-2013 all plants involved in the survival experiment perished and did not regenerate. Water hyacinth's average health and percent survival both declined at a lower rate than water lettuce for both years.
Germination was found to occur at 35°C and 28°C for 2 of 4 treatment groups, while another group was found to germinate only at 35°C. The seeds that were sequenced from this experiment along with seeds extracted from two other locations were found to be *Eichhornia crassipes*.

Conclusions: Current results suggest that neither water hyacinth nor water lettuce is capable of surviving winter conditions in Southern Ontario. However, the results from the germination experiment indicate that sexual reproduction and the creation of seed banks is a plausible mode of survival for water hyacinth, if not water lettuce. As for reintroduction, locals have admitted to releasing both species into area waterways, lending some validity to this hypothesis as well.

Acknowledgments: Canadian Aquatic Invasive Species Network, NSERC, Ontario Ministry of Natural resources, Alice Grgicak-Mannion, Leadley Environmental Corp., Colin van Overdijk, Mr. and Mrs. Tracey, Mr. and Mrs. Hornick, Mr. Barrett, Islandview Marina.

KEYWORDS: alien, nonindigenous, invasive, macrophyte, Great Lakes, Eichhornia crassipes, Pistia stratiotes

OC3.02
SEEDLING PERFORMANCE OF LEUCAENA LEUCOCEPHALA (LAM.) DE WIT IN MIXED CULTURES WITH TWO OTHER LEGUMES, UNDER DIFFERENT DENSITY AND WATER REGIME CONDITIONS

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INTRODUCTION
The legume *Leucaena leucocephala* is native to Mexico and Central America, and is ranked among the most invasive plants worldwide. This success might be boosted by its constant introduction in the environment, through a variety of uses such as livestock fodder and urban ornamental, as is the case in Brazil. Thus, susceptible phases in its lifecycle and prone to specific management actions might be masked. Seedlings, for example, represent a particularly sensitive phase. Phenotypic plasticity, represented by traits that increase both survival and competitive ability of plants, has been interpreted as a predictive factor of species invasiveness (Dahler 2003). Therefore, seedling plasticity would denote a species with good invasive capability. We compared the competitive performance of leucaena seedlings to two other legumes, the native *Caesalpinia ferrea* and the exotic *C. pulcherrima*, which are also used as ornamental urban species.

OBJECTIVES
To assess seedling performance of *L. leucocephala* growing in monoculture and in the presence of *Caesalpinia ferrea* and *C. pulcherrima*, under different densities and water regimes.

METHODS
Seedlings of the three species were combined in a factorial experiment of control (1 individual) and three densities (6, 30, 80) and two water regimes (100 and 25% field capacity), planted in 2L pots (17 X 13 X 10 cm^3). Seedling development was monitored in a greenhouse during 180 days, and performance was evaluated as a function of several variables: survival, shoot length, leaf number and length, biomass (aerial and root), and Relative Competitive Performance index (CPI, the percent change in plant performance when grown with neighbors, Weigelt & Jolliffe2003) based on total biomass.

RESULTS
Except for survival, all other parameters were significantly affected by density and water availability, with very poor shoot and leaf growth compared to the controls. Seedling performance of *L. leucocephala* was highly reduced at 25% field capacity, when there was an increase in relative root biomass, and was negatively affected by density. The best performance (stem, leaf length, CPI, and biomass) was observed in seedlings that grew together with *C. pulcherrima*. Competition intensity was greatest among seedlings that grew either in monoculture or together with *C. ferrea*, a species native to the Brazilian semi-arid and probably adapted to water shortage.

CONCLUSIONS

Although leucaena seedlings show plasticity, its invasive power is context-dependent, as suggested by its performance under water shortage conditions, compared to the more adapted *C. ferrea*. The poor seedling performance of the exotic *C. pulcherrima* might account for it low invasive ability.

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ACKNOWLEDGEMENTS

We thank the Graduate Program in Ecology, Conservation and Management of Wildlife, UFMG, for logistic support. CMJ thanks CNPq for a Research Productivity fellowship.

KEYWORDS: competitive performance, Fabaceae, phenotipic plasticity , propagule pressure

OC3.03

COEXISTENCE OR COMPETITION AMONG NATIVE AND INVASIVE SPECIES? A CASE STUDY OF CENTRAL-EUROPEAN *IMPATIENS* CONGENERS

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INTRODUCTION

Many studies show that some invasive species are competitively superior to native species (Vilà 2011) and particularly strong competition is expected if there is a native congener present in the new range (Dayan 2005).

OBJECTIVES

To obtain an insight into these processes we investigated performance of three annual species of *Impatiens* (Balsaminaceae) with different origin and invasion status (*I. noli-tangere*, native to central Europe, highly invasive alien *I. glandulifera*, and less invasive alien *I. parviflora*), often occurring in the same habitat. We explored the relative role of competition and coexistence in two field and one garden experiments.

METHODS

The first experiment was aimed at identifying the microsite requirements (moisture, light, nutrients, pH) and population dynamics in the field over four years. The second one addressed response in fitness of the native species to the removal of the congeners over two years in the field. The third one explored response to different levels of competition among the three species under controlled conditions (two levels of water availability and shading derived from situation in the field) in an experimental garden.

RESULTS

Our results suggest that there is a microsite differentiation among the *Impatiens* species that makes them possible, up to some extent, coexist in the field. *Impatiens noli-tangere* prefers wet shaded sites, *I. parviflora* dry shaded sites and *I. glandulifera* open places irrespective of soil moisture. Field preferences of *I. noli-tangere* and *I. parviflora* contradict their positive response to high light and water availability in the garden experiment, indicating possible competitive exclusion from more favourable sites in the field. The rather week relationship of *I. glandulifera* to the soil moisture, which is contrary to the literature, indicates its capacity for future spread from riparian to adjacent habitats. In the field *I. glandulifera* strongly suppresses both congeners while the native *I. noli-tangere* benefits from the congener removal. On the other hand, in the garden experiment seedlings of native species emerged earlier and profited from faster start, compensating thus for the competitive advantage of the invasive species.

CONCLUSIONS

The coexistence of the native and invasive *Impatiens* congeners in the field is possible despite of the latter being competitively superior, because the native species overcomes its competitive inferiority by a strong seed dormancy leading to precise timing in the germination, and by tolerating deep shade.

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KEYWORDS: coexistence, competition, congeners, microsite requirements, Impatiens

OC3.04

APPETITE OF ALIEN IMPATIENS SPP. GROWING IN THE BALTIC REGION

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INTRODUCTION. Due to climate shifts and intensification of internal and external transport since 1990's the spread of invasive alien species became a great concern in Baltic region. The elemental concentrations reflect many different aspects of the plants and their environment. Existing data on elemental concentrations of alien species is very limited in terms of elements analyzed and number of populations examined.
Two *Impatiens* species, Small Balsam (*Impatiens parviflora*) and Himalayan Balsam (*Impatiens glandulifera*) are outspread invaders in many parts of Baltic region. In order to assess nutritional preferences of these species, estimation of their elemental composition has been done.
OBJECTIVES. To evaluate nutritional state and accumulation of non-essential elements in the leaves of Small Balsam (*I. parviflora*) and Himalayan Balsam (*I. glandulifera*) from the Baltic region; inside each species to compare variability between populations.

METHODS. Each plant species was collected from 20 locations, also soil samples were taken. Dried and milled (Retsch MM 400, Germany), plant leaves were digested in the closed vessel microwave system (Ethos One, Milestone, Italy). The determinations of metals (Ca, Mg, K, Na, Al, Fe, Zn, Cu, Mn, Pb, Cd, Cr, Ni) were performed by flame or graphite furnace AAS (Shimadzu AA-6800). Nitrogen was analyzed by Kjeldahl method (Velp Scientifica, Italy). In total, over 1500 element analyses were done.

RESULTS AND DISCUSSIONS. The highest soil acidity was defined for *I. parviflora* growing in the vicinity of the nitrogen fertilizer factory. Significant differences were observed according to all element concentrations in the leaves of Lithuania populations of *I. glandulifera*. The same trend was observed for *I. parviflora* populations. According to leaf nitrogen concentrations alien for Lithuania Impatiens species belong to the part of plants very well supplied with this element. Two species significantly differed by concentrations of the other main nutritional elements of the leaves: Ca concentration was higher and K, Mg, P lower for *I. glandulifera* when compared to *I. parviflora*. Leaf Na concentrations were significantly higher for *I. parviflora* than for *I. glandulifera*. This observation could be explained by the proximity of *I. parviflora* to the roads. For *Impatiens*, growing in soils with $pH < 7$, higher concentrations of Fe, Al, Zn, Mn and Cu were observed. Uptake of heavy metals was different comparing two *Impatiens* species. For both *Impatiens* species nutritional and non-essential element concentrations did not reach limit values neither for deficiency nor for excess.

CONCLUSIONS. Our element data show that euthrophication of environment is favorable factor for spread of alien *Impatiens*. Very good supply of essential elements may explain high growth rates of invaders. It shows that habitat and anthropogenic factors greatly affect nutrition and accumulation of some trace metals in alien for Baltic region *Impatiens* species.
ACKNOWLEDGEMENT. The study was funded by the Science Council of Lithuania, Project № LEK-07/2012.

KEYWORDS: Impatiens parviflora, Impatiens glandulifera, populations, element, nutrition, heavy metals

OC3.05
THE REPRODUCTIVE INVESTMENT OF AN INVASIVE SPECIES (ACACIA LONGIFOLIA) IS DEPENDENT ON CLIMATE AND PLANT COMMUNITY STRUCTURE?

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Reproductive traits are an important component of establishment and spread of non-native plant species and then in their invasiveness character. In Portuguese dune ecosystems, *Acacia longifolia* is one of the most aggressive invasive plant species and can be present in habitats ranging from mesic to xeric conditions.
In this study we considered two sites with climatic (mesic and xeric conditions) and plant community structure differences in order to evaluate the impact of environmental conditions on the phenology and reproductive output of *A. longifolia*.
The study was conducted at two different sites on the Atlantic coast of Portugal, Osso da Baleia (OB) and Pinheiro da Cruz (PC), 180 Km north and 70 Km south of Lisbon, respectively. In the OB (Meso-mediterranean climate) annual precipitation is higher with lower air temperature and a shorter drought period than in the PC (Typical Mediterranean climate). In each site we have studied *A. longifolia* trees under pine forest canopy and in an open sand dune area. Additionally to climatic variation, forest characteristics such as density and canopy cover are higher in the OB than in the PC sites. Along a time period of 2-years (2010-2011), a monitoring study was undertaken to compare the timing of phenological phases, the branch RGR, the nº of inflorescences and fruits, the inflorescences/fruits ratio and the % of fruits aborted.
In the PC plants, all measured phenological phases were displayed earlier than in the North plants and this was particularly evident when comparing reproductive phenophases. We found an association of early peak flowering dates with an increase of air temperature, while later peak of flowering is in association with an increase of air relative humidity and cumulative rainfall. Moreover, the results also indicate that rate of flowering development was accelerated in *A. longifolia* under more xeric climate (PC) by warmer temperatures, contrasting with the longer flowering period under Meso-mediterranean climate (OB sites).The proportion of fruits per inflorescences was significantly higher in the OB areas and the number of fruits aborted was notoriously lower than in the PC areas. Moreover, the presence of a higher dense pine forest in the OB forested area resulted in highest proportion of fruits by inflorescences and highest number of fruits production. On the other hand, the plants under forested OB area presented lowest RGR.
In conclusion, *A. longifolia* can't maximize growth and reproduction across all environments and this study provides further evidence of the trade-offs between reproductive and vegetative investment in *A. longifolia* under habitats with limited resources. The combination between climate and forest structure can cause pronounced differences in reproductive output of *A. longifolia.* These data can help to understand the different invasive rates through out of the *A. longifolia* geographical distribution in Portugal and could justify the larger and more aggressive invasiveness behaviour in the north of Portugal, with more mesic conditions and denser forests.

KEYWORDS: Acacia longifolia, pine forest, flowering period, phenology, reproductive success

OC3.06

NEW EVIDENCES FOR ALLELOPATHY IN BRACKEN FERN

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INTRODUCTION

Understanding the mechanisms that govern the success of invasive plants has been one of the greatest scientific challenges of recent decades (Catford et al., 2009). Allelopathy is any process involving secondary metabolites that influence the growth and development of natural and cultivated systems, including positive or negative effects (IAS, 2011). Recent studies have proposed that some exotic species develop competitive advantage from the production and release into the environment invaded of new secondary metabolic compounds for which native plants have no defenses (CALLAWAY et al., 2008). *Pteridium aquilinum* (Kaulf.) Maxon., known as bracken fern, is a worldwide spread species, invading recently burned areas or abandoned fields. It is an important problem species expanding in the Atlantic Forest and Cerrado in Brazil (MIATTO et al. 2011; SILVA & MATOS, 2006; ARONSON et al., 2011), which can be considered as a potentially invasive species, since its proliferation in the studied communities occurs following exogenous environmental disturbances, affecting the stablishment of other plant species (VALÉRY et al., 2008). Given the lack of knowledge about the role of secondary compounds of bracken in the ecology of this plant, the present work aimed at the phytochemical study of the phytotoxic compounds in its green fronds and litter.

MATERIAL AND METHODS

Green fronds and litter were collected in the area of Cerrado reserve of UFSCar (CITES/FLORA IBAMA export license nº 12BR009485/DF). The material was dried, crushed and used to the phytochemical study by the bioguided isolation methodology (Dayan and Duke, 2006). After the initial extraction, a series of chromatographic procedures were adopted, using different solvent systems and stationary phases. The fractions obtained from each chromatography were subjected to activity bioassay using wheat coleoptile (Macías et al., 2006). The data obtained in these assays were subjected to the Welch test ($\alpha = 0.05$) for means comparison.

RESULTs

According to its composition, yield and activity, the fractions were then chromatographed, until the obtention of a isolated compound, purified by HPLC-IR and subjected to spectroscopic analysis. The bioguided isolation process led to the isolation of a major compound of bracken secondary metabolism, present in active extracts of the material analyzed. NMR analysis indicates that it is a new compound from this plant, a catechin trimer.

CONCLUSION

The results point to a new evidence of allelopathy in bracken, the presence of a major compound not yet described from bracken fern, present in the active fractions obtained from its litter and green fronds.

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FUNDING

CAPES Scholarship - Process No. BEX 13753/12-6.

KEYWORDS: Allelopathy, Phytochemical Study, Pteridium aquilinum

OC3.07
THE IMPACT OF FOREST MANAGEMENT AND CLIMATE CHANGE ON THE PHYSIOLOGICAL PERFORMANCE OF THE INVASIVE ACACIA LONGIFOLIA

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In Portugal, *Acacia longifolia* is one of the most aggressive invasive plant species and causing major ecological problems. In contrast to native species, *A. longifolia* reveals lower investment in adaptive traits; it exhibits a high resource allocation and a constant allocation pattern under different conditions

The objective of this study is to understand the physiological response, vegetative growth and reproductive output of *A.longifolia* under different climatic conditions and forest structure.

The study was conducted at two different sites, Osso da Baleia (northern of Portugal) and Pinheiro da Cruz (southern of Portugal), where we have different climate conditions, being Meso-mediterranean in the northern site and typical Mediterranean climate in the southern site. Both sites are occupied by *Pinus pinaster* plantation. The pine forest is approximately 2 times denser and has higher canopy cover in the Osso da Baleia than in Pinheiro da Cruz. We compared the physiological performance and vegetative growth of *A. longifolia* between both sites in plots with a *P. pinaster* forest canopy and open areas. In each plot were performed leaf water potential (Ψw) and gas exchange measurements in three occasions: March, June and July (2010). Vegetative growth of selected *A. longifolia* trees was monitored by measuring shoot elongation and by counting leaves and reproductive investment by counting flowers and fruits.

The results showed that, although the higher precipitation registered in the Meso-mediterranean site, the Ψw values of understory *A. longifolia* were as negative as in the Mediterranean site. But, the Ψw values of *A. longifolia* under *P. pinaster* overstory were significantly lower compared with *A. longifolia* in the open plot. Carbon assimilation (A) and stomatal conductance (gs) decreased with increasing drought in *A. longifolia* in all study plots but the understory *A. longifolia* in the north site were the most affected by drought showing the strongest decrease in *A* and *gs* values. In the northern forest understory *A.longifolia* showed highest reproductive investment and lowest growth rate comparatively with open areas and southern forest.

In this work we can conclude that forest systems in the north of Portugal, with Meso-mediterranean conditions but relative higher biomass and higher resources competition (such as water and sunlight) might be more stressful for understory *A. longifolia*, displaying a lower physiological performance and higher reproductive costs than in the south forests systems. These results are especially important for the understanding of the factors that can determine the reproductive costs in *A.longifolia*, emphasizing a potential differences in the invasive pattern according to forest management and climate change. Moreover, this study may contribute for a future model that will account for climate change scenarios and invasiveness patterns in the Mediterranean region.

KEYWORDS: Acacia longifolia, Climatic conditions, Forest structure, Physiology, Vegetative growth, Reproductive output

OC3.08

26 YEARS OF INVASION DEMOGRAPHY FOR THE ALIEN SHRUB SCOTCH BROOM (CYTISUS SCOPARIUS) – ECOLOGICAL INSIGHTS FOR MANAGEMENT

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INTRODUCTION: Long-term studies (i.e. >10 years) are rare in ecology, and even more so in the study of alien plant invasions. Information on the long-term demographics of alien plant invasions is crucial if we are to manage invasive species effectively. *Cytisus scoparius* (L.) Link (Fabaceae) is an invasive alien shrub, native to Europe. It is a transformer species that has invaded large areas in Australia, New Zealand, North America (Canada and USA), and Japan. Whilst there have been many ecological studies on *C. scoparius* very few have been long-term in nature.

OBJECTIVES: Here we report on a 26-year study established in the summer of 1985 to examine the long-term invasion demography of the invasive alien shrub *C. scoparius*, at Barrington Tops, New South Wales, Australia, by comparing different invasion starting points.

METHODS: Within a series of 25m^2 plots all individual *C. scoparius* plants were tagged and monitored over a 26 year timeframe. Measurements for each plant included age, height/length and basal circumference. The plots were established within a series of different invasion stages, representing three different stages or starting points in the invasion cycle – an invading front, an invaded area, and old dense stands (i.e. that had been invaded for at least 1 generation). A series of treatment plots were established within close proximity to the invasion front plots after 20 years (or 1 generation) to determine how management might change the invasion succession trajectory.

RESULTS AND CONCLUSIONS: Results from the first 14 years have been published (Downey and Smith 2000), which combined with the next 12 years of data is presented here. Whilst the initial invasion resulted in high densities of *C. scoparius*, the population declined over time through high levels of mortality, mostly in younger plants (i.e. <4 years old). The probability of surviving to >4 years of age is very low, around 0.02%, but plants that do survive past this age are likely to live much longer (i.e. to 15+ years). The second generation of plants that have established in the invading front plots have a lower density. The treatment plots established after 20 years, showed that disturbance and management (herbicide treatment) changed the succession trajectory of the *C. scoparius* stand. Our understanding after 26 years differs from that presented after 14 years, highlighting the value of long term ecological studies on plant invasions, both for the ecology and management of alien plants.

CITATIONS: Downey P.O. and Smith J.M.B. (2000) Demography of the invasive shrub Scotch broom (*Cytisus scoparius*) at Barrington Tops, NSW: insights for management. *Aust. Ecol.* 25, 477–485.

ACKNOWLEDGMENTS: The authors thank the large number of people who helped with data collection over the 26 years of the study. The NSW National Parks and Wildlife Service provided support for the project

KEYWORDS: Invasion patterns, long-term study, Cytisus scoparius, management, survival rates

OC3.09

THE ELEPHANT IN THE ROOM: THE ROLE OF FAILED INVASIONS IN UNDERSTANDING INVASION BIOLOGY

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INTRODUCTION

Most species introductions are not expected to result in invasion, and species that are invasive in one area are frequently not invasive in others. However, cases of introduced organisms that failed to invade are rarely studied in as much detail as successful invasions and are reported in many instances as anecdotes or are simply ignored.

OBJECTIVES

In this analysis, we aimed to find common characteristics between non-invasive populations of known invasive species and evaluated how the study of failed invasions can contribute to research on biological invasions.

METHODS

We conducted extensive searches by querying academic search engines (ISI Web of Science and Google Scholar) using combinations of the key words introduction, naturalization, invasion, invasive, fail, and failure. We also searched the reference lists and citations received by the papers identified in the search. Complementary, we searched mentions for failures in global catalogues of naturalized species. Experts in the field also helped identify cases of failed invasions.

RESULTS AND CONCLUSIONS

We found intraspecific variation in invasion success and several recurring explanations for why non-native species fail to invade; these included low propagule pressure, abiotic resistance, biotic resistance, genetic constraints, and mutualist release. Furthermore, we identified key research topics where ignoring failed invasions could produce misleading results; these include studies on historical factors associated with invasions, distribution models of invasive species, the effect of species traits on invasiveness, genetic effects, biotic resistance, and habitat invasibility. In conclusion, we found failed invasions can provide fundamental information on the relative importance of factors determining invasions and might be a key component of several research topics. Therefore, our analysis suggests that more specific and detailed studies on invasion failures are necessary.

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KEYWORDS: invasive alien species, invasion ecology

OC3.10

HOME SWEET HOME: RESOLVING NATIVE PROVENANCES WITHIN THE GENUS *CARDIOSPERMUM* USING PHYLOGENY

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Introduction: A key aspect of effective invasive alien plant management is knowing the natal provenances of invasive populations. In the balloon vine genus, *Cardiospermum*, uncertain native range biogeographies are hampering on-going biological control efforts against invasive taxa in southern Africa. In order to minimize potential non-target impacts it is therefore prudent that the native ranges of all balloon vine taxa in the region be resolved prior to the release of biological control agents.

Objectives: The key objective of this study was to elucidate the likely native provenances for selected *Cardiospermum* species (*C. corindum, C. halicacabum* and *C. pechuelii*) found in southern Africa with direct implications for management efforts against invasive *C. grandiflorum*.

Methods: Balloon vine populations were collected from numerous native and supposedly non-native regions around the world, including Australia, Fiji, South Africa, Ghana, Hawaii, Brazil, Argentine, Namibia, Mayotte and Tahiti. Phylogenetic relationships and dispersal histories were estimated using a dated multi-gene phylogeny, constructed from the nuclear internal transcribe spacer region (*ITS*) and the non-coding chloroplast *trnL* intron. A third chloroplast gene, Rpl32, was used to reconstruct a haplotype network in order to more closely investigate the relationship within and among balloon vine species.

Results: Our phylogeny indicated that *Cardiospermum halicacabum* from southern Africa shared a close relationship with *C. halicacabum* from South America with very recent diversification between taxa. The haplotype network supported this close relationship and indicated reciprocal paraphyly between the two continents, indicating that *C. halicacabum* cannot be considered native to southern Africa. On the other hand, *C. corindum* formed two distinct monophyletic clades, with a relatively old phylogenetic split between southern African and South American taxa. The haplotype network also illustrated high genetic similarity between *C. pechuelii* (a true African taxon) and *C. corindum*, and along with the distinct South American and southern African clades, supports a native southern African range for *C. corindum*.

Conclusions: Our results indicate that some balloon vine species of questionable biogeography are indeed native to southern Africa. The old divergence date between *C. corindum* samples from South America and Africa predates potential anthropogenic dispersal, rendering a native status to the region. Moreover, the true African species, *C. pechuelii*, probably arose from African *C. corindum*. On the other hand, our phylogeny suggests that *C. halicacabum* was likely introduced several times into southern Africa and should not be considered native. We advise that already-identified biological control agents not be released against invasive *Cardiospermum* taxa in South Africa due to potential non-target impacts against native *C. corindum and C. pechuelii*. Future studies should focus on identifying host specific agents against *C. grandiflorum* with limited non-target effects on African *C. corindum* and *C. pechuelii*.

KEYWORDS: Phylogeography, native range, Cardiospermum, biological control, invasive plants

OC3.11

WILDFIRES AND PRESCRIBED FIRES DIFFER IN THEIR EFFECTS ON NATIVE AND INTRODUCED VEGETATION: A GLOBAL META-ANALYSIS

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Introduction: Fire shapes plant community dynamics in many ecosystems of the world. While fire is a natural disturbance, climate- and human-caused shifts in fire regimes can compromise plant community structure and function. Further, the introduction of exotic species to novel habitats may interact with altered fire regimes to synergistically degrade ecosystem functioning. However, whether fire generally promotes invasion has not been rigorously tested.

Objectives: We used meta-analysis to determine whether native and exotic species composition (richness, diversity) and performance (cover, density, biomass) differentially respond to both wildfires and prescribed fires in several fire-prone regions of the world.

Methods: We searched the available literature for studies that compared the effects of fire on native and introduced plant composition and performance. Using a set of predetermined inclusion criteria, we compiled 50 studies containing > 200 comparisons of native and exotic species responses to fire from an initial pool of nearly 3700 studies.

Results: Wildfires markedly favored exotic composition and performance, with the effects lasting over extended timescales of up to 10 or more years post-fire. Wildfires did not affect native composition but strongly reduced native performance. Prescribed fires generally had no effect on exotic composition or performance, except in heathland ecosystems such as California chaparral, where they unexpectedly favored exotics. For natives, prescribed fire favored composition, albeit over brief timescales, and without attendant effects on performance. Vegetation response to fire was also ecosystem-specific, with exotics responding positively in desert scrub, heathlands, and temperate forests, yet showing no strong response in tropical forests or temperate grasslands. In contrast, native species showed a positive response only in heathlands, and a strong negative response in desert scrub, which was in large part represented by sites in the highly invaded (by *Bromus tectorum*, or cheatgrass) Great Basin region of the western U.S.

Conclusions: Our results provide striking evidence that wildfire on average promotes exotic invasion in several ecosystems and that this effect may be sustained over long timescales. These findings quantitatively confirm the growing concern that wildfire negatively interacts with exotic invasions to synergistically degrade ecosystem health. They further suggest that management with prescribed fire has on average achieved only moderate success in promoting native species. However, site-specific variation in the direction and magnitude of community responses to fire underscores the importance of a regional focus in determining fire management policy.

KEYWORDS: disturbance, fire regime, species richness, performance

OC4.01

LATITUDINAL CLINES IN DAMAGE TO INVASIVE PLANTS BY THEIR NATURAL ENEMIES

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INTRODUCTION: Plants often lose enemies invading new regions, as predicted by the Enemy Release Hypothesis. However, a similar reduction in attack may occur locally within an invader's new range: isolated plants may escape enemies that cannot find them or maintain local populations (MacKay 2008). Previously, we have found damage by insects to the invader common burdock (*Arctium minus*) declines approaching its northern limits (Kambo *in press*). Here, we show this is a common phenomenon for exotics, and likely is explained by latitudinal changes in insect communities.

OBJECTIVES: We investigated whether invasive Asteraceae near their northern limits escape enemies present in southern areas, and compared these results with those for native species. For *Arctium* we further investigated whether latitudinal trends in damage reflect plant defences.

METHODS: We surveyed populations of native and exotic Asteraceae over an 800 km transect from temperate southern to boreal northern Ontario and assessed insect damage. We also used a common garden to assess damage to *Arctium* genotypes sampled over a large latitudinal range.

RESULTS: Results indicate insect damage generally declined with latitude. Native and exotic plants showed similar patterns. The common garden experiment did not find evidence *Arctium* from northern sites experienced less damage, indicating they were not better defended.

CONCLUSIONS: Results suggest invaders near their range limits benefit by escaping their usual enemies. This pattern resembles latitudinal clines reported for native plants. If the common garden results are typical, the likely explanation is a reduction in herbivorous insects in isolated areas. Escape from enemies near invaders' range margins may accelerate spread, including migration in response to climate change (Walther 2009).

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ACKNOWLEDGMENTS: This work was supported by NSERC, the OMNR, and the Koffler Reserve. Dasvinder Kambo, Yoonsoo Lee, Krystal Nunes, and Colin Cassin contributed data.

KEYWORDS: Arctium minus, Asteraceae, biotic resistance, burdock, Enemy Release Hypothesis, latitudinal gradients, Metzneria lapella

OC4.02

THE CONTROL OF THE INVASIVE JACKFRUIT TREE (MORACEAE) AT ILHA GRANDE AND ITS EFFECTS ON SMALL MAMMAL COMMUNITY, SEED RAIN AND SEED DISPERSAL.

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INTRODUCTION

Jackfruit, *Artocarpus heterophyllus* is an invasive species originated from Southeast Asia and introduced in Brazil during the 18th century. Its presence is outstanding in northeastern and southeastern Brazil. Since 2006, we have studied the effect of jackfruits in the small mammal community, in the seed dispersal and in the seed rain at Ilha Grande, RJ, Brazil. Our data showed that the presence and density of *A. heterophyllus* affect small mammal community structure.

OBJECTIVES

i) Evaluate how the small mammal community responds to the control of *A. heterophyllus*; ii) assess how the seed dispersal network was affected by the control of jackfruit trees, and iii) evaluate how the seed rain is affected by *A. heterophyllus*.

METHODS

Mammals were caught in live traps in 18 grids (10 with jackfruit trees and eight without). Feces of captured animals were collected and the seed frequency calculated. We used 32 seed collectors with 1m of diameter in 16 grids (8 with and 8 without jackfruit trees). Since 2009, we began to control jackfruit trees in the study area, using mechanical and chemical methods.

RESULTS

The small mammal community differed among grids with different jackfruit densities (F=7.018; P=0,017), before the jackfruit control. After 60 and 150 days of initial treatment, the number of dead trees was greater in those treated chemically. After two years, the production of jackfruits chemically treated was not different from that before the treatment (t=0.024; p=0.981). However, after the jackfruit control, the small mammal community did not differ among the grids (F=2.491; p=0.134). The dispersion seed network before the treatment was composed by seven species of mammals and 28 seed species, with 46 interactions and a connectance of 0.235. After the jackfruit control, the composition of dispersion seed network decreased to three species of mammals and 12 species of seeds, with 20 interactions and a connectance of 0.308. We observed 166,376 seeds in seed collectors. Areas without jackfruits showed a higher richness of seeds (F=12.56, p=0.003), but there were no differences in abundance of seeds in areas with or without jackfruits. The abundance of jackfruit trees affected negatively the richness (F=8.36; p=0.012) and the abundance (F=7.02; p=0.038) of seed rain. The composition and abundance of seeds in an ordination analysis (NMDS) related significantly with the abundance of jackfruit (F=10,178; p=0,007).

CONCLUSIONS

Presence of jackfruit trees have consistently changed the small mammal community and negatively affected their role in the dispersal of native plant species. Chemical method seems to be more advantageous in terms of costs, but the mechanical method seems to have greater effect in the long run. The most important seed disperser in our networks was the marsupial *Didelphis aurita*, while the most important dispersed species before the control of *A. heterophyllus* was *Piper rivinoides* and after the control, *Cecropia pachystachya*. Both are considered pioneer species in neotropical region. A lower diversity of native seeds reaches the ground in areas with jackfruit affecting the succession and dynamics of the forest. The management of jackfruit trees at Ilha Grande should be largely increased to reduce the impact of this invasive species on mammal and plant communities.

FUNDERS: Capes, CNPq, FAPERJ, Prociência/UERJ

KEYWORDS: Control methods, Trinomys dimidiatus, community structure, seed dispersal network, seed rain

OC5.01

ASSESSING FUTURE INVASIVE ALIEN PLANT THREATS UNDER CLIMATE CHANGE

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INTRODUCTION

Over 3000 alien plant species have naturalised in Australia since Europeans arrived 225 years ago. About 350 of which have subsequently become highly invasive, posing significant impacts to the environment, primary production and human health. The remaining alien plants are at various stages of the invasion spectrum. Currently Australia has strategies to manage the worst species (i.e. Weeds of National Significance initiative), to prevent the introduction of potential new alien species (i.e. pre-border, through the Weed Risk Assessment system), and to target species which are likely to become problematic (i.e. an alert list). However these systems do not incorporate climate change and how it may affect the invasive potential of alien plant species that are already naturalized.

OBJECTIVES

The objectives of the project were to develop a: (1) prioritisation scheme for risk assessment of naturalized alien plants within Australia under current and future climatic conditions; and (2) web-based tool to provide information on the invasion risk of naturalized alien plants at a variety of spatial scales (national, state, local government, and conservation areas).

METHODS

We used species distribution modelling as the basis for assessing the threat posed by 292 naturalised alien plants under current and future climates within Australia. A combination of 5 bioclimatic variables and 1 soil variable was used to build models of suitable habitat. We used 7 global climate models (GCM) and 2 greenhouse gas emission scenarios (RCPs 4.5 and 8.5) to assess future climate in the years 2035 and 2065 and WorldClim baseline climate conditions (1950-2000) to find areas of current suitable habitat. Gridded maps of the 7 GCM projections were averaged to determine the suitability of each area for each scenario, and to identify areas of highly suitable habitat. We developed a point-based prioritisation system to allocate species into low, medium and high risk categories with regard to their potential invasion capacity under current and future climate conditions, based on occurrence records and habitat suitability. The system is designed to assist managers to prioritise species for which more comprehensive risk assessments are needed.

RESULTS AND CONCLUSIONS

The integration of modelling, spatial analysis and species trait information provided a comprehensive assessment and information source for naturalised alien plants under both current and future climates in Australia. The website-based decision-support tool provides users with the ability to interrogate individual profiles for 292 naturalised alien plant species within Australia and assess emerging threats for a range of areas of interest, helping land managers and policy makers to target management of naturalized species at the most cost-effective stage.

ACKNOWLEDGEMENTS

This work was funded by the National Climate Change Adaptation Research Facility.

KEYWORDS: Naturalised plants, prioritisation, climate change, risk assessment

OC5.02

A STANDARDIZED SET OF METRICS TO ASSESS AND MONITOR TREE INVASIONS

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Scientists, managers, and policy makers need functional and effective metrics to improve the understanding and management of biological invasions. Based on discussions and a paper emerging from a meeting on tree invasions in Bariloche, Argentina in 2012, we outline some of the fundamental features of tree invasions, the methods that can be used to describe and monitor them, and which metrics should be used to assess progress towards management goals and increase compatibility across administrative borders and between invasions. We recommend six metrics: a) status per region (including an interpretation for trees following Blackburn's invasion framework); b) potential status (using a species distribution model to estimate climate suitability); c) the number of foci requiring management; d) compressed canopy area (i.e. area of occupancy (AOO) or net infestation) as a measure of abundance; e) range size (i.e. extent of occupancy (EOO) or gross infestation) as an estimate of the total affected area that needs to be considered for management; and f) observations of current and potential impact. These metrics can be used in concert (e.g. we describe a proposed method of categorizing invaders based on AOO and EOO; and develop a simple risk analysis tool combining potential status and threat), but for many purposes additional information will be required (e.g. information on detectability is required to assess the feasibility of eradication). These metrics represent a step towards standardized reporting of invasions, but we caution that more work is required to develop metrics for impact and threat. We conclude with a proposed template for reporting tree invasions and how they could be used in the context of measuring invasion debt.

KEYWORDS: metrics, trees

OC5.03

HANDLING HETEROGENEOUS SURVEY SOURCES AND ESTIMATING TRUE INVASION PROGRESS IN AN IMPERFECTLY OBSERVED, PAN-EUROPEAN INVASION

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Large-scale spatio-temporal spread data of biological invasions are frequently based on surveys with imperfect detection rates: only a portion of the truly extant populations are observed, and commonly detection clearly lags behind colonisation. Detection rates may further vary over space and time, and the thus resulting heterogeneous bias patterns can both hamper scientific analyses and give rise to misguided management efforts. Here we show a generally applicable, integrative modelling framework not only accounting for imperfectly detected data, but implicitly also estimating the true invasion spread progress and detection efficiency.
We present a hierarchical Bayesian modelling framework which jointly integrates processes of dispersal, growth, propagule production, temporal dynamics, habitat suitability and, finally, heterogeneous survey modes. The true, yet unobserved biological invasion itself and the anthropogenic detection of the invasion constitute separate model layers but become jointly fitted using MCMC, delivering estimates for invasion and detection process properties, respectively, as well as the true invasion state. We apply our framework to the Central European invasion of *Ambrosia artemisiifolia* over more than a century, and in this large-scale context we set a specific emphasis on the concurrent integration of multiple survey schemes and intensities.
We show that the integration of imperfect, heterogeneous detection rates constitutes a core model component and has leverage impact on overall invasion inferences. Yearly overall detection probabilities of colonized sites are, depending on the survey scheme employed, rather low to nearly zero, and delays of over a decade between colonization and detection appear frequently applicable. Our model estimates that the invasion density already reached is much higher than what is suggested by the raw data; concurrently core invasion process properties, such as climate-dependence or kernel spread, are shown to be clearly sensitive to a proper integration of detection aspects as their associated parameter estimates differ significantly from an otherwise identical model but assuming perfect detection conditions for the data.
We demonstrate 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. The clear separation between invasion process itself from human detection both delivers more robust scientific inferences and provides an efficient method for merging historical data collected under varying survey conditions. The implicitly inferred true invasion progress also aids the development of applied management strategies, while insights on realized detection rates allow for the design of more directed survey strategies and enhanced error estimation.

Acknowledgments: We thank the Austrian Academy of Sciences (DOC-fellowship to TM) and the Austrian Climate Research Panel (B068662) for funding.

KEYWORDS: hierarchical model, imperfect detection, invasion, MCMC, survey

OC5.04

A SIMPLE METHOD TO DEVELOP 'WATCH LISTS' FOR INVASIVE SPECIES

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Introduction: Preventing the introduction of alien species can be the most effective form of invasive species management, but such preventative management strategies are only efficient if they focus on species with a high invasive potential without unduly restricting personal freedom or commercial activities. To achieve this, methodologies used to predict which alien species are likely to be invasive have been developed around the world, including the development of 'watch lists' of species whose introduction should be prevented. However, the development of such 'watch lists' is not always transparent or scientifically defensible, and some methodologies require extensive investigations.

Objectives: Using South Africa as a case study, we aimed to develop a rapid, easily repeatable invasive species risk assessment method.

Methods: Three basic criteria: a history of invasion, climate match and propagule pressure were used to identify alien plants as either potential future invaders, requiring further study, or as posing a low invasion risk. Additionally, the use of two climate match methods and three propagule pressure levels was assessed.

Results: The models predicted that 95% of alien plant species with a history of invasion elsewhere have the potential to be introduced and become invasive in South Africa. Additionally, the majority of these species were found to occur in high risk donor regions. Model sensitivity varied (between 32 and > 95%) based on the method used for evaluation, while model specificity was consistently high (96%).

Conclusions: This is a promising technique that can be used in any region of the world for the rapid identification of potential threats.

Acknowledgements: South African National Biodiversity Institute's Invasive Species Programme and the University of Pretoria, South Africa for funding. The DST-NRF Centre for Invasion Biology for logistical support. The Global Biodiversity Information Facility for aiding us with obtaining occurrence data.

KEYWORDS: biological invasions, risk assessment

OC5.05

UNLOCKING THE POTENTIAL OF GOOGLE EARTH AS A TOOL IN INVASION SCIENCE

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Distribution data are central to many invasion science applications. The shortage of good information on the distribution of alien species and their spatial dynamics is largely attributable to the cost, effort and expertise required to monitor these species over large areas. Virtual globes, particularly Google Earth, are free and user-friendly software which provide high-resolution aerial imagery for the entire globe. We suggest this has enormous potential for invasion science. We provide suggestions and tools for gathering data on the distribution and abundance invasive alien trees using visual interpretation of Google Earth imagery, and propose how these data may be used for a number of purposes, including calculating useful metrics of invasions, prioritising species or areas for management, and predicting potential distributions of species. We also suggest various practical uses of Google Earth, such as providing a tool for early detection of emerging invasions, monitoring invasions over time, and to help researchers and managers identify suitable field study sites. Virtual globes such as Google Earth are not without limitations and we provide guidance on how some of these can be overcome, or when imagery from Google Earth may not be fit for invasion science purposes. Because of Google Earth's huge popularity and ease of use, we also highlight possibilities for awareness-raising and information sharing that it provides. Finally, we provide the foundations and guidelines for a virtual global network of sentinel sites for early detection, monitoring and data gathering of invasive alien trees, which we propose should be developed as part of a "citizen science" effort. There has been limited use of virtual globes by invasion scientists and managers; it is our hope that this talk will stimulate their greater use, both within the field of invasion science and within ecology generally.

KEYWORDS: Early detection, Biological invasions, Google Earth, Monitoring, Remote sensing, Tree invasions, Sentinel sites.

OC5.06

ESTIMATE OF *PINUS TAEDA* DISPERSION IN THE MIDDLE WEST OF SANTA CATARINA, BRAZIL

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The invasive nature of the genus Pinus in Brazil, can be verified by the gradual occupation of open spaces, especially areas without vegetation, but also areas of native grasslands and natural protected areas raising concerns about their impacts. Anyway, measures to be taken regarding its control, whether physical, mechanical, chemical, or legal, must be based on solid technical arguments, considering the social and economic importance from the silviculture of this genus to the Brazilian development . Objective: To generate information on potential seed dispersal of Pinus spp. under different field conditions in the middle west of Santa Catarina. Methodology: The study sites were in the cities of Agua Doce in 2 plots of pines aged 13 years, and in the Vargem Bonita city on 2 plots of pines with 18 years old. We obtained information on rate of seed dispersal, germination rate of seeds dispersed and the velocity germination index - IVG. The dispersed seeds were classified as standard, non-standard, only wings, and damaged. Results: The highest concentration of dispersed seeds (90.77%) occurred up to 51 meters away from the plots. The germination rate of the seeds dispersed was observed among 60% to 70%. The highest rates of index IVG on dispersed seeds was until 31 meters. It was observed that the highest rate of seeds dispersal occurred until 21 meters. Conclusions: The study shows that seeds dispersed more distantly had lower vigor and seeds sampled in the perimeter had more vigor than those inside the plots.

KEYWORDS: Biological Invasions, Seeds Dispersal, Pinus taeda, IVG

OC5.07

OCCURRENCE AND REPRODUCTIVE GROWTH OF *MELINIS MINUTIFLORA* AND *UROCHLOA DECUMBENS* IN SITES OF CERRADO SUBJECT TO CONTRASTING WATER AVAILABILITY REGIMES

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Introduction

Neotropical savannas vary in structure and function based on the variation of water availability, from those without shortage or excess of water to those permanently waterlogged (Sarmiento, Ecology of Neotropical Savannas, 1984). Water availability likewise influences the gradient of vegetation in the cerrado or Brazilian savanna (Gottsberger and. Silberbauer-Gottsberger, Life in Cerrado, 1, 2006). In these areas, local factors affecting water stress including water saturation, can influence local scale invasibility (Kreyling, Oikos, 117, 1542, 2008). Therefore, in spatially heterogeneous environments we expect to observe variation in invader performance among microhabitats (Renne, Ecology, 87, 2264, 2006).

Objectives

Here we assess how water table dynamics affect the presence and reproductive growth of *Melinis minutiflora* and *Urochloa decumbens*, two of the main invasive species in the cerrado (Pivello et al, 1999). We specifically aimed to clarify the relationship between the water table level and abundance and tiller production of these grasses.

Methods

We conducted this study at the Estação Ecológica de Itirapina (EEI), which maintains one of last natural grasslands stands within the cerrado in São Paulo state. We randomly distributed six 10 x 10m plots in four sites of each vegetation types (cerrado *sensu stricto*, campo cerrado, campo sujo, campo limpo and campo umido), and identified all individuals of both grasses in six 1 x 1m subplots. Around each plot we followed the tiller production of a single individual twice monthly over one year, while also measuring the water table depth in each plot.

Results

We found 1351 individuals of *U. decumbens* and 646 of *M. minutiflora*, and followed the phenology of 67 and 47 individuals of each species, respectively. Abundance and tiller production of both species were differently affected by the water table level (Figure 1). Although generally more abundant, *U. decumbens* was less common and had lower production of tillers in plots where in some moment the water table depth was lower than 1m (Figure 1). Conversely, *M. minutiflora* attained maximum abundance and tiller production even in plots whose water table was close to 0 during some period of the year (Figure 1).

Conclusions

Our results suggest contrasting invasion risk by the two African grasses in grassland sites within cerrado in the EEI. The weak performance of *U. decumbens* under flooded conditions has been reported in other biomes (Guenni, Interciencia, 31, 505, 2006), and indicates a low risk of invasion by *U. decumbens* in sites subject to short flood intervals or with a shallow water table. A lower reproductive output of this species under this conditions is expected, mostly because the persistence and spread of grasses under water stress used to depend on specific adaptations (Sarmiento, J. Veg. Sci, 3, 35, 1992). Conversely, *M. minutiflora* had high density and tiller production at conditions close to flooding. Invasions by *M. minutiflora* in sites experiencing flooding and saturated soils has not been previously reported. Although *M. minutiflora* presented no specific adaptation to flooding, this tolerance as well as its known invasiveness in other non-flooded sites, suggests a high invasibility across the grasslands of cerrado.

Acknowledgments

We thanks to FAPESP (Foundation for Research Support of the State of São Paulo) by the PhD scholarship granted.

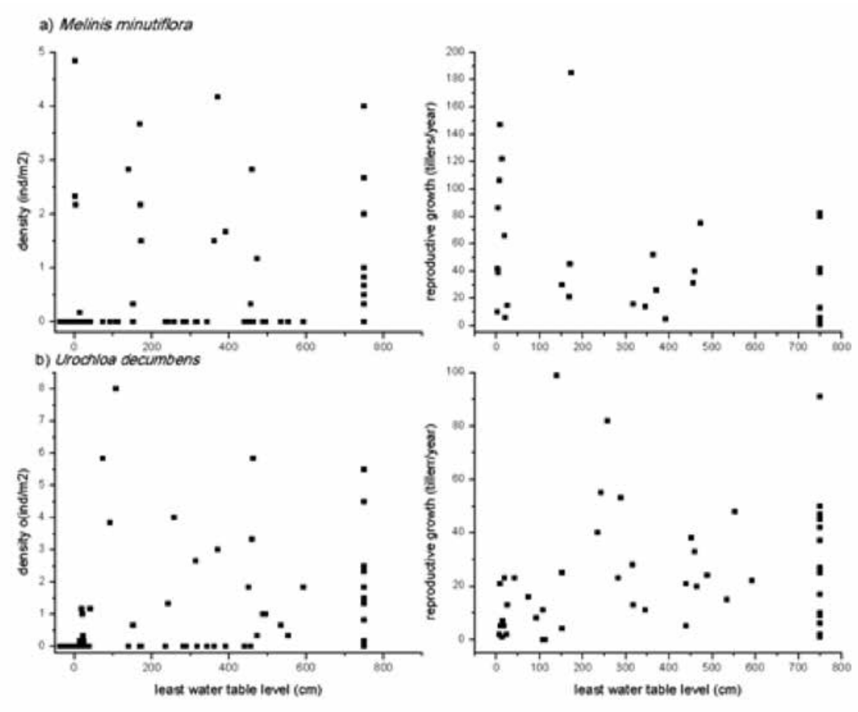

Figure 1 - Density and tiller production of *Melinis minutiflora* (a) and *Urochloa decumbens* (b), as a function of the least water table level.

KEYWORDS: water stress, water table, grasslands, invasion risk, African grasses

OC5.08

TESTING GEOSPATIAL MODELING METHODS FOR MANAGEMENT OF INVASION OF UNDERSTOREY SHRUB *LANTANA CAMARA* IN TROPICAL FORESTS OF WESTERN GHATS, INDIA

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INTRODUCTION: Several geospatial methods are used in invasive plant species' monitoring and management across diverse ecosystems. Non-native invasive species establish themselves in favourable habitats in alien regions. Such favourable habitats are largely determined by local climatic, soil and biogeographic factors. Modeling the importance of these factors can prove beneficial to managers to identify areas of possible invasion risk. Monitoring invasive species occurrences and spread also proves greatly useful to managers for deployment of resources to control them. This paper tests the use of two different geospatial methods and expert knowledge to detect and automatically monitor understorey invasive plant species in a tropical hill forest in India.

OBJECTIVES: Two main objectives for this biodiversity hotspot region were: 1. To determine whether logistic regression modeling on presence/absence data can identify variables conducive to high invasion in a tropical mixed forest. 2. To test the usability of very high resolution (VHR) satellite imagery to map occurrence of understorey invasive species in a complex tropical mixed forest based on expert knowledge.

METHODS: 1. Using presence-absence data of an invasive species *Lantana camara* and local habitat variables from increasing buffer distances around sampling locations along with broad scale climatic parameters, we applied a logistic regression framework to identify variables that support invasion and spread. 2. Using an object-oriented approach and logical rule-sets, we tested usability of seasonal VHR satellite imagery for detection and mapping of *L. camara* in a mixed forest.

RESULTS AND CONCLUSIONS: The study demonstrates the potential of geospatial modeling methods to monitor and manage invasive species in tropical forests. While logistic regression modeling identifies the contribution of moist deciduous forests to growth and spread of *L. camara* in this region; the VHR satellite imagery mapping technique highlights ease and rapidity of invasive species detection for control of their spread through an object-oriented approach.

ACKNOWLEDGEMENTS

We thank Bharath Sundaram and Ankila Hiremath for providing us with datasets on *L. camara*. This research has received funding from the European Union's Seventh Framework Programme, within FP7/SPA.2010.1.1-04: "Stimulating the development of GMES services in specific area", under grant agreement 263435 for the project *Biodiversity Multi-Source Monitoring System: From Space to Species* (BIO SOS) coordinated by Palma Blonda, CNR-ISSIA, Bari-Italy. (www.biosos.eu). Satellite data purchase and field work for ground truth collection was made possible by National Geographic Society Grant No 9037-11 awarded to Ankila Hiremath.

KEYWORDS: invasive species, Lantana camara, logistic regression, object-oriented, very high resolution satellite imagery, Western Ghats

OC6.01

BEST MANAGEMENT PRACTICES FOR SELECTED INVASIVE PLANTS IN THE SOUTHWESTERN UNITED STATES

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INTRODUCTION

Invasive plants cause economic or environmental harm or harm to human health. The objective is to present information for best management practices that provide control of nine invasive plants common in the Southwestern United States. Management information is gleaned from literature and field research conducted by the author in Arizona. The material presented is from desert rangelands, riparian habitats, woodlands and forest plant communities.

METHODS

Best management practices rely on four categories of vegetation management techniques: (1). Cultural, (2). Prescribed fire, (3). Biological agents and (4). Chemicals. These treatments can be applied alone or in a sequence depending on the management goals. In some cases, herbicide combinations are used increase efficacy and/or lower the cost of the treatment. In the case of the author's research, treatments on perennial species are evaluated for at least 2 years to show mortality. Selected invasive plants for this presentation include: *Acroptilon repens* (L.) DC., Alhagi maurorum Medik., Bromus rubens L., *Centaurea melitensis* L., C. solstitialis L., *Elaeagnus angustifolia* L., Pennisetum cilare (L.) Link., Salsola *kali* L., and *Tamarix ramosissima* Ledeb.

RESULTS

Acroptilon repens is a deep rooted perennial and is best controlled by using selective herbicides. Livestock grazing can reduce canopy cover. Biological control agents have recently been released.
Alhagi maurorum is a deep rooted perennial that spreads by vegetative means. The best management practice for *A. maurorum* is the application of herbicides late in the growing season. This species is not reduced by fire, livestock grazing or mechanical practices.
Bromus rubens is an cool season annual grass best controlled with pre-emergence herbicides. Its presence promotes wildfire in warm deserts where fire was a rare event. Early season grazing can suppress its presence.
Centaurea melitensis and *C. solstitialis* are annuals that can be controlled by pulling, mowing and prescribed fire. These plants can cause human harm. Selective herbicides are highly effective for their control.
Tamarix ramosissima and *Elaeagnus angustifolia* are invasive riparian trees that degrade habitat quality. Both regrow after fire. They can be removed by mechanical treatments, but these may be cost prohibitive. *T. ramosissima* saplings are readily grazed by goats. An introduced insect is showing promise for *T. ramosissima* control. Selected herbicides will control both species when applied as basal bark, cut stump or foliage sprays.
Pennisetum cilare is a perennial forage grass that is difficult to control with herbicides because of its morphology and seasonal growth. While pulling/digging of clumps is effective, the best management practice is herbicidal individual plant treatment.
Salsola kali, an annual plant, can be controlled by early season grazing. Prescribed fire or hand removal can control the plant. Choosing a pre or post emergent herbicide is the best management practice.

CONCLUSION

Integrated pest management is practiced for invasive plants, but herbicides tend to be the most economical practice for controlling invasive plants in the Southwestern USA.

ACKNOWLEGEMENTS

Funding for the author's field research is primarily from DuPont (Crop Protection). Many federal, tribal, state, and county agency personnel have cooperated in the studies. Will Coffee serves as a research technician.

KEYWORDS: warm desert, invasive plants, buffelgrass, salt cedar, Russian olive, star thistles, red bromegrass, camelthorn, Russian knapweed, rangelands, riparian habitat

OC6.02

DENSE WILDING CONIFER CONTROL WITH AERIAL BOOM SPRAYED HERBICIDES IN NEW ZEALAND.

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INTRODUCTION

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.

Objectives

The objective of the work was to test the efficacy of four triclopyr butoxyethyl ester based herbicide mixtures, applied as an aerial blanket boom sprays, to kill dense infestations (>80% canopy cover) of mature wilding *Pinus contorta* and *Pinus nigra* ssp. *laricio* trees.

Methods

Two replicated aerial field trials were set up, one each for *P. contorta* and *P. nigra*. Both trials had an identical setup and comprised three 0.5 ha replicates for each herbicide treatment. The herbicides were applied as water-based mixtures at 400 l/ha using a calibrated helicopter boom spray and a droplet size of 350 μm. The four herbicide treatments were:

1) triclopyr butoxyethyl ester 18 kg/ha, i.e. Grazon herbicide (G),

2) triclopyr butoxyethyl ester 18 kg/ha & picloram 2kg/ha, i.e. Grazon / Tordon herbicide mixture (GT),

3) triclopyr butoxyethyl ester 18 kg/ha & dicamba 5kg/ha, i.e Grazon / Dicamba herbicide mixture (GD) and

4) triclopyr butoxyethyl ester 18 kg/ha & picloram 2kg/ha & & dicamba 5kg/ha, i.e. Grazon / Tordon / Dicamba herbicide mixture (GTD).

For each treatment 100 trees were marked and measured prior to treatment. Tree response was monitored by scoring percentage needle death at 24 months post treatment.

Results

Tree response data were analysed separately for each species, using a S.A.S. general linear model and a stepwise multiple comparison procedure (SNK) to identify if sample means differed significantly from each other. The table below shows mean mortality (%) for *P. contorta* and *P. nigra* by treatment after 24 months. SNK means followed by the same letter are not significantly different at P<0.05.

Treatment	Mortality	
	P. contorta	P. nigra
GTD	92.1 A	24.3 AB
GD	89.9 A	37.5 A
GT	65.1 B	18.2 AB
G	38.2 C	1.0 B

Conclusions

After 24 months *P. contorta* was more susceptible to the tested herbicides than *P. nigra*. The GTD treatment was highly effective against *P. contorta* and can be used operationally to control dense wilding infestations. Although the *P. nigra* mortality percentage of the GTD treatment are relatively low (24%) after 24 months, the average needle death of all trees was 88.4%. This observation suggests that these trees may still die. This trial will be monitored again after 48 months to determine whether any additional mortality did in fact occur.

KEYWORDS: Wilding conifers, aerial boom spraying, herbicides

OC6.03

THE IMPLEMENTATION OF A LANDSCAPE SCALE WOODY WEED HERBICIDE CONTROL SYSTEM USING *PINUS CONTORTA* AS A CASE STUDY

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Introduction

Control of woody weeds at the landscape scale in New Zealand is based on two activities, namely physical and chemical control methods. Although effective, physical control can only be used where trees are accessible. Also, these methods are labour intensive and relatively expensive. When they work, chemical control methods are more cost effective and less labour intensive than physical control methods. For dense infestations or situations where trees are inaccessible chemical control is the only solution. A new woody weed herbicide control system has been developed to deal with accessible scattered individual trees (ground-based basal bark and cut stump techniques), inaccessible scattered individual trees (aerial bark application) and dense infestations (boom spraying). We explain the research developments and field implementation of these techniques at the landscape scale. We use the control of *Pinus contorta* as a case study to demonstrate examples of each of these components in New Zealand and explain how they have changed the face of woody weed control for the New Zealand Department of Conservation (DOC).

Objective

The aim of implementing the herbicide trial research results in the field was to improve weed control using innovative strategies and equipment so that effective herbicide control of woody weeds could be achieved at the landscape scale.

Methods

Herbicide efficacy trials, new methods of application and flow calibration lead to the development of the herbicide weed control system. This was compared to the traditional system used by DOC which is predominantly physical control methods. The findings and implications for the future management of woody weed infestations will be discussed.

Results

We now have a woody weed herbicide control system to control woody weeds at the landscape scale that work efficiently and effectively leading to reduced labour input and lower costs compared to previous methods (for example, $500/ha cf. $5000/ha). The ground-based basal bark and aerial spot methods enable trees to be quickly and cost-effectively controlled before they seed. Precision herbicide application is resulting in very little collateral damage to native vegetation which aids recovery and helps suppress the re-establishment of woody weeds. The boom spraying control methods are designed to control dense, closed canopy infestations of woody weeds, with little impact on grasses in the understorey.

Conclusions

Herbicide control of woody weeds is yielding more efficient and effective control than conventional methods.

If used correctly and consistently, the herbicide control system will restrict weed populations and reduce the impact of woody weeds on the environment at the landscape scale with minimal effect on native vegetation or farmland grasses. For light woody weed infestations the system may achieve eradication. The New Zealand Department of Conservation is now using this system in its operations resulting in significant time and cost savings. The methods are also being used by forestry companies for selective control of woody weeds in plantation forests.

KEYWORDS: woody weed herbicide control system, Pinus contorta, basal bark, aerial bark treatment, boom spraying

OC6.04

AERIAL SPOT HERBICIDE TREATMENTS TO CONTROL WILDING CONIFERS IN NEW ZEALAND

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Introduction: Wilding conifers threaten over 200,000 hectares of land administered by the Department of Conservation in the South Island of New Zealand. Sparsely, scattered and difficult-to-reach, wilding conifers are a major concern, as they increase the point of invasion once they seed. Elimination of these outliers before they seed is critical to an effective containment strategy. 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, which is costly and time consuming. This paper explains the use of a custom built spot gun to aerially apply herbicides from a helicopter, to efficiently target and control difficult-to- reach wilding conifer trees.

Objectives: The objective of the work was to test the efficacy of a custom built spot gun, calibrated to deliver ester herbicides in paraffinic oil to the trunks of different species of wilding conifer trees from a helicopter.

Methods: The spot gun comprises of a 2m long stainless steel lance connected to the helicopter pump system via a hand operated trigger. The liquid herbicide is delivered through a 5mm tube at the end of the lance into the top and onto the trunk of target trees. The spot gun was calibrated to deliver one litre per treatment. Three oil-based herbicide treatments (60 g/l triclopyr, 120 g/l triclopyr and 120 g/l triclopyr + 20 g/l picloram) and an oil only control were tested on *Pinus contorta*, *P. nigra* subsp. *laricio, P. sylvestris* and *Pseudotsuga menziesii*. Treatments were applied by helicopter using the spot gun, at 1000 ml herbicide solution per tree to the main trunk. For each treatment a minimum of 30 trees of varying ages and sizes were marked and monitored prior to treatment. Tree response was monitored by scoring percentage needle death at 12 and 24 months post treatment.

Results: As indicated by the percentage needle death, 24 months after treatment application the 120 g/l triclopyr + 20 g/l picloram herbicide treatment performed better than the other treatments on *P. nigra* ssp. *laricio* (90%), *P. sylvestris* (98%) and *Pseudotsuga menziesii* (87%). However, for *P. contorta*, needle death was highest (88%) where 120 g/l triclopyr had been used. It was noted that smaller trees, less than 2 m, were killed by the paraffinic oil control. The spot gun performed without any problems and consistently delivered the calibrated dose with accuracy and precision.

Conclusions: Results indicate that herbicides applied in paraffinic carrier oils via a lance to the top centre trunk of wilding conifers, by helicopter, caused significant mortality to all four conifer species trialled. This method, allows for an immediate, rapid-response control of outlier wilding conifer detections and can be used while conducting aerial surveillance of incipient wilding conifer infestations. Because it is much cheaper and quicker than chainsaw felling, this is now the preferred methodology of the New Zealand Department of Conservation for controlling isolated wilding conifer trees.

KEYWORDS: Wilding conifers, aerial spot spraying, lance, herbicides

OC7.01

A NEW NATIONAL UNIT FOR INVASIVE SPECIES DETECTION, POST-BORDER RISK ASSESSMENT, AND ERADICATION PLANNING IN SOUTH AFRICA

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INTRODUCTION

Even with no new introductions, the number of biological invasions in South Africa will increase as introduced species naturalise and become invasive. As of 2010 South Africa had ~8,750 introduced plant taxa, 660 naturalised, 198 included in invasive species legislation, but only 64 subject to regular control, i.e. only widespread invaders are managed post-border. There is only one documented example of a successful eradication programme in continental South Africa—against the Mediterranean snail (*Otala punctata*) in Cape Town.

OBJECTIVES

We describe the establishment in 2008 of a unit funded by the Working for Water Programme as part of the South African National Biodiversity Institute's Invasive Species Programme (SANBI's ISP) designed to: i) detect and document new invasions; ii) provide reliable and transparent post-border risk assessments; and iii) provide the cross-institutional co-ordination needed to successfully implement national eradication plans.

RESULTS

As of the end of 2012 SANBI's ISP had an annual budget of ZAR36 million, employed 33 staff working across all nine provinces, supported ten post-graduate students, hosted 35 interns (including as part of a drive to collect DNA barcodes for all invasive taxa), and had created over 50 000 days of work as part of government poverty alleviation programmes. The unit had worked towards full risk assessments for 32 plant taxa; and had developed and is helping implement eradication plans against four species.

CONCLUSION

By focusing on science-based management and policy, we argue that SANBI's ISP can play a leading role in preventing introduced species from becoming widespread invaders.

BIBLIOGRAPHIC CITATION

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ACKNOWLEDGEMENTS

This work was funded by the South African Working for Water Programme of the Department of Environmental Affairs. J.R.U.W. acknowledges support from the DST-NRF Centre of Excellence for Invasion Biology. All current and past staff of SANBI ISP contributed valuable insights, discussion and enthusiasm. Sjirk Geerts, Di Spear and John Moore provided useful comments and Sjirk Geerts assisted with analyzing the relationship between effort spent and size of infestation.

KEYWORDS: biological invasions, post-border biosecurity, early detection and rapid response (EDRR), invasion debt, South Africa

OC7.02

RAPID INVASIVENESS ASSESSMENT TOOL FOR EXOTIC SPECIES IN MEXICO

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INTRODUCTION: In April 2010, modifications were made to Mexico´s two main environmental laws in order to address the issue of invasive species. These changes clearly stated the different activities needed to protect natural resources from the harmful effects of exotic invasive species, both those present and those posing a potential risk, as well as the need to publish an official invasive species list for Mexico.
Although a preliminary listing had already been compiled by the National Commission for the Knowledge and Use of Biodiversity (CONABIO), it was necessary to set up a method that could be used to evaluate these, and any new species of concern. Given that resources are usually limited, it was also important that this method allowed prioritizing the species and provide a way to group them into different management categories. A decision was made to develop a tool that could be used as a rapid assessment and give an initial rating for species of suspected high risk.

OBJECTIVES: Establish the criteria for a rapid assessment method to define and prioritize the invasive species for Mexico.

METHOD: We reviewed the different risk assessment tools used worldwide, to obtain an initial list of possible criteria. We then held a first workshop with academic and technical experts and obtained an agreed set of standards that could be used as a rapid assessment tool for all groups. The species in CONABIO´s original list were used to test and fine tune the methodology by groups of specialists. A multicriteria analysis was used to obtain the scores. In 2013 a new workshop was held to peer review the results and present the findings to the Ministry of Environment (SEMARNAT).

RESULTS: We proposed a methodology with 10 questions grouped into three categories: 1) Status, 2) Invasiveness and 3) Impacts. Each question had six possible answers, ranging from null to very high as well as an uncertainty rating, related to the quality of the information used. A system to contain the information and calculate the final invasiveness score was developed by CONABIO, as an additional product. The system also allows to categorize the species according to different management needs. To date, 359 species have been analyzed, and the results are being reviewed by experts. The findings and the method will be submitted for public consultation before publishing the official listing of invasive species for Mexico by the end of the year.

CONCLUSION: We have developed a system that will be adopted as the official Rapid Prescreening tool to be used in Mexico; it has been validated by the Ministries of Environment and Agriculture and will be crucial for decision making in terms of invasive species and the actions to be taken for their prevention, control and eradication.

KEYWORDS: Risk assessment, Invasive species black lists, scoring

OC8.01

INTRODUCTION HISTORY OF INVASIVE PLANTS IN BRAZIL: PATTERNS OF ASSOCIATION BETWEEN BIOGREOGRAPHICAL ORIGIN AND REASON FOR INTRODUCTION

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INTRODUCTION

In Brazil, little is known about the introduction history of many invasive plant species and analyses of historical factors associated to invasions are lacking.

OBJECTIVES

The goal of this study is to present the first analyses of historical factors associated to biological invasions in Brazil by describing patterns of introduction history and testing the association of continent of origin and reason for introduction.

METHODS

For this study, I used the 117 invasive nonnative species and 13 invaded plant communities identified in a national database on invasive alien species and a previous study (I3N-Brazil 2011, Zenni and Ziller 2011). I compared observed and expected numbers of invasive species in Brazil from each of the following attributes: continent of origin, reason for introduction, and family. Using the same data, I explored the relationship of continent of origin × reason for introduction to determine the influence of interacting factors on the distributions of invasive plants.

RESULTS AND CONCLUSIONS

More invasive species in Brazil are native from Africa (n = 32) and Asia (n = 39), and most invasive species were introduced for horticulture (n = 50) and forage (n = 19). Also, 10 invasive species were introduced accidentally. The majority of the invasive species belong to the families Poaceae (n = 24), Fabaceae (n = 16), and Pinaceae (n = 6). These three families encompass 39.3% of all the known invasive species in Brazil, while the other 60.7% (n = 71) belong to 39 different families.
I found the association between continent of origin and reason for introduction to be greater than expected ($p < 0.001$). More species than expected were introduced from Africa for forage, and more species than expected were introduced from Asia for agroforestry and horticulture. The reason for introduction is marginally associated with habitat occupancy ($p = 0.056$). Only horticulture had a significant effect ($p = 0.04$) by showing more habitats invaded by species introduced for this reason.
This study supports the hypothesis that Eurasian species (i.e., Old World) tend to be more invasive than species from other origins (Di Castri 1989). However, while Asian species correspond to ca. 40% of the invasive species in Brazil, and European species correspond to less than 3% of the invasive flora, against 80% and 58.9% worldwide, respectively (Pyšek 1998). In temperate regions of southern Brazil, European species are more representative in the herbaceous alien flora, making up to 40% of some species pools (Schneider 2007), but still the number of European invasive species is low (4 species). At least for Brazil, Asia is currently the main source of invasive plants. Interestingly, South America (and Brazil in great part) is also the major source of invasive plants in China, contributing with 35% of the Chinese invasive plant species pool (Weber et al. 2008). Finally, the results suggest that risk assessments of invasions should take into consideration not only biogeographical origin and economic use of species, but also the potential interaction between these two factors.

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ACKNOWLEDGEMENTS

I thank Michele Sá Dechoum, Mariano Rodriguez-Cabal, Jen Schweitzer, and Mark Genung for help on different stages of this study.

KEYWORDS: invasive plant species, alien plants, horticulture, forage, forestry, risk assessment

OC8.02

HOW DOES DISTURBANCE INFLUENCE THE GERMINATION OF AN INVASIVE GRASS IN CERRADO?

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INTRODUCTION: Fire has been present in Cerrado (Brazilian savanna) for some millions of years as a natural disturbance and selective force (Simon *et al.* 2009). In the present time, a great part of Cerrado is converted into pastures and croplands, and fire is used as a tool for deforestation and farming management whereas the Cerrado preserves are threatened by wildfires and invasive grasses. One of the most common and aggressive invasive species in Cerrado is the African grass *Urochloa decumbens* (Pivello *et al* 1999). Although it is well known that disturbances facilitate the establishment of invasive species in new habitats (Hobbs & Huenneke, 1992) the mechanism of *U. decumbens* invasion in Cerrado remains poorly known.

OBJECTIVES: The aim of this study was to evaluate how high temperatures and temperature fluctuations caused by wildfires affect the germination of *U. decumbens*.

METHODS: Seeds of *U. decumbens* were submitted to the following treatments (3 replications; 30 seeds/replication): 1. Fire simulation (FS) – temperature was increased up to 50ºC and then decreased continuously up to 25ºC for 30 minutes, to simulate the passage of fire in the soil. 2. Temperature fluctuation (TF) - temperature was increased continuously during the day up to 40ºC and then decreased to 10ºC for 30 days, to simulate day/night temperature fluctuations. 3. Fire + Fluctuations (FF) – seeds were exposed to the increase of temperature (50ºC) and after that, to temperature fluctuations for 30 days. 4. Control (C) – environmental temperature. After the treatments, seeds were put in Petri dishes in germination chambers at 25ºC (dark) for 40 days. We evaluated changes among treatments by using one-way ANOVA and Tukey test.

RESULTS: High germination rate could be observed in all treatments (>60%), however, TF and the FF showed the highest germination percentages (G=89,1% and G=92,2%, respectively, $p=0.002$) when compared to C and FS.

CONCLUSIONS: The results showed that fire alone is not sufficient to stimulate germination, but the stimulus can be caused by temperature fluctuations in the post-fire environment susceptible to such fluctuations. Other disturbances, as grazing or deforestation, can also promote temperature fluctuations. These results support that *U. decumbens* has an advantage in disturbed areas, and its germination can be enhanced in gaps where temperature fluctuations occur.

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ACKNOWLEDGMENTS: CAPES, CNPq, Fundação Grupo Boticário

KEYWORDS: Urochloa decumbens, temperature fluctuations, fire, disturbance, Cerrado

PT1.01
DISTRIBUTION AND SOCIOLOGICAL CHARACTER OF A GARDEN ESCAPEE, INDIAN STRAWBERRY (POTENTILLA INDICA) IN HUNGARY

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Potentilla indica (G. Jackson) Th. Wolf (syn.: *Duchesnea i.* (G. Jackson) Focke, Rosaceae) is a perennial forb native to the Indo-Himalayan region, but became also widespread in Southeastern Asia a considerable time ago. Today, the plant can be found worldwide. In Europe, it first arrived in England as an ornamental in 1805. Its naturalization has been detected throughout the continent since the early 20th century, but its more obvious spreading has become extensive in the last decades. *P. indica* is a fast growing semi-evergreen species. It disperses its seeds through zoochory and also spreads vegetatively along its runners, rooting and producing crowns at each node. Its first detected escape from cultivation in Hungary was in 1926. Ever since, it has become naturalized and spreads in settlements, mainly in anthropogenic moist lawns. It is dominantly present in hilly regions and is more frequent in the western part of the country.
We investigated the stands of *P. indica* in four settlements by sampling 66 (4 m^2) plots. The number of coexisting plant species was 158 in the studied plots, which is approximately 5% of the Hungarian native and naturalized species. Most of the species were accidental, indicating the indifferent phytosociological status of the plant or the pioneer character of its habitat. Approximately two third of the coexisting and 70% of the accidental species are perennial, members of the moist and semi-moist lawns and mown grasslands in the urban environment. Among these perennials, there are hardly any adventive plants, but 21% of the associated species are exotic, and a significant part of them (14 species) are spontaneously regrowing, planted woody species. 20% of the species have a similar spreading and growth strategy to *P. indica*. The most frequent among them are *Bellis perennis*, *Glechoma hederacea*, *Trifolium repens*, and *Viola odorata*. It is likely that *P. indica* spreads at the cost of these latter species and also at the cost of *Potentilla reptans* that was already an accidental element. Most of the studied sites were managed urban habitats. The species occurs rarely in semi natural vegetation types, but it can also grow wild in such habitats. By applying hierarchical, multivariate statistics, the studied plots can be divided into two main types according to the average coverage of *P. indica*. In plots, where the coverage of the plant was lower, *Lolium perenne* and *Glechoma hederacea* reached a higher cover, while in the other group the proportion of these species was lower. This might be attributed to: 1. in the more closed *Lolium perenne* and *Glechoma hederacea* stands, the spreading of *P. indica* is more difficult; 2. *P. indica* spreads at the expense of these species.
Nevertheless, the negative effect of *P. indica* on the species richness is clear. There is a negative correlation between the extent of its coverage and the species richness of the plots.

KEYWORDS: impact, lawns, Potentilla indica, spreading, urban environment, vegetation

PT1.02

PLANT INVASION OF A GRAVEL MINE REVEGETATED WITH SEWAGE SLUDGE IN THE CERRADO REGION OF BRAZIL

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INTRODUCTION

Rehabilitation of materials exposed by mining involves physical amelioration and organic matter incorporation, which along with propagules from regional species are expected to trigger autogenic recovery. As ecological succession progresses the degraded system driven by new edaphic thresholds should move towards its original condition or to an analogous equilibrium.

OBJECTIVES

The objectives of this research were:

1) Evaluate the floristic composition spontaneously established on the treated mining spoil.
2) Check whether the original species were taking over the area after nearly a decade from biosolids incorporation.

MATERIAL AND METHODS

Opencast mining activity took place at the study site in the Brazilian Federal District in 2001-2004 and operations left a flat 74ha and also ~40 mature native trees on mounds at original soil level. Restoration activities occurred in 2002-2005 and consist of mechanical 20cm subsoiling of the exposed regolith and the incorporation of tertiary domestic sewage sludge (biosolids) as source of organic matter and plant nutrients. After 7-10 years from biosolids incorporation, a floristic survey was done on the spontaneously revegetated mining surface and on undisturbed-soil mounds.

RESULTS AND CONCLUSION

We sampled 133 plant species to find 93 species on undisturbed-soil mounds and 64 on the revegetated mining surface. Allochthonous (56%) invasive (82%) herbs (42%) was the group of plants most common among the species on the mined surface. Besides the existence of allochthonous (27%) invasive (38%) herbs (22%), autochthonous (73%) woody species (76%) prevail on the mounds where the original Cambisol was preserved. The majority of propagules that developed a plant on the mined surface came from elsewhere than the native trees spared in the site. Increased soil fertility due to sewage sludge application may have stimulated the propagation of invasive plants in detriment of native Cerrado species.

KEYWORDS: Sewage sludge, allochthonous, invasive, herbs, autochthonous, woody species

PT1.03

NOT ALL INVASIVES ARE EQUAL - THE CASE OF *PSIDIUM GUAJAVA* AND *UROCHLOA MAXIMA* IN STATE OF SÃO PAULO

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Despite the globally recognized threat of several non-native plants species on the economy and biodiversity, only a small fraction of these species may actually be considered invasive. This distinction is especially important when there are limited human and monetary resources to control actions and invasion prevention. Based on these assumptions and considering that biological invasions should be treated as biogeographically and not only taxonomically, we focused our study on two non-native species in the state of São Paulo classified as high risk (*Psidium guajava*) and very high risk (*Urochloa maxima*) by the risk analysis technique for exotic plants. Since these species are already widespread throughout the state and preventing their introduction based on risk analysis is impossible, we seek to diagnose the in situ status of invasion. We collected geographical coordinates points of occurrence of *Psidium guajava* and *Urochloa maxima*, selected systematically in natural fragments and protected areas throughout all the state of São Paulo. Each point was categorized as environmental (inner or edge fragment, disturbed area, riparian zone), conservation status, population size and ecosystem / habitats. In total we sampled 75 points of occurrence of *P. guajava* and 323 *U. maxima*, while only 9% of the points were recorded within the fragments. *P. guajava* was found more frequently in forest physiognomy (62%), similarly to edge or inner fragment, often as individuals (82%) and in environments considered well conserved (51%). *U. maxima* was recorded more frequently in semideciduous forest (54%) and cerrado *s.s.* (21%) physiognomies, mainly located on the edge of the fragments (85%). Only 18 points were recorded within the fragment, seven of them as a dense population and two in the primary zone. In the real world, despite the secular time since the introduction of *P. guajava* and *U. maxima* in Brazil, there are few occurrences of invasion by these species in high density within undisturbed vegetation fragments. Therefore, the probability such species may cause a loss of diversity is low in natural and well preserved ecosystems. Considering only the frequency of occurrence within the fragment, the potential for invasion by *P. guajava* surpasses that of *U. maxima*, unlike was pointed by risk analysis. When dealing with biological invasions, the precautionary principle should not be ignored. However, generically classify these or other exotic species already established as "invasive" without differentiating them by causing real damage to natural ecosystems, can lead the decision maker to misplaced priorities and even unnecessary actions, as would be the control of populations of these species at all points of occurrence.

Sponsors: Brazilian Council for Scientific Research – CNPq (# 476839/2011-4 and # 303402/2012-1), and Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP (#2011/05930-0).
KEYWORDS: invasivity, invasibility, risk assessment, impact assessment

PT1.04

DETERMINING THE INVASIVE POTENTIAL OF *CROTALARIA AGATIFLORA* (CROTALARIEAE, FABACEAE) IN SOUTH AFRICA

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Introduction

Crotalaria agatiflora is native to tropical East Africa (Tanzania, Ruanda, Burundi, Kenya and Ethiopia). In South Africa this plant was introduced as an ornamental garden shrub, and has since become invasive in many localities (savanna, grasslands, watercourses and forest margins). From the table in the position paper (Wilson et al.,SAJS, vol.109, pg 1-13, 2013); *Crotalaria agatiflora* Schweinf.: state of project: Risk assessment, delimitation and eradication planning. ~122: ~100 in Gauteng, 12 in Mpumalanga, 6 in KwaZulu-Natal, 4 in Limpopo. Populations range from 1–40 seedlings to 150–300 big plants. Found along road verges, riparian areas, dump sites and abandoned sites.

Objectives

To map the present distribution of the species, the predicted future distribution, sizes and growth characteristics of existing populations, the soil seed bank of the species. Using these data predict if *C. agatiflora* poses a significant threat as an invasive alien plant to South Africa and provide recommendations for how it should be managed.

Methods

We recorded more than thirty populations of this species and mapped them. We predict the future distribution of the species based on climatic suitability using Maxent and arcGIS. We explored and monitored five populations of this species to measure and count the number of individuals in populations. We analysed the soil from these five different populations and tested the seeds for viability and germination.

Results and conclusion

Soil seed bank and records of occurrence show that *Crotalaria agatiflora* is a slow but persistent invader. Its seed coat dormancy and ability to resprout makes it very persistent. 100% viability and germination was acquired from tested seeds. The preliminary scientific data obtained from this study show that *C. agatiflora* poses a significant threat to the flora of South Africa and that it should be controlled. However, it remains to be seen whether eradication is feasible.

Acknowledgements: Department of Environmental Affairs South Africa, Working for Water, the Expanded Public Works Programme and the South African National Biodiversity Institute-Invasive Species Programme.

KEYWORDS: C. agatiflora, SAPIA, Invasive, South Africa

PT1.05
GERMINATION BIOLOGY OF INVASIVE POTAMOGETON NODOSUS: PREDICTING GERMINATION RESPONSE OF RHIZOME SPROUTS TO TEMPERATURE

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Introduction: Pondweed *(Potamogeton nodosus)* is a perennial aquatic plant which has become invasive to the rice fields in northern area of Iran. Rice suffers more than 20% yield loss due to this weed species. It propagates with both seeds and rhizome.
Materials and Methods: A growth cabinet experiment was conducted in 2012 to study the germination response of the rhizome sprouts to the temperature. Ten fleshy rhizome pieces with eight centimeters long and three nodes were planted in pots at a water depth of 3 cm. Pots were kept at temperatures of 5, 12, 19, 26, 33 and 40 in growth cabinet for 21 days and germinated buds were daily counted. *Time* to reach *50% germination* (T*50*) was calculated. 1/T50 (as germination rate) was regressed against temperatures using piece-wise model (triangular function, RMSE=4%).
Results: Parameter estimates indicated a base temperature of 14 c (SE=1.2), and an optimum temperature of 23c (SE=1.7) at which the highest rate of germination was recorded. The ceiling temperature was estimated at 35c (SE=0.85) from which no germination was ever found.
Conclusion: Understanding the germination biology of invasive weeds provides basic knowledge for decision making systems.

KEYWORDS: Potamogeton nodosus, rhizome sprouting, base temperature, optimum temperature, ceiling temperature, piece-wise model

PT1.06
PLANT INVASIONS IN PRIVATE NATURAL FORESTS SURROUNDED BY *EUCALYPTUS GLOBULUS* PLANTATIONS

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The conservation of forest ecosystems is not a task solely for governments and requires the active participation of the private sector. The Chilean forestry industry is based almost entirely in plantations of alien species (*Pinus radiata* and *Eucalyptus spp*). However, the forestry companies kept in their patrimony remnants of natural forest for the conservation and protection of water courses and biodiversity. These fragments of natural forests are not managed and are surrounded by forest plantations. This work aims to evaluate the degree of alien plant invasions in natural forests adjacent to plantations of *E. globulus*. Twenty-five transects were installed in natural forests located in Cordillera de Nahuelbuta in South-Central Chile. The transect consists of three plots, one plot parallel to the plantation edge and the other two plots perpendicular, together forming a "T". Each plot is 50 x 2 m with a total length of 50 m along the perimeter plantation/forest and at least two plots perpendicular to the edge, which ends 100 m inside the natural forest. We recorded a total of 130 species in the 25 transect of which 27 (20.8%) were alien plant. Five alien species correspond to trees, five to shrubs and 17 to herbs. The most abundant families are Poaceae and Fabaceae which together accumulate 38% of the species, followed by the species of the family Asteraceae and Rosaceae which have around 30%. The plots located on the perimeter plantation/forest have an exotic species richness of 26. Edge plots, located 25 m from the plantation, have an average of 14 exotic species and into the forest richness declines to 8 alien species. The abundance of these species also shows a pattern of decline towards the interior of natural forest, from an abundance of 12.6% in the perimeter plantation/forest to 1.9% inside the forest. The alien herbs species *Cirsum vulgare, Holcus lanatus, Hypochaeris radicata, Solanum nigrum* and shrubs *Rosa rubiginosa, Rubus ulmifolius, Teline monspessulana* are present throughout the whole the transect. Interestingly, planted tree species (*Eucalyptus* and *Pinus*) are not frequently found into the native forest. In all of the natural forest studied the aliens species are concentrated in the perimeter area of natural forest fragments, which facilitates future management actions intended to reduce its invasion. Acknowledgment: This work was funded by the Instituto de Ecología y Biodiversidad (IEB), Project ICM P05-002 and PFB-23 and Forestal Volterra S.A.

KEYWORDS: Alien plants, Forest Plantantations, Management

PT1.07

HOW DOES AN INVASIVE GRASS AFFECT THE NATIVE VEGETATION BIOMASS OF CERRADO?

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INTRODUCTION

Invasion species is one of the main threats to the global biodiversity (Dukes 1999) and it can cause native species extinction. In Brazil, the Cerrado vegetation is in constant threat, mainly by the presence of invasive grasses, such as *Melinis minutiflora* (Pivello 1999). This C4 African grass was originally introduced for forage, becoming invasive in most of the conservation units of Cerrado in Brazil. Its presence might exert strong competitive pressure on the native herbaceous community (Pivello 1999). Therefore, the goal of this study is to evaluate the accumulation of the invasive grass biomass in comparison to the native vegetation in a Cerrado area under regeneration.

MATERIALS AND METHODS

The study was carried out in a Cerrado area under regeneration after the removal of a *Pinus oocarpa* stand at the Estação Experimental de Itirapina, Southeast Brazil. The study area is under natural regeneration and no planting or seeding was done after *Pinus* removal. Twenty-four plots (4x4 m) dominated by *Melinis minutiflora* were established in this area. Within each plot, a random subplot (0.5x0.5 m) was established and all above-ground biomass was sampled. The biomass was separated into categories (dead biomass, dead and live biomass of *Melinis minutiflora*, forbs, palms, shrubs, graminoids), dried at 70ºC (3 days) and weighed.

RESULTS

The total amount of biomass found was 1943.3 $g.m^{-2}$ from which 64% was composed by the invasive grass, *Melinis minutiflora* (1257.7 $g.m^{-2}$), 18.4% (357 $g.m^{-2}$) of dead biomass , 0.1% (2.8 $g.m^{-2}$) of graminoids, 0.2% (4.6 $g.m^{-2}$) of forbs, 14.4% (280 $g.m^{-2}$) of palms and 2.1% (41 $g.m^{-2}$) of shrubs. Considering only the total biomass of *Melinis minutiflora*, 73.3% (922 $g.m^{-2}$) is dead, 26.7% (335.7$g.m^{-2}$) live biomass.

CONCLUSION

It is concluded that the total biomass is composed by more than a half of invasive grass and no more than approximately 17% of the native vegetation biomass counted for. Possibly, the accumulation of biomass of the invasive species is limiting the regeneration and establishment of native species. Moreover, this accumulation of biomass was probably favored by the vulnerability of the exposed area, based on the history of this place of study.

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KEYWORDS: invasion biology, Melinis minutiflora, conservation unit, area under regeneration

PT1.08

CLIMATIC NICHE AND POTENTIAL DISTRIBUTION OF PINUS CONTORTA AN INVASIVE PINE IN SOUTH AMERICA: DO DIFFERENCES EXIST AMONG VARIETIES?

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Pinus contorta, is regarded one of the most invasive conifers worldwide (Richardson and Rejmánek 2004). This species has been planted in different countries of the southern hemisphere. In most cases, it has become invasive, thus colonizing and establishing in native ecosystems (Richardson, 1998). *P. contorta* is comprised by a complex of varieties which differ morphologically and ecologically: *P. contorta var. bolanderi, P. contorta var. murrayana, P. contorta var. latifolia* and *P. contorta var. contorta* (Geral E. Rehfeldt et al 1999). These four varieties have traditionally been well recognized (Critchfield 1957), however, this fact has been consistently ignored in invasion studies (*Réjmanek* and *Richardson 1996*). Clearly, this is a simplification and it is probable to expect significant differences in climatic requirements, impacts and geographic extent. In this study, we compared the climatic niche among four varieties of *Pinus contorta*, we constructed their potential distribution in the native range as well as toward South America (SA).
We obtained presence data of the four varieties in their native range. We also obtained climatic variables from Worldclim (http://www.worldclim.org/), previous selection to correct for colinearity. Presence points were converted into density values using a kernel function to smooth the distribution of the densities. We constructed climatic niche models and compared them using *Schoener´s D* overlap index (Schoener, 1970). We constructed Species Distribution Models (SDMs) using the software Maxent.
Climatic niche and potential geographic distribution varied significantly among varieties. The most similar varieties were *var contorta* and *var. latifolia* (niche similarity = 0.549) while the most differents were *var. latifolia* and *var bolanderi* (niche similarity = 0.076). In SA, *var contorta* projected the largest areal extent followed by *var latifolia*, then by *var bolanderi* and finally by *var. murrayana*.
In summary, intraspecific varieties reflect ongoing differentiation processes within species, a fact that ought to be considered in niche dynamic and biogeography studies. In the case of *Pinus contorta*, our result indicate that *P. contorta var contorta* could be the most invasive variety, a fact that ought to be considered by foresters when they decide to establish plantations in S.A. Further experimental studies ought to be conducted to test this hypothesis

ACNOWLEDGEMENTS: We acknowledge to project ICM P05-002, Institute of Ecology and Biodiversity

KEYWORDS: Pinus contorta, biological invasions, climatic niche, geographic distribution

PT1.09

DO THE REMOVAL OF NEEDLES ENHANCE THE INITIAL REGENERATION OF THE CERRADO VEGETATION IN A FORMER PINE PLANTATION?

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INTRODUCTION: Species of *Pinus* are some of the many invasive species that occupies large areas of the Southern Hemisphere, such as Australia and Brazil (Simberloff, 2009). Studies on the long-term consequences of *Pinus elliottii* invasion in Cerrado showed that these exotic trees cause visible changes in the composition and structure of the vegetation. Less than 10 years after pine establishment, a dense forest of pine trees can be observed, where competition for light becomes the main ecological filter driving the community (Abreu, 2011). However, mechanisms regarding the restoration of areas where pine trees were removed remains unknown. Thus, the aim of this study was to evaluate a management technique (the removal of pine needles) to enhance the initial regeneration of Cerrado species in areas where *Pinus elliottii* was removed.

METHODS: 40 experimental plots (10x10m) were established in a former *Pinus elliottii* plantation and the following treatments were applied: NR - needles removal and C - control (20 plots/ treatment). Before the experiments, five supblots (1x1m) were randomly established within each plot. In the subplots, the cover of bare soil, dead biomass, graminoids, forbs, palms and shrubs (<1 m) were estimated before and after the removal of needles.

RESULTS: Needle removal plots showed a higher cover of bare soil than control plots. There was an increase in ca. 6% of palm cover in both C and NR plots four months after the removal of needles. No establishment of graminoids could be observed in control plots, while in NR plots some graminoids could be observed (0.3± 1.5%). cover of shrubs increased ca. 2% in both treatments. Finally, forbs increased 0.9%, in control plots.

CONCLUSION: In short-term, the initial regeneration of graminoids was favored by the removal of needles, whilst the other groups were not affected by the treatment. In short-term, in all treatments there was vegetation regeneration after removal of *Pinus elliottii*. However, long-term studies may be important to show how the needles affect the regeneration of Cerrado species.

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KEYWORDS: regeneration, Cerrado, needles, Pine plantation

PT1.10

SYMPHYTUM (BORAGINACEAE) IS A GENUS OF NOMADIC SPECIES

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In recent years, research of alien flora in the botanical gardens of Moscow was started. It has been found that *Symphytum* (Boraginaceae) is most active genus, all species of this genus is detected outside the sites of collections.
Symphytum L. is a small genus with 20–25 species, native to Europe, the Caucasus and Asia Minor. Some species are grown as ornamental plants or forage. In the Moscow region only *S. officinale* is a native plant. This species grows in damp meadows or on the banks of the rivers, but sometimes it occurs as an urban weed. In addition, at the botanic gardens of Moscow 7 introduced species of Symphytum and some hybrids are grown.
S. caucasicum M.Bieb. is the most widely distributed.This species was introduced into wider culture about 30 years ago as an ornamental plant, it differ long flowering and unpretentious. Currently, *S. caucasicum* is often found on waste grounds in cities, country settlements, forest edges and country roads. Because of the ability to form root suckers, it often forms large thickets. Hybrids with *S. officinale* are known — *S.* × *mosquense* S.R.Majorov et D.D.Sokoloff, that only a few times detected.
S. asperum Lepechin was introduced to the culture in the 19th century as an ornamental plant, in the 20th century it was used as forage plant. Currently *S. asperum* can only be found in old parks as a relic of cultivation and in the collections of botanical gardens. In many places, this species was replaced by hybrid *S.* × *uplandicum* Nyman (*S. asperum* ×*S. officinale*), which is more robust and higher growth.
S. tauricum Willd. is known in the collection of the Main Botanical Garden of the Russian Academy of Sciences. This species escapes from culture and grows in a shady park places. In the one old park near Moscow *S. tauricum* is known since the XIX century. Probably hybridisation with other comfrey species takes place, because the some plants with bluish corolla was found in the garden of the Russian Academy of Sciences (yellowish or white corolla is typical for *S. tauricum*).
Three other species with yellowish corolla (*S. cordatum* Willd., *S. ibericum* Steven ex M.Bieb., *S. tuberosum* L.) also escaping from the collection of the Main Botanical Garden. They are grow in shady places under trees. Such resettlement is possible only through seed reproduction, because the individual plants are spaced from each other.
S. azureum H.C.Hall is only known in the Botanical garden of the Moscow University as a weed. Earlier this species in the collection of botanical garden was not cultivated. This comfrey grows in open places, resistant to mowing and propagated by root suckers. The origin of this species is unknown. Apparently, *S. azureum* was originated in culture as an ornamental plant.
Thus, all species of genus *Symphytum*, which are grown in the moscow botanical gardens, escaped from the culture and naturalized near places of cultivation. *S. caucasicum*, *S.* × *uplanditcum* are naturalized outside the botanical gardens, and are found at waste grounds, roadsides, forest edges. Easy hybridization between the *Symphytum* species leads to genetic pollution, same hybrids are capable to active dispersal (eg., *S.* × *uplanditcum*).

KEYWORDS: Symphytum, alien species, botanical garden

PT1.11

BIOLOGICAL INVASION OF THE ASIATIC TREE *SYSYGIUM JAMBOS* L. (ALSTON) (MYRTACEAE) IN URBAN FORESTS OF SOUTHEAST BRAZIL.

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Introduction

Natural ecosystems in urban landscapes that regenerate from human impacts are known as novel ecosystems (Hobbs *et al*. 2006). A central question on its studies is to quantify invasive species importance on the structure and dynamics of communities, where those species assume primordial roles (Marris 2009).

Forest inventories done in urban fragments of Atlantic Forest in Juiz de Fora (Minas Gerais, Southeast Brazil) are finding patterns similar to those reported to neotropical novel ecosystems, with high representativity of exotic trees. Among these species, *Syzygium jambos* L. (Alston), native of Tropical Asia, stands out by its high density in the studied fragments.

Objectives

Evaluate the population structure and representativity of the exotic species *Syzygium jambos* in urban forest fragments in Southeast Brazil.

Methods

We studied three urban fragments of Semidecidual Forest in Juiz de Fora, Minas Gerais, Brazil, two located on the Botanical Garden of the Universidade Federal de Juiz de Fora (UFJF) (areas 1 and 2) and one on the UFJF Campus (area 3). In each, 25 permanent plots (20 x 20 m) were randomly placed to survey adult tree individuals (diameter at breast height, DBH ≥ 5 cm). In each plot, a subplot (5 x 5 m) was placed to survey tree regeneration (height > 1 m and DBH < 5 cm).

Results

Among the adult trees, *S. jambos* occurs as the 2nd most abundant in area 3 (148 ind/ha, 9.7% of total density) and as 4th (182 ind/ha, 8.9%) e 5th (105 ind/ha, 4.9%) most abundant in areas 1 and 2, respectively. In tree regeneration it occupies the 1st position of densities in area 3 (2480 ind/ha, 31.8%), the 3rd position on area 2 (1920 ind./ha, 9.8%) and the 6th position in area 1 1120 ind./ha, 6.6%).

The distribution of diameter classes shows a typical reverse "J" curve, with more than 65% of individuals on the first class (diameter < 10cm), indicating populations with a great number of young individuals that can replace dead adults.

Conclusions

The results demonstrate the great colonization potential of this species in the urban forests studied, forming self regenerating populations with expressive densities. This of concern because *S. jambos* is considered one of the most invasiveness species in the Neotropics (Rejmanek *et al.* 1996), with a wide range of invasion on diverse kinds of forests, especially urban forests (Kueffer *et al*. 2010). This study shows the necessity to monitor the population dynamics of this species, a fundamental step to determine its trajectories and outline strategies for its management.

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Acknowledgements: FAPEMIG (financial support, Project 04438/10), CAPES and CNPq (scholarship).

KEYWORDS: Brazilian Atlantic Forest, Novel ecosystems, permanent plots

PT1.12

DENSITY DEPENDENT MORTALITY IN AN URBAN FOREST INVADED BY THE ASIATIC TREE SYSYGIUM JAMBOS L. (ALSTON) (MYRTACEAE).

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Introduction: Urban forest fragments are vulnerable to frequent human impacts and tend to have a typical secondary structure, with strong impediments to the progression of forest sucession. This can promote a gradual homogenization of biodiversity (Mckinney, 2006) becoming more susceptible to biological invasions.
Syzygium jambos (L.) Alston is a native species from Southeast Asia introduced in Brazil in the 18th century (Carvalho, 2005). *S. jambos* is listed as one of the worst invasive species in Neotropical forests, with wide invasion capacity in different forest types, including urban forests (Kueffer et al., 2010).

Objectives: The goal of the study is to evaluate if the *S. jambos* population structure is related to the distribution of native dead trees in the community.

Methods: We studied a urban fragment of Semidecidual Forest in Juiz de Fora, Minas Gerais, Brazil. 25 plots (20 x 20 m) were randomly placed to survey adult tree individuals (diameter at breast height, DBH ≥ 5 cm). Chi-square normality test was applied to analyze the spatial structure of *S. jambos* individuals and dead standing trees. Pearson correlation test was applied to test the relation between *S. jambos* individuals and dead trees.

Results: We found 182 individuals of *S. jambos* and 437 dead trees. Chi-square test didn't found significant values to *S. jambos* (χ^2=2.04, P=0.15) and dead trees (χ^2 = 0,12; P = 0,73) distributions. Correlation between *S. jambos* density and dead trees density was positively significant (r = 0,59; P < 0,01).

Conclusions: Chi-square test showed that both *S. jambos* and dead trees are widely spread along the forest fragment. The relationship between mortality and *S. jambos* individuals is a strong indicative of competitive exclusion with other tree species of the community, a fact justified by *S. jambos* good dispersion, great shading of its crown, diffuse and shallow roots, what tends to difficult the development of other plant nearby. This is a first record of this competitive exclusion and future studies of the population dynamics will be necessary to a better understand of this process.

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Acknowledgements: FAPEMIG (financial support, Project 04438/10), CAPES and CNPq (scholarship)

KEYWORDS: Atlantic Forest, biologic invasion, alien plants, novel ecosystems

PT1.13

PINUS CONTORTA INVASION IN PATAGONIAN CHILEAN STEPPES: SPATIAL PATTERNS AND INTERACTIONS AT A STAND SCALE

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Pinus contorta has been reported in several countries as invasive and Chile is not the exception. In the Chilean Patagonian territory, *P. contorta* was introduced in several ecosystems for control erosion and for commercial purposes. One of the most affected ecosystems is the native steppe. These landscapes, dominated for cushion species, are now in a changing state. Seeds from adult pine plantations are dispersed with Patagonian winds, reaching great distances. In a few years, no more than a decade, the landscape has changed, going from a Patagonian steppe to a pine forest especially in the first 100 meters of the invaded area. The objective of this study is to describe the intra-specific spatial interactions of *P. contorta* and those with the resident vegetation. This study analyses the spatial pattern of *P. contorta* invasion at three one-hectare plots, differentiated from each other for the proximity to the initial plantation and the direction of the wind. We recorded the geographical position of every pine for each plot, the cushions and bare soil percentage of cover and physics attributes of each pine like height, DBH and crown area, for each pine in the three plots of study. Considering our results, spatial pattern of the *P. contorta* invasion seems to be random, just influenced by the propagule pressure and prevalent Patagonian winds. For intra-specific analysis, we studied the pattern of Pines at four different height classes. The most lowest class, corresponding to Pines < 10cm, are aggregated to the most highest Pines with heights > 100cm. For the other height classes we found a random pattern. No positive interactions were found between the resident vegetation and pines, just some negative effects with high covers of tussock grasses. Considering the rapid advance of the invasion, we can expect a continuous advance of the invasion in the landscape over the next decade, independently of the spatial heterogeneity of the resident vegetation at the stand scale. This study was funded by Fondecyt 1100792, ICM P05-002 and CONICYT PFB-023. This research is part of the work done by the Biological Invasions Lab (LIB), IEB-UdeC. http://www.lib.udec.cl.

KEYWORDS: Biological invasions, Pinus contorta, Patagonian steppe, Chile

PT1.14

NATIVE AND NON NATIVE SPECIES IN A CHRONOSEQUENCE OF FOREST RESTORATION

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Ecosystems containing new combinations of species arise as a result of human action and have been called novel ecosystems. Since native and non-native species have been often used for ecological restoration, the outcomes of restoration projects can be novel ecosystems. The question that arises is: what happens with native and non-native species under the influence of ecological filters and ecological processes in these ecosystems during succession? To answer this question we assessed the proportions of native and non-native species planted and naturally regenerating in a chronosequence (6 to 53 ys) of 21 Atlantic riparian forests undergoing restoration in southeastern Brazil. We tested two alternative hypotheses: 1) exotics tend to dominate the communities, and 2) the natives tend to dominate the communities over time. We analyzed the proportion of exotic species and their relative density among plants in natural regeneration through time and also in comparison to the set of species planted at each site. The proportion of native species as well as their relative density in the understory tend to increase with the age of communities being restored. The relative density of exotics among plants spontaneously regenerating was lower than the proportion in which they were planted in 33% of sites and did not differ for the remaining sites. The native species planted as well as those arriving from the regional species pool seem to take advantage over non-natives under the biotic and abiotic filters driving the community assembly. Thus, the novel forests from the first years after planting tend to become gradually more similar to the native forests over time.

Financing: Secretaria de Meio Ambiente do Estado de São Paulo; Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP (Process 2009/11752-8); Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq (Process 143423/2009-6 and 303402/2012-1).

KEYWORDS: restoration ecology, exotic species, novel ecosystem

PT1.15

WHAT DETERMINES THE INVASIBILITY OF GRASSLANDS IN THE PAMPA BIOME, IN SOUTHERN BRAZIL?

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INTRODUCTION

The invasion of exotic species is considered one of the main causes of depletion of biodiversity (GISP, 2010). The process of invasion was classified into a number of stages by several authors (Freckleton et al., 2006; Marchetti et al., 2004), whose sum proposed six stages: introduction, establishment, naturalization, dispersion, distribution population and spread of invasion (Henderson et al., 2006). Understanding this process in natural environments is generally know the steps involved in the expansion of a particular ecosystem. In the field of ecology of the invasion, the susceptibility of environments to invasion by species from other regions of the world is called invasiveness. According Kleunen et al. (2010), the major goal in ecology is identifying determinants of invasiveness, types of characteristics that promote or peculiarities, which are of utmost significance in general for an understanding of the success of the plant, particularly for understanding the mechanisms of exotic plants invasive. The first evidence to evaluate the susceptibility of a given area is the recognition of sources of potentially invasive species (Davis, 2009). Williamson (1996) mentions that the chances of an invasive species expand their range and occupy new areas successfully is due to potential scattering (propagule pressure), number of propagules emitted in a single dispersal event associated with quality. The success of the dispersion depends on the mechanisms and physiological characteristics and structural bodies find a compatible environment for its survival. Groves (1991) mentions that only 10% of the introduced species are established, and 10% of these become invasive, persisting to a new set of abiotic factors and using resources available in the environment for its maintenance.

The evaluation of the environmental variables and the importance of soil management on the structure and composition of grassland formation where there is extensive cattle farming, agriculture, and mainly eucalyptus represents an important step to identify invasibility processes in protected areas.

OBJECTIVES

This study aims to identify determinants of invasiveness in the Pampa grassland sites. Specifically, we intend to evaluate how the invasion of exotic plant species is related to the composition and structure of native flora, historical land use and regional climate in a region heavily modified by forestry.

METHODS

Location: Our data collection was conducted in twenty-two sites in Rio Grande do Sul state, Brazil, they all consist of grassland interspersed with eucalyptus plantations with different historical land use and current management.

Data sampling: Sampling was performed in blocks of five plots to determine the coverage of species. We identified and estimated cover of all vascular plants in 0,25 m^2 (n=215) at each site were established transects 50 which were distributed as a standard 5 plots (in 5x5m)

Analysis: For each sampling unit were calculated following phytosociological parameters: absolute frequency (FA), relative frequency (RF), relative cover (RC) and the index of cover (VC), as (Mueller-Dombois and Ellenberg 1974). For multiple regression analysis was used as the predicted variable relative cover of exotic species (CREE), obtained by sampling unit by the sum of absolute cover of exotic species divided by the sum of absolute cover of all species.

RESULTS

Two hundred and seventy species were identified, including exotic species, which is an important data that demonstrates the high floristic diversity (roughly 10% of grassland species of Rio Grande do Sul state) established on the regional scale. In general the communities with higher species diversity demonstrated to be less invaded ($p=0.06$). Communities with lower species diversity were those with a history of more intensive land use and were demonstrated to have a close relationship with exotic species ($p=0.001$).

CONCLUSION

These areas thus may also present source areas for dispersal of exotic species, thus possibly increasing risks of plant invasions in the Pampa biome, and especially in farms with eucalyptus plantations the southern part of Rio Grande do Sul state

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KEYWORDS: Pampa Biome, Invasibility, Grassland, Environmental Variables, Land Use

PT1.16

CONTROL OF *PTERIDIUM ARACHNOIDEUM* (KAULF.) MAXON INVASION AND SECONDARY SUCCESSION OF GALLERY FOREST AFTER FIRE IN THE IBGE RESERVE (RECOR), BRAZIL.

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INTRODUCTION: *Pteridium arachnoideum* (bracken fern) is an opportunistic pteridophyte that invades forests disturbed by fire (Roos, Inv. Plt. Sci. Mgmt. v.3(4) p.402, 2010). There are indications that this species changes the course of secondary succession due to its high growth rate, thick canopy layer and the ability to acidify soils, which makes this fern a strong competitor in relation to native plants (Marrs, Ann. Bot. v.85(6) p.857, 2000). One month after the wildfire that burnt 95% of the RECOR area in September 2011 it was started an effort to restore the forests previously invaded by *P. arachnoideum.* In this burnt and fern invaded areas the fern fronds were manually cut and tree seedlings were planted. **OBJECTIVE:** The objective of this study was to test the effects of cutting *P. arachnoideum* fronds on the regeneration of native plants in three sections of gallery forests disturbed by fire. **METHODS:** Four months after the fire, in the restoration areas, it was carried out an experimental cut of fern fronds on 1 m^2 plots (1m x 1m). In each gallery forest section, 20 plots were randomly allocated and the fern frond was clear cut. In each forest, five plots (six in one of them) were randomly selected outside and adjacent to the restoration areas to be used as experimental controls. In each plot all the vascular plants were identified and it was measured the ground cover of each species; the number of individuals by species and height classes; and the maximum fern canopy height. This measurements were taken in March and October 2012, before and after the dry season. **RESULTS:** In the 76 plots sampled in March it was found 6,440 individuals of native plants, belonging to 84 species. 20% of this species are ruderal plants associated with agriculture. Only five individuals were from four tree species. The most frequent habits were herbs (mostly grasses) and vines. Before cutting the fronds of *P. arachnoideum,* it was covering more than 50% of the ground for 53 plots and more than 80% for 38 plots and the maximum canopy height was in average 1.3m (s.d.=0.37) (only 25 native individuals had more than 1m). The cutting treatment decreased significantly the density of fronds ($F_{1,70}$=0.42; P=0,5), ground cover ($F_{1,70}$=13.8; P<<0.01) and maximum canopy height ($F_{1,70}$=6.05; P=0.01) of *P. arachnoideum.* This decrease of the invasive fern dominance reflected on significant increase in richness ($F_{1,70}$=4.3; P=0.04) and ground cover ($F_{1,70}$=5.7; P=0.01) of native plants. **CONCLUSIONS:** Even though the results showed significant and positive effects of the fern cutting treatment, this might be just a temporary event if cutting is not repeated. Several cutting treatments showed to be efficient to control *P. aquilinum* (Stewart, Ann. of Bot. v.101, p.957, 2008)*,* so the same might be true for *P. arachnoideum* as our results suggested*.*

KEYWORDS: Fire disturbance, fern invasion, secondary succession, gallery forests

PT1.17

INVASIVE ALIEN TREE SPECIES IN CONSERVATION AREAS: MONITORING AND MANAGEMENT

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Introduction

Exotic species are considered the second greatest threat to global biodiversity, agriculture and human health, second only to a directly destruction by human exploitation (MURPHY, 2006). Invasive aline tree species (IATS) can be define as exotic species with high capacity for growth, proliferation and spread, able to modify the composition, structure or ecosystem function (MATOS, 2009). The process for biological contamination of the environment by invasive species refers to the damage caused by species that do not grown naturally in that ecosystem, but are naturalize, this species begin to disperse and cause changes in the ecosystem, not allowing its recovery naturally (ZILLER, 2006).

The impact of invasive species is ecologically complex, covering levels of ecosystem, habitat, community, species and even genetic (KAIRO, 2003). This is a very special problem when related to the loss of biodiversity in protected areas (MIELKE, 2012). Even when populations of native species are not completely extirpate for invasive species, their genetic constitution can be affected (selective loss of genotypes, changes in the gene pool (RICHARD, 2000). It is estimated that two-thirds of native species extinctions involves competition with invasive species, which are considered as the biggest threat to biodiversity in isolated geographical systems (UNEP, 2011). Because of that, in Brazil, there is a specific law regarding the presence of invasive alien Trees (IATS) in public areas, being obligatory their eradication and control in order to prevent the enlargement of biological contamination (PARANÁ, 2007).

However, eradication and/or control a kind of high invasive capacity is not an easy task. It requires the application of different associated techniques and, the effect is not always what was expected (GLEADOW, 2007). All available alternatives imply species ecology better understanding, identifying the factors and/or processes that once interrupted or altered prevent the establishment of the IATS. In this context, studies on the population dynamics could be the first steps to understand the behavior and development of a species over time. The dynamics of a plant species significantly influence the composition and structure of communities and the direction taken by the ecological succession (GUARIGUATA, 2001). Knowing the dynamics of regeneration is essential for the proper design and implementation of management plans, forestry treatments (RAYOL, 2006) and the maintenance of biodiversity conservation.

At the Curitiba Municipality (Paraná State, Brazil), there are 33 urban conservation units (covering 313 ha), representing approximately 5% of the remaining Araucaria Forest. These areas have being suffering the consequences of human disturbance arising from urbanization processes, including biological contamination by invasive alien trees. Since 2007, the city has started a long-term project, aiming to replace the exotic species with native species in landscaping and urban forestry as well as eradication or control of invasive alien trees of Conservation Units in Curitiba (BIOCIDADE, 2013).

A first step on this perspective was a general IATS census performed in all the 22 conservation units, were eight tree invasive alien species were identified (see MIELKE, 2012). Based on that, a more detailed study was performed in one conservation unit focusing on *Pittosporum undulatum* Vent. population dynamics, in order to establish proper controlling measures for it (see MIELKE, 2012).

Objectives

In the continuation of this effort, aiming to provide additional basis for better understanding of the global dispersion of IATS, as well as support a local control in each Conservancy Unit in Curitiba, a second part of the project is being developed. At this stage, the focus is to analyze the progression of the alien species invasion in the conservation units, comparing with the results of the 2007 census.

Specifically, the project objectives at this phase are:

- Update the state (qualitative and quantitative) of tree alien species (adult component) invasion at the 22 Curitiba municipal conservation units;
- Identify and evaluate the pattern of regeneration of IATS in the different studied conservation units.
- Define the best strategy to control the invasion and to extirpate and replace the identified invasive tree species.
- Design a management plan related to invasive tree species to be applied at each Curitiba Municipal Conservation Units.

Methods

The Project covers the 22 conservation units (Parks) of Curitiba, Paraná State, southern Brazil, as follows (forest remnant area): Atuba (4.795,89 m²), Nascentes do Rio Belém (8.852,51 m²), Portugal (16.965,4 m²), Clementina (17.908,48 m²), Gutierrez (25.662,41 m²), Alemão (28.042,7 m²), Iberê Matos (29.487,94 m²), Cambuí (38.662,01 m²), Zaninelli (38.959,15 m²), Capão da Imbuia (40.718,9 m²), João Paulo II (49.333,44 m²), Fazendinha (53.176,11 m²), Trabalhador (93.529,25 m²), Tanguá (94.715,86 m²), Jardim Botânico (100.351,3 m²), R. Maack (101.958,91 m²), São Lourenço (110.761,41 m²), Barreirinha (113.019,71 m²), Tinguí (153.029,33 m²), Passaúna (36.6399,71 m²), Barigui (645.375,71 m²) and Iguaçu (1.663.637,58 m²).

Curitiba city is located at 934.6 m above sea level. This region is covered by the Araucarian Forest. The climate is classified, according to Köeppen, as subtropical climate Cfb-mesothermal, humid, with cool summers and severe frosts, no dry season. The average annual temperature is 16.5 ° C (MAACK, 1981).

The census is being conducted, second ROTTA (1977), covering all the forest remnant areas, in the 22 Conservation Units, focusing on adults IATS (higher than 1.3 m tall; DBH ≥ 5 cm) and its regeneration component. Through free walking around the forested area, the adults IATS are identified, GPS located and measured (height and DBH - diameter at breast height). Using 1m x 1m plots, the regeneration component of the IATS are identified, evaluated and registered. The quantity of plots using in this evaluation is dependent of the total size of the forest area at the conservation units, resulting in 10 parks with 40 regeneration plots, 9 parks with 80 regeneration plots, 2 parks whit 120 regeneration plots and a one park with 240 plots. 70% of the plots were disposed in a systematic way and 30% of them were randomly set. For each plot, GPS located, it is being registered the level of opening using a canopy spherical densiometer.

Results

So far, 27.27 % of the 22 Curitiba conservation units were evaluated. Almost all studied parks showed highest IATS compared to 2007 census. As expected, the parks with the highest number of representative showed also highest density of natural regeneration. In only one park, it was observed a decrease of IATS presence, the Jardim Botânico Park. This Park was the only one where it was register a reduction of IATS presence, compared to 2007 census. After 2007 this Park was submit to a IATS controlling and extirpation program. As a positive consequence it was evidenced that the native species *Araucaria angustifolia* (Bertol.) Kuntze. is in an expansive dynamic regeneration. This native tree is an important component to ecological balance conservancy. These data show how the constant monitor and control can minimize the impacts of IATS. *Ligustrum japonicum* W.T.Aiton, *Pittosporum undulatum* Vent., *Hovenia dulcis* Thunb., *Morus nigra* L., *Pinnus* spp., *Eucalyptus* spp. were the species identified with the higher level of infestation. Among those, *Ligustrum japonicum* and *Hovenia dulcis* must be seeing as the strongest threat due to their higher regeneration capacity. *Eryobotrya japonica* (Thunb.)Lindl. a species that was not referred as IAT in the 2007 census, was registered in various parks at the present census showing a high regeneration potential.

Conclusion

The current census is showing an important increasing of IATS contamination in the municipal conservation units in Curitiba (Parana State, Brazil), since 2007. The IATS prevention, control, eradication and management must be defined, accordingly to each situation and each species identified in the different Parks. It is relevant solve the problem of IATS as early as possible, especially in the smaller affected areas.

The Project is carried out by the Laboratory OIKOS at the Department of Botany at the Federal University of Paraná State (UFPR) and the Curitiba Municipal Secretary of Environment. It is financially supported by the Foundation O Boticário Nature Protection, with administrative support from the UFPR Foundation (FUNPAR).

Table 01: Number of individuals register in the adult IATS census (2007 and 2013) in some Municipal Conservation Units (Curitiba, Paraná, Brazil)

	Studied Municipal Parks (total area (m2))											
	Alemão (28.042,70m²)		Portugal (16.965,40m²)		Nasc. Rio Belém (8.852,51m²)		Capão da Imbuia (40.718,90m²)		R.Maack (101.958,91m²)		Jardim Botânico (100.351,30m²)	
Species	2007	2013	2007	2013	2007	2013	2007	2013	2007	2013	2007	2013
Ligustrum japonicum	11	20	35	96	1	4	16	128	33	187	6	5
Morus nigra	28	54	25	43	0	0	5	23	6	28	14	13
Eucalyptus spp.	0	1	2	1	0	0	0	0	1	1	0	1
Pittosporum undulatum	1	1	24	64	0	1	0	3	0	0	0	0
Hovenia dulcis	22	14	9	11	4	4	4	6	42	67	31	12
Pinnus spp.	12	2	0	0	0	0	0	0	0	22	0	0
Eriobotrya japonica	9	12	17	22	0	0	4	6	4	10	6	2

Table 02: Number of seedlings and young individuals (natural regeneration) registered at the 2013 IATS Census in some Municipal Conservation Units (Curitiba, Paraná, Brazil)

	Studied Municipal Parks					
Species (sampled area)	Alemão (40m²)	Portugal (40m²)	Nasc. Rio Belém (40m²)	Capão da Imbuia (40m²)	R.Maack (80m²)	Jardim Botânico (80m²)
Ligustrum japonicum	76	7	7	6	38	64
Morus nigra	8	0	4	6	21	18
Eucalyptus spp.	0	0	0	0	0	0
Pittosporum undulatum	21	0	0	2	0	0
Hovenia dulcis	0	0	52	1	0	33
Pinnus spp.	0	0	0	0	0	0
Eriobotrya japonica	0	0	0	10	5	17

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KEYWORDS: Biological contamination, Invasive alien tree, growing potential of infestation

PT1.18

FORMATION OF SECONDARY DISTRIBUTION RANGE AND INTRASPECIFIC VARIABILITY OF BIDENS CONNATA

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Variability of taxonomic characters within *Bidens connata* Mühl. ex Willd. was studied both on herbarium (P, LE, MHA) and living specimens with special attention to the diagnostic characters of intraspecific level.

Bidens connata started to establish a secondary distribution range in Europe in 1890s – for the first time is was collected in 1895 in Brandenburg for Flora Marchica [1]. Next year *Bidens connata* var. *fallax* (Warnst.) Sherff was found ex-cultivation in Hamburg [2] and in Potsdam [3]. The majority of European specimens of *B.connata* differ from the type variety (*B. connata* var. *connata*) within the natural distribution range (the European specimens were even attributed as a separate species *B.decipiens* Warnst.): there are no ray flowers in the inflorescence, the first real leaves less narrow than in American specimens, clearly petiolate, with less number of denticles along the margin; denticles big and irregularly located. Outer bracts of involucres clearly phylloid, 3-6 cm long .

Bidens connata has been rarely recorded for Europe until XXI century. Only recently distribution range of *B. connata* expanded further East, and invasive populations of *B. connata* appeared in Russia (Kaluga and Vladimir Provinces - MHA).

1. Flora Marchica 1895, leg. E. Neumann (P)
2. Hamburg, 1896, leg. J. Schmidt (4107) (P)
3. Potsdam, 1896, leg. Dr. Behrendsen, s.n. (LE).

KEYWORDS: bidens, invasive species, variability

PT1.19
FORMATION OF SECONDARY DISTRIBUTION RANGE AND INTRASPECIFIC VARIABILITY OF BIDENS FRONDOSA

Vinogradova Y[1], Mayorov S[2] - [1]Main botanical garden, [2]Moscow state University

Variability of taxonomic characters within *Bidens frondosa* L. was studied both on herbarium (P, LE, MHA) and living specimens with special attention to the diagnostic characters of intraspecific level. *B. frondosa* within the natural distribution range is represented by a number of tiny populations of self-pollinating plants; only a few intraspecific taxa are recorded for Europe (secondary distribution range). In the Montpelier Botanic Gardens (France) in 1762 only plants with non-verrucate achenes were cultivated [1]. During the following 100 years similar plants have been rarely recorded for Europe (Poland, Germany, Portugal, Italy). Besides, they never escaped from cultivation. In St.Petersburg Botanic Gardens the plants with following characters were cultivated: 1) с non-verrucate achenes and long bracts of involucres [2]; 2) – with triple-divided leaves and yellowish-green achenes [3]. Both "varieties" also didn't escape from cultivation. In Botanic Gardens of Lucca (Italy) in 1861 the specimen similar to *B.frondosa* var. *stenodonta* Fernald & H.St. John was collected (lanceolate denticles with long acumen at the top on leaf segments' margin; long bracts of involucres, 2-4 times exceeding length of heads – [4]). At the same time (1861) in the vicinity of the Garden the specimen with 5 segments of leaf blade [5] was collected, in 1874 г. – the plant with long slender petiole, leaf blade divided in 3 segments [6].
Only in 1896 in Potsdam (Germany) the specimen, characterized by the following set of characters was recorded – leaf dissected in 3 segments, short bracts of involucres and brownish verrucate achenes [7]. The plants of this "variety" demonstrated a high invasive potential, starting to penetrate in natural communities of flood-plains. At present, plants of this "variety" are widely distributed through the secondary distribution range, the populations being pretty similar morphologically. Thus, the modern secondary distribution range of *Bidens frondosa* is formed by ancestors of that initial population.
Around 1950s *B. frondosa* f. *anomala* (the diagnostic character - upward denticles of achenes' arista) – started to enlarge its distribution range in Europe (in 1954 it was recorded for Germany, in 1960 - for Poland, later - for England, the Netherlands, Belgium and Czechia). At present that taxon is widely distributed, being dominant along the river Ruhr and the channel Rhine-Herpe. In Russia that taxon is recorded only for Moscow [8].

A few other naturalized populations with different set of characters are poorly represented in herbaria: the specimen with very short bracts of involucres (2 times shorter than a head) and almost rounded heads was collected in Chatillon/ Loire (France) in 1973 [9]. In Kaluga Province (Russian Federation) the plants with the same set of characters plus pubescent shoots were collected in 2008 [10].

1. Montpeller, cult. 1762 (**LE**)
2. St. Petersburg, cult. 1825 (**LE**)
3. St. Petersburg, cult. 1851 (**LE**).
4. Lucca 1861 Anon., s.n., (**P**)
5. Lucca 1861 leg. Savi (P)
6. Lucca, 1874, leg. E. Levier (P)
7. Potsdam, 1896 frondosa
8. Moscow, 2003, leg. A.Skvortsov (**MHA**)
9. Chatillon/Loire, 1973, leg. G. Aymonin (P)
10. 10. Kaluga, 2008. leg. N. Reshetnikova (**MHA**)

KEYWORDS: bidens, invasive species, variability

PT2.01

HOW INVASIVE SILVER WATTLE IS CHANGING THE SOIL CHEMICAL PATTERN AND ABOVE- AND BELOWGROUND DIVERSITY IN THE ISLAND OF ELBA (ITALY)?

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Introduction. The Australian silver wattle (*Acacia dealbata* Link, Fabaceae) is one of the most invasive species in south-eastern Europe, southern Africa and South America. Recent investigations have proved that this species leads to changes in understory floristic composition, modifies the structure of soil microbes and increases soil nutrients content.
In the island of Elba (Tuscany, Italy) silver wattle invasion has been enhanced by recurring fire events, rapidly spreading over wide areas and showing an invasion rate rapidly increasing.

Objectives. The present study was addressed to test the hypothesis that silver wattle invasion alters soil chemical pattern and transforms the composition and structure of above- and belowground biota, decreasing the biodiversity of both understory plant species and soil bacteria and fungi of the invaded areas.

Methods. Vegetation and soil sampling was performed in macchia ecosystems in SE island of Elba. Three types of patch were differentiated along the invasion gradient: invaded patches with silver wattle as the dominant species, transition patches where the invasive and native vegetation are mixed and non-invaded patches with purely native vegetation.
In each of these areas, soil total organic C and total N were measured using elemental analyzer; concurrently species richness and diversity of understory plants, soil bacteria and soil fungi were determined. Plant richness was determined as the number of plant species per 50x50 cm plots and plant diversity was calculated by Shannon's index (H'). Richness and diversity of soil bacterial and fungal communities were assessed by PCR-DGGE and the cluster analysis of the resulting profiles was performed using UPGMA algorithm and Dice coefficient.

Results. An increase of total N was observed in invaded patches, whereas no significant changes in soil C content were found. As regards to understory vegetation, significant differences were found in species richness and diversity (H') between the different stages of invasion, with invaded patches showing significant lower number of species and diversity than both transition and non-invaded patches. No significant differences in species richness and diversity were observed for soil bacteria and fungi along the invasion gradient. Cluster analysis rendered different clusters for invaded soils separated from non-invaded and transition soils.

Conclusions. We conclude that silver wattle invasion is associated with a significant increase in total soil N, and that as a results above- and belowground diversity are seriously affected; more specifically, understory plant species are more sensitive to invasion than soil microbial communities.

Acknowledgments. This study was part of Regione Toscana QuiT project, POR-FSE 2007–2013. Finally, we thank the National Park of the Tuscan Archipelago for financial support.

KEYWORDS: Acacia dealbata, invasion, soil chemistry, diversity, understory plants, soil microbial communities

PT2.02
MEGATHYRSUS MAXIMUS IN RESTORATION SITES ON ATLANTIC FOREST, BRAZIL: LIMITATIONS ON SEEDLING REGENERATION

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INTRODUCTION
Megathyrsus maximus (Jacq.) B. K. Simon & S. W. L. Jacobs was introduced in Brazil for feeding cattle and expanded to the whole country. In restoration sites, it causes tree growth depression and even the exclusion of both planted trees and spontaneous regeneration (Mantoani et al. 2012; Ammondt et al. 2013). This research was intended to answer how *M. maximus* affects regeneration in young reforestations sites and if species of different sucessional categories show differences in response to the grass invasion.

MATERIAL AND METHODS
Reforestations with native species were studied in the Capivara Reservoir on South Brazil; 17 different sites aging from 40 to 110 months were selected and in each site 10 plots (10x10m) were installed. All woody species individuals taller than 10 cm were recorded and grass dry biomass was verified by four subplots (1m²) in each plot. Simple linear regressions were performed treating regeneration as dependent of *M. Maximus* abundance.

RESULTS
There are no relationship between the abundance and dry biomass of *M. maximus* with regenerating native (58) or exotic (10) species richness, but woody species abundance was negatively affected by *M. maximus* density (r^2=0.47; p=0.002) and dry biomass (r^2=0.48; p=0.001). Taking successional groups separately, only pioneer species was affected negatively by *M. maximus* density (r^2=0.40; p=0.005) and dry biomass (r^2=0.64; p=0.0001).

DISCUSSION
The absence of relationship between *M. maximus* abundance and woody species richness can be related with the influence of the distance to forest fragments that serve as a source of seeds for the restoration site (Zimmerman et al. 2000). However, *M. maximus* abundance and dry biomass affected abundance of woody species, possibly by competing for water and nutrients (Mantoani et al. 2012; Ammondt et al. 2013), and this effect was stronger for pioneer species. Another possible influence is the suppression of germination by impeding seeds to reach the soil surface in high grass cover spots (Mason et al. 2009).

CONCLUSION
M. maximus presence is harming native woody species regeneration in restoration sites, and pioneer species are most affected than late succession species.

ACKNOWLEDGMENTS
Authors thank to CNPq provided research grants to JMDT (grants 313854/2009-2 and 503836/2010-9), JD and MCM thanks CAPES for graduate course grants.

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KEYWORDS: Panicum maximum, pionners, reforestations

PT2.03
GLOBAL ANALYSIS OF IMPACTS OF NON-NATIVE PLANTS ON BIODIVERSITY
Vilà M, Rohr R, Espinar JL, Schaffner U, Pyšek P

INTRODUCTION

Numerous studies have focused on testing the ecological impacts of non-native plants. A recent review analysis have found that invaded sites by non-native plants have lower native plant species diversity than non invaded sites, but the generality of this pattern on animal species diversity is less clear (Vilà et al. 2011). Moreover, both the magnitude and direction of these impacts are highly context dependent (Hulme et al. 2013).

OBJECTIVES

To test whether the magnitude and direction of impact of non-native plants on native species richness varies between ecosystem types, climatic regions and plant traits while accounting for phylogenetic differences among non-native plants. This analysis includes 58 % more studies than Vilà et al. (2011) review.

METHODS

We combined phylogenetic regression and meta-analysis to study the impact of 106 non-native plants on native species richness based on 228 field studies. The effect size was computed as the log-transformed ratio in the average number of native species between control and invaded plots. We explored to which extent the effect size was influenced by (1) the non-native life form, (2) their clonality or vegetative reproduction, (3) whether the non-native species was N-fixing, (4) the type of invaded ecosystem, (5) the biogeographical region, and (6) if the study was conducted on an island. The analysis was done separately for the impact on plant and on animal richness.

RESULTS

We found that phylogeny of non-native plant species had a significant effect on impact to native plant and animal species. Clonal plant growth and phylogeny were by far the best predictors for the impact on native plant richness. Plant life form and N-fixing had also a significant effect. However, habitat type, biogeographical region, and insularity did not. Annual forbs had the strongest effect and trees had the weakest. Moreover, there were significant interactions between species traits. For example, clonal perennial forbs decreased native species richness but non-clonal, N-fixing perennial forbs increased it. Regarding the effect of non-native plant species on native animal richness, we found that only the phylogeny and insularity had a significant negative effect. Impacts did not differ much among plant traits, ecosystem types and regions.

CONCLUSIONS

Regardless of the particular habitat and geographical region invaded, the presence of a phylogenetic signal indicates that even once taken into account the life form, N-fixing, and clonal growth of the non-native species, species identity plays a key role in determining their impact, i.e., two closely related species tend to have a similar impact, more so on impacts to animal richness.

REFERENCES

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Vilà M. et al. 2011. Ecol. Lett. 14: 702-708.

KEYWORDS: biodiversity, impacts, plant traits, phylogeny, species richness

PT2.04

IMPACTS OF JERUSALEM ARTICHOKE (HELIANTHUS TUBEROSUS S. L.) INVASION IN NORTHEASTERN HUNGARY

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Introduction: Jerusalem artichoke (*Helianthus tuberosus* L.), which is native to North America, has been introduced to Europe as a crop plant in the 17th century. Due to easily running wild, by the 21st century it has been considered as an aggressive invasive plant throughout Europe. In the Carpathian Basin it is listed among the most dangerous so-called transformer species.

Objectives: The present work aimed at determining how various degrees of Jerusalem artichoke coverage influence the vegetation along freshwater streams in north-east Hungary.

Methods: In total 246 plots were sampled along ten streams. The sampling plots were 2 × 2 m in size, and were classified into 5 categories based on the degree of Jerusalem artichoke coverage: (1) 76-100% and (2) 51-75% – heavily infested; (3) 26-50%, (4) 1-25% – moderately infested; (5) no Jerusalem artichoke infestation. In plots with Jerusalem artichoke the height of 10 randomly selected individuals was measured and the percentage of bare ground was estimated. Data were analyzed with GRASS 6.4, Excel, Past (Normality tests, One-way ANOVA), Turboveg 2.92 and SYN-Tax 2000 softwares.

Results: Multivariate analyses (ordination - PCoA-Similarity ratio, classification - Ward's method) revealed that the plots can be divided into two well separated units, one of them comprising the moderately infested (1-50%) and the Jerusalem artichoke free plots, the other including the heavily infested ones (51-100%). In heavily infested plots the ten most frequent species included exotic species (e. g.: *Solidago gigantea*), which are aggressively spreading aliens in Europe. The least diverse plots were the most infected ones (76-100%) (Simpson and Shannon index, $p<0.001$); while the lowest number of species ($p<0.001$) was characteristic in both categories of heavily infested plots (51-100%). The randomly selected Jerusalem artichoke plants were significantly higher (up to 4 m high) in the most heavily infested plots (76-100%), compared to the 1-75% infested ones ($p<0.001$). The largest surfaces of bare ground, in some cases exceeding 50%, were found in the most heavily infested areas ($p< 0,001$), the relationship between Jerusalem artichoke infestation and bare ground being directly proportional.

Conclusions: Wild Jerusalem artichoke was found to be an invasive species in all ten study areas, contributing to reduced species numbers above 50% and lower diversity of native vegetation above 75% coverage. Soil erosion is another form of threat to the habitats, increased by the lack of plant coverage, which is also typical in the heavily infested areas.

ACKNOWLEDGEMENTS
The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement number 300639.
University of Pécs, Doctoral School of Biology
Szentágothai János Scholastic Honorary Society

KEYWORDS: erosion, freshwater streams, plant community, species diversity

PT2.05

IMPACT OF *LEUCANTHEMUM VULGARE* ON RESIDENT PLANT COMMUNITIES ASSOCIATED WITH INTRODUCTION TO NOVEL ENVIRONMENT

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Leucanthemum vulgare is a very popular plant in Europe occuring in well-managed meadows, whereas it has become invasive when introduced into the North America. This species is capable being dominant in both ranges however it may suddenly reach staggeringly high population densities in a new range that might cause ecological as well as economic problems, e.g. a low quality of feedstuff for cattle and horses. Consequently in Montana for example, areas infested by oxeye daisy (mostly open forests) are herbicided that might have many other undesirable side effects.
We suppose that the fundamental difference might be in how resident plant communities in both ranges respond to their dominants and what their resilience is following disturbance. We test this assumption by using a biogeographic comparison to reveal if the recovery of a plant community (resilience) after disturbance event (in terms of plant species richness, diversity and composition) differ in native and non-native range and if oxeye daisy recolonizing the site recovers better in native or invasive range following its removal. In both ranges, we have established six experimental sites in (semi)grassland areas where the given species reaches 50% cover at least. We designed each plot with a complete block of four randomized treatments: soil disturbance/ no seed addition, soil disturbance/seed addition, no soil disturbance/no seed addition (control), and no soil disturbance/seed addition. Seed addition means that seed of six common native plant species growing at the experimental site were added to the plot to strengthen the natural level of propagule pressure from the surroundings.
Here, we report the preliminary results from the first two years of the project. The studied plant communities are more species-rich in the native range compared to their new range. Concerning the species composition, North American sites contain many more aliens than their native counterparts, e.g. only one native species (*Fragaria virginiana*) was found at the experimental site close to the Glacier NP in Montana. The first year after disturbance, we observed an obvious difference between seeded and unseeded plots in both ranges. In contrast to native range, huge numbers of oxeye daisy seedlings were found within seeded plots in non-native range (e.g. 100 (non-native) vs. 1 (native) seedlings per plot). Weedy species and r-strategists (annuals) have predominantly colonized disturbed plots in Europe, whereas alien species and r-strategists (annuals) were found within the plots in North America. The second year of project, the portion of K-strategists increased and r-, s-strategists decreased. Two years after disturbance, Leucanthemum vulgare still recovers much better in non-native range where it is also significantly higher that might facilitate it to compete for light.

KEYWORDS: impact, invasive, Leucanthemum vulgare, plant community, native and non-native range

PT2.06

COMPARISON OF ALLELOPATHIC EFFECTS OF THREE *TYPHA* SPECIES ON PLANTS FROM THEIR NEW AND ORIGINAL RANGES

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Introduction

Allelopathic effects can affect plant-plant interactions and it has been hypothesized that allelochemicals produced by invaders can have stronger effects on the new evolutionarily naïve neighbors than on the species from their home ranges. However, few studies have tested if allelochemicals from native and exotic plants have different effects on other plant species from their new and original ranges.

Objectives

We aimed to compare allelopathic effects of three species of *Typha* on plant species native to Europe or to North America.

Methods

We tested the effects of root leachates from *Typha angustifolia* (native to Europe), *T. latifolia* (native to North America, Europe and part of Asia) and their hybrid (*Typha* x glauca) on a wide range of species native to Europe or to North America.

Results and Conclusions

Overall *T. latifolia* root leachates had stronger negative effects than either *T. angustifolia* or *T. glauca*, and important on both European and North American target species. North American species were more inhibited by leachates from *T. latifolia* than European species. Thus root leachates had the potential to elicit strong negative effects but we found no evidence for root mediated allelopathy as a mechanism for any biogeographic differences in the invasion or impact of *T. angustifolia.*

KEYWORDS: Cattail, allelopathy, native, exotic, inhibition, invasion

PT2.07
EFFECT OF INVASIVE SPECIES ON THE ENZYME ACTIVITY IN THE RHIZOSFERIC AND NON-RHIZOSFERIC SOIL IN DIFFERENT ECOSYSTEMS, VENEZUELA

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Plant species alter soil biota in ways that lead to either positive or negative plant–soil biota feedback effects. The enzyme activity in the soil can be used as indicators of soil quality because they usually respond rapidly to changes due to natural and anthropogenic factors. The objective of this study was to quantify changes on enzyme activities in the soil in nine species of invasive plants. For this, we found each species of study in different regions of Venezuela. In each population, we collected samples of soil in the understory (in an area of 2 m^2) in invaded patches (n = 8) and in patches of native vegetation (n = 8) adjacent to the front of invasion. Soil samples were analyzed in the laboratory to determine their urease, deshidrogenase, acid/alkaline phosphates and fluorecein diacetate activity. Preliminary results of this study showed that the invasive species have substantially altered enzyme activities in the rhizosphere soil, furthermore the enzyme activities changed in different regions. *Pteridium aqualinum* and *Melinis minutiflora* exhibited most differences on enzyme activities between rhizosphere and non- rhizosphere soil, in contrast *Calotropis procera* did not show differences on enzyme activity between different sampling sites.

KEYWORDS: invasive species, urease activity, deshidrogenase activity, acid and alkaline phosphates, fluorecein diacetate activity

PT2.08

IMPACT BY PTERIDIUM AQUILINUM INVASION ON BIOLOGICAL AND PHYSICO-CHEMICAL PROPERTIES OF SOILS IN TROPICAL MONTANE FORESTS

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Pteridium aquilinum (PA) invade large areas for their ability to grow in contrasting environmental conditions. In areas of interest agricultural, PA, produces significant economic losses, due to crop displacement generating toxic substances that sicken farm animals that can be transferred to humans through the consumption of the milk. Additionally PA limits the adjacent forest regeneration in natural ecosystems (1). The objective of this research was to evaluate the changes caused by the invasion of PA on biological and physicochemical properties of the soil. The study was developed in the Andes Range and the Coast. Soil samples were collected randomly in invaded (IS) and non-invaded (NI) sites, with native vegetation adjacent to the invasion front. In each sample texture, moisture, pH, nutrients, organic matter (OM), carbon and nitrogen microbial and soil biological activity were estimated. The results show a decrease in pH and nutrients in the IS compared with NI, in the two study sites, these differences were greater in the Andes. These results suggest that the invasion of PA can limit the availability of nutrients from the soil, either by capturing the complex system of rhizomes, or by acidifying the soil. The activity of β-glucosidase and dehydrogenase were lower IS values than the NI ones, in the Andes and the Coast, respectively. Enzyme activity could be affected by the clay content, moisture and OM, but these results did not support this thesis. Another possibility is that these variations are associated with the quality of OM. In conclusion, the invasion of PA reduces nutrient content, soil acidification, provides OM of low quality and alters some enzyme activities, representing a change in the conditions that potentially could limit the recruitment of native species and further promotes the invasion by PA.

Bibliographic citation

1 DeLuca et al. 2012

Acknowledgments: This research was funded by FONACIT (N° 2011001229).

Keywords: organic matter, soil acidification, soil biological activity, nutrient availability.

KEYWORDS: nutrient availability, organic matter, soil acidification, soil biological activity

PT2.09

THE IMPACT OF INVASION BY AN ALIEN TREE ON RANGE CONDITION AND LIVESTOCK PRODUCTION IN A GRASSLAND ECOSYSTEM

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INTRODUCTION

The natural ecosystems of South Africa provide a variety of ecosystem services. The provision of grazing by these natural ecosystems has arguably been one to the key ecosystem services in this region for the last 2000 years. Much of South Africa's grazing ecosystems have become invaded by invasive alien species affecting the livelihood of those who rely on this service. Levels of invasion here vary from one region to another according to disturbance regime, resource availability as well as past and current land management strategies.

OBJECTIVES

This study investigated the ecological impacts resulting from the invasion by *Acacia mearnsii* (black wattle, an introduced Australian tree species) on rangelands, and the subsequent condition or these environments following clearing restoration activities.

METHODS

We located uninvaded, lightly invaded, densely invaded and cleared sites in a grassland ecosystem in the Eastern Cape, South Africa, and examined the impacts of these treatments on forage quality and quantity, and on soil resources.

RESULTS

Invasion by *A. mearnsii* reduced grazing capacity by 56% and 72% on lightly and densely invaded sites respectively, whereas clearing improved grazing capacity by 66% within 5 years. Loss of grazing capacity during invasion was largely due to reduction in basal cover (by up to 42%) and herbaceous biomass (from 5200 to 1200 kg ha^{-1}). Subsequent clearing of invaded sites allowed both basal cover and biomass to return to pre-invasion levels. With the exception of low coarse sand content on cleared sites, there were no changes on soil physical properties (clay, silt, fine, medium), or soil moisture content, following invasion. However following invasion plant litter increased from 1.3 to 4.2%, the carbon content of the soil increased from 1.98 to 3.95%, and Nitrogen concentrations increased from 0.14 to 0.22% following invasion, due to nitrogen fixation by the alien trees.

CONCLUSIONS

Overall, these changes reduced grazing capacity, from 2 to 8 ha required to support one large livestock unit in uninvaded and densely invaded sites respectively. These findings provide a strong motivation both for preventing further invasions and for clearing of existing invasions.

ACKNOWLEDGEMENTS

Funding for this study was provided by South African CSIR and the Working for Water programme of the Department of Water Affairs. We would like to thank, Dohne Agricultural Research Institute for helping us identify suitable sites for this study as well as for permission to use their facilities and equipment during field survey. We thank Mfundo Macanda for his leadership in this regard. We also thank Brian van Wilgen for his valuable comments.

KEYWORDS: Grazing, invasion, wattle species, grazing capacity

PT2.10

EFFECTS OF *PINUS CONTORTA* DOUG. EX LOUD INVASION ON FUEL IN THE NATIONAL RESERVE MALALCAHUELLO, CHILE

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Biological invasions are one of the principal causes of biodiversity loss worldwide, due to the negative effects on biodiversity, changes in the hydrologic cycle, biogeochemical cycle and fire regime. Fire regimes influence and are influenced by the composition and structure of the plant community. The relationship between plant invaders and the fire regime is not fully understood, especially when the species is a woody exotic plant. Most of the research has focused on exotic grasses, reporting increases in fuel load and horizontal fuel continuity. Pine invasions may have important effect on fire regimes because they rapidly accumulate biomass, which is highly flammable.
The aim of this research was to determine the effects of the invasion of *Pinus contorta* on fuel load and fuel continuity in the National Reserve Malalcahuello (south Chile), where the species is invading araucaria (*Araucaria araucana*) and ñirre (*Nothofagus antarctica*) forests.
The survey was conducted in five conditions: araucaria and ñirre stands with and without the invasion of *P. contorta*, and stands with only *P. contorta* (invasion source). Twenty five plots were established in total, five per condition, each plot was of 100 m^2 for the tree layer sampling, two 1 m^2 plots for the quantification of the shrub layer biomass and four 0.063 m^2 plots for the quantification of the herb layer, litter and downy wood material biomass. To determine the crown fuel biomass, allometric equations were developed using destructive samples.
Paired comparisons between the conditions invaded vrs. non-invaded showed significant differences on the biomass of fine downy woody material (< 0.6 cm diameter) between the ñirre stand invaded vrs. non invaded. When we compared the biomass between the three conditions with *P. contorta*, we found significant differences in the invaded araucaria stand in the fine crown fuel (leaves + branches < 0.6 cm diameter) and total crown fuel biomass, with a higher biomass in this condition, due to the araucaria trees. The results are not consistent with the literature, where pines are expected to increase fuel load that would increase the intensity and frequency of fires. But when we evaluate the vertical continuity we found significant differences in the disruption of the fuel continuity between the araucaria stand invaded vrs. non invaded, this suggests that the type of fires will change from surface to crown fires, change that could affect on the long-term the composition of native plants.
Acknowledgments: This work was funded by Comisión Nacional de Investigación Científica y Tecnológica (CONICYT), Project FONDECYT 1100792, and Instituto de Ecología y Biodiversidad, Project ICM P05-002, and PFB-023.

KEYWORDS: woody plant invasion, Pinus contorta, fuel continuity, fuel biomass, biological invasion

PT2.11

INVASIVE AQUATIC PLANTS IN CHILE: CURRENT DISTRIBUTION AND POTENTIAL IMPACTS

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Introduction

Biological invasions are a common phenomenon in aquatic environments. A main feature in aquatic ecosystems is the presence of highly specialized aquatic plants. Chile has a large expanse of freshwater bodies and there is an increasing number of intentional and accidental aquatic plant introductions, therefore the country is at a high risk of invasion by aquatic plants.

Objectives

Determine which invasive aquatic plant species are naturalised in Chile and estimate their distribution and potential impacts on limnic systems.

Methods

We search for evidence on the invasive behavior of all aquatic plant species currently naturalized in Chile. This search was done in ISI Web of Science and in more than 100 databases related to biological invasions.

Results and Conclusions

We found 15 hydrophytes with invasive potential currently recorded in Chile. Of these, species those that with the largest number of references were *Myriophyllum aquaticum*, *Eichhornia crassipes* and *Egeria densa*. While *Limnobium laevigatum* and *Utricularia gibba* they got the least amount of references. Of the 15 species, 4 are native and 11 introduced, taxonomically represented 1 fern, 5 monocots and 7 dicots. The major represented family is Hydrocharitaceae with 3 species. The taxa most widely distributed in Chile are *Azolla filiculoides* and *Myriophyllum aquaticum*, present throughout the national territory, while *Alternanthera philoxeroides*, *Pistia stratiotes* and *Veronica beccabunga* was the least common of all, present only in one region of the country. The most common impacts of these plants are the modification of the physicochemical conditions of the water, preventing the growth of other aquatic plants and hinder the development of recreational activities. It is important to quantify the threat of invasive aquatic plants in limnic systems at Chile, as it is very likely that in the near future these impacts become more prevalent across freshwater ecosystems.

Acknowledgements: This work was funded by the Instituto de Ecología y Biodiversidad (IEB), Project ICM P05-002 and PFB-23.

KEYWORDS: Hydrocharitaceae, hydrophytes, invasive behavior, limnic systems

PT2.12

NATIONAL INVENTORIES OF ALIEN PLANTS SPECIES IN DEVELOPING COUNTRIES: ADVANTAGES AND DISADVANTAGES OF USING HERBARIUM RECORDS

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INTRODUCTION

There is an urgent need for comprehensive national databases on alien plant species, especially in developing countries. Although, plant invasions are considered a threat to biodiversity, they have been poorly studied and not considered a conservation priority in South America.

OBJECTIVES

Assess the current state of alien and native plants distributions in Chile, and discuss the advantages of using herbarium records in developing alien plants databases.

METHODS

We assessed alien plant distribution in Chile using a herbarium alien plant database. We analyzed the implications of using herbarium records to develop national databases of alien plants. We used herbarium records to assemble a comprehensive national database of alien plants. We calculated the number of alien and native species and specimens recorded in Chile (10 x 10 km cell). We evaluated sampling efforts and tested for relationships between alien and native specimens, as well as spatial patterns along the latitudinal gradient.

RESULTS AND CONCLUSIONS

We recorded 743 alien plants. Alien and native species richness was positively correlated. Alien plants were mostly collected in central Chile, with few species collected in both the extreme north and south. Native plants were strongly collected in central Chile, as well as in both extremes of the country. Areas of high number of alien and native species are associated to large cities or herbarium locations. Overall, the collection of native plants is more diverse than the collection of alien plants. Alien and native plants followed the same pattern of accumulation along the latitudinal gradient, with native plants being relatively more collected than alien plants. Herbarium records provide valuable baseline information to evaluate plant species distribution. However, there are important gaps in this database, (e.g. variable sampling effort for alien and native plants, incomplete information on life-history traits). Given scientists and land managers increasing demand for baseline information and the high cost of collecting such data in developing countries, herbarium records should be used more frequently for research and management of plant invasions.

ACKNOWLEDGEMENTS: This works was funded by the Instituto de Ecología y Biodiversidad (IEB), Project ICM P05-002 and PFB-23.

KEYWORDS: Botanical records, database, invasive species, non-native plant, plant richness, Chile

PT2.13

IMPACT OF ALIEN PLANT INVASIONS ON NUTRIENT AND REPRODUCTIVE ALLOCATIONS OF NATIVE PLANT SPECIES IN NIGERIA

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Resource availability is one of the known factors that influences invasion success and processes that increase or decrease resource availability therefore have strong effects on invasions. The impact of two major invasive plant species (*Tithonia diversifolia* and *Chromolaena odorata*) on biomass, nutrient and reproductive allocations of native species were examined in this study. Sample plots, 5m x 5m each were established on invaded and non-invaded area in 10 sites in areas invaded by each of these species. Five plants of dominant native species at maturity on invaded and uninvaded plots were harvested. Each plant was separated into leaf, stem, root and reproductive parts oven dried to constant weight at 80ºC, weighed and ground for chemical analysis for nitrogen, phosphorus, calcium, potassium, magnesium and sulphur. One way ANOVA was used to determine significant difference in the biomass and resource allocations of native species in invaded and non-invaded plots. The result showed that there was no significant difference in biomass production and allocation to various plant parts between native species in invaded and uninvaded sites though the uninvaded sites had slightly higher biomass. The concentrations of all the nutrients were allocated in higher amount in native species of uninvaded sites when compared to sites invaded by *Tithonia diversifolia and Chromolaena odorata* for all plant parts. It can be concluded that plant invasions by these two species have proved not to significantly affect the allocation of resources of the native species of the invaded sites as compared with those of the uninvaded sites.

KEYWORDS: Nutrients, Resource allocation, Biomass

PT2.14

IMPACT OF INVASION OF PINUS CONTORTA ON THE RESIDENT PLANT COMMUNITY OF THE PATAGONIAN STEPPE.

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The study of invasive species is of great interest for researchers due to current changes that occurred on ecosystems by species movement and the prospects of climate change which may worsen the scenario. Plant invasiveness, spatial patterns and functional traits are crucial to understand invasion processes. Current research seeks to understand the distribution patterns of invasive species and what life history attributes explain the invasion success. Likewise, the impacts of these invasions on resident biota are poorly known.

In Chile, Pinus contorta, a conifer native to North America, which was introduced to the country for production forest and recovery of degraded soils is considered one of the most invasive trees. In the Patagonian region in the province of Coyhaique, Chile, this species shows high rates of spread in adjacent areas where it was established (ca. 1970). We aim to determine changes in community parameters (e.g. species richness and beta diversity) in a *Pinus contorta* invasion gradient in Patagonian steppe. Our hypothesis suggests that the invasion of *P. contorta* decreases the number of original species and adds new species (mostly alien plants) adapted to the new environmental conditions. Therefore, *P. contorta* decreases native species richness and changes diversity along the invasion gradient. We define the gradient in three conditions (mature, intermediate and non-invasion), where we established seven transects with three plots of 100m2 (10x10m), one in each condition. Within this plot, we measured all individuals of *P. contorta*. Complementarily, we sampled nine 1m2 plots to determine the floristic composition. The results indicate that the invasion of *P. contorta* has a negative impact on the plant community (richness and diversity of Sorensen and Jaccard), modifying the original species assemblage. We expect to contribute with these results to the understanding of the impacts of invasion on plant community residents Patagonian ecosystems.

Acknowledgements: This work was funded by FONDECYT REGULAR 1120171, Instituto de Ecología y Biodiversidad (IEB), Project ICM 05-002 and PFB-23

KEYWORDS: Patagonian ecosystem, Invasion Impact, Pinus contorta

PT2.15

COMPARATIVE STUDY OF GERMINATION FROM SEEDS OF GREEN AND MATURE FRUITS OF *CRYPTOSTEGIA MADAGASCARIENSIS* BOJER EX DECNE, AN INVADER IN CEARA

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INTRODUCTION

The invasion and occupation of environments by exotic species is a major threat to biodiversity, contributing to the loss of native species (Ziller, 2001).The *Cryptostegia madagascariensis* Bojer Ex Decne is originally from Africa, in Madagascar island, and displays an invasive behavior in carnauba forests, in the state of Ceará. *C. madagascariensis*, popularly known as unha-do-cão, unha-de-moça, cipó-de-sapo, in english is rubber-vine (D'Alva, 2004), was brought to Brazil possibly to ornamental purposes and has adapted very well to the northeastern climate, occupying mainly native riparian vegetation. According to Da Silva and Pereira Barreto (2008), there are evidence of the aggressiveness of the occupation of this plant in other countries, but in northeastern Brazil its presence stands out for ease and speed with which it can kill carnauba *Copernicia prunifera*, (Miller) H. E. Moore. The rubber-vine is a shrubby plant from the *Apocynaceae* family (Vinicius; Lorenzi, 2008),and may be presented as an "opportunist climbing", it has comosas seeds (Gonçalves; Lorenzi, 2007), and the wind is the main dispersal agent. The follicle type of the fruits of *C. madagascariensis* vary in length from 6 to 9cm and storesabout 83 seeds / fruit.We studied the biology of the rubber-vine, as well as its growth and dominance of the carnauba through tests of seed germination in the laboratory. Thus, it is extremely important to detect the beginning of the invasion process for the development of viable strategies to help prevent the spread of invasive populations preventing biological losses (Bezerra et al., 2009 apud Sakai et al., 2001).

OBJECTIVES

- Compare the viability and germination rate of the seeds of green fruits (dried and fresh) and mature *C. madagascariensis*.
- Estimate the minimum time required for the initiation of germination of seeds from green fruits (dried and fresh) and mature *C. madagascariensis*.
- Demonstrate effective power of germination of exotic plants and weeds.

MATERIALS AND METHODS

It was performed in the laboratory the germination tests with mature seeds and green *C. madagascariensis* collected in the county Aquiraz, Ceará. Two hundred seeds from the green fruit of the rubber-vine were subjected to different treatments. One hundred of these green seeds were kept in a drying oven at 50 ° C for 24 hours and then transferred to petri dishes with autoclaved filter paper.The other hundred seeds from green fruits were directly transferred to Petri dishes (25 seeds per plate), without any pretreatment. The plates were placed in a greenhouse germination with photoperiod of 12 hours, varying the temperature of 30 ° C (day) to 20 ° C (night) for 10 days. The petri dishes were irrigated with distilled water on alternate days, and the process of emergence of the radiclewas daily monitored.One hundred seeds of the rubber-vine from mature fruits followed the same protocol of germination untreated.

RESULTS AND DISCUSSION

The rate of germination of green fruit subjected to prior treatment was considered too high, the total 100 seeds, all germinated in 10 days and suffered no fungal contamination. On the 4th day of observation of the test, all the seeds had germinated, and germination of the first seed occurred 24 hours after the beginning of the experiment. On the sixth day, 40 seeds already exhibited leaflets, if 40% of the seeds germinated, and on the 10th day, only one seed did not exhibit leaflet. The index of germination of fresh green fruits, which have not undergone prior treatment was zero, if no seeds germinated until the tenth day of observation and all were contaminated by fungi. The evaluation criteria of the seeds was only the emergency rootlets (Vieira et al., 2004). In the case of seeds of C. madagascariensis from mature fruits and without any prior treatment, the germination rate was high since the 200 seeds, germinated 78%, 22% experienced no germination and fungal contamination. On the 2nd day of the experiment 36 seeds had radicle displayed and not confirmed the presence of fungi in any plate. On day 7, the first leaflets began to appear, with a total of 34 seedlings. At 10 days after germination, 52 seeds already exhibited leaflets. The presence of fungus in some seeds certainly affect the rate of germination. According to Ferreira (1989), one of the most serious problems in studies of germination is the major fungial contamination of seeds, mainly on testing germination or incubators, which provide ideal conditions for the development and dissemination of some fungi. The results confirmed the high germination of seeds of unripe fruits (subjected to prior treatment) and mature this invasive species. This explains the high competitive potential of this plant in natural environments, such that when installing on the ground when the ripe fruit or green, does not allow other native plants can inhibit their growth, with unequal competition and advantageous for this invasive plant.

CONCLUSION

Given the results, we confirmed the good viability and rapid germination of green *C. madagascariensis* submitted to prior treatment, exceeding the high rate of germination of seeds from mature fruits. The fungal contamination of green seeds without pretreatment prevented the diagnosis of physiological quality of the seed lot analyzed. Germination tests confirmed the good adaptation of this invasive exotic plant to the environments invaded by it, competing with native, having easy dissemination and rapid occupation of environments with riparian vegetation.

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KEYWORDS: Tropical invasive plant, Allient plant in Northest Brazil, Germination of seeds.

PT2.16

INFLUENCE OF TEMPERATURE AND LIGHT ON GERMINATION OF THE INVASIVE *CRYPTOSTEGIA GRANDIFLORA*

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INTRODUCTION: The process of biological invasion is influenced by environmental factors that can directly control the success of the invasive species and define the range to its distribution (Sakai et al. Annual Review of Ecology and Systematics , v. 32, p. 305, 2001). Light and temperature are important factors that affect seed germination and the ability of germinating under different conditions facilitates the success of invasive plants in a wide variety of habitats (Pattison et al., Oecologia, v. 117, p. 449, 1998).
Cryptostegia grandiflora R. Br, an invasive species of the caatinga (Zenni et al., Revista Brasil. Bot., v.34, p.431, 2011), is an important threat to the biodiversity in different habitats from the Northeast of Brazil. As seed germination is a primary factor for the spread of an invasive species, the aim of this work was to evaluate how light and temperature affect its germination.

MATERIAL AND METHODS: The experiment was conducted at the Laboratório de Análises de Sementes, in the Universidade Federal do Ceará, UFC. To evaluate the interaction between light intensity and temperature on seed germination we tested different periods of exposure the light (8/16h photoperiod and dark) and temperatures from 20 to 40°C at intervals of 5°C. In each temperature, we placed seeds to germinate in Petri dishes with two sheets of filter paper, moistened with distilled water. The dark condition was achieved by engaging the gerboxes in aluminum foil and black polyethylene bags.
We used a completely randomized 2 x 4 factorial scheme with four replications of 25 seeds per treatment.

RESULTS: Temperatures of 20°C and 30°C provided the highest values of percentage of germination while no germination was observed at 40°C.
The germination rate was higher when seeds were placed in the photoperiod of 8/16h. Although the condition of completely darkness did not inhibit germination, we observed a decrease in the percentage of germination.
The germination speed index varied according to the temperature and higher at 20°C and 25°C. Regarding the effect of light on the germination speed index, no differences were observed between light and full darkness.

CONCLUSION: Our results demonstrated that germination of *C. grandiflora* is more influenced by temperature than light condition. *C. grandiflora* has its germination inhibited at temperatures above 35°C, also reducing the speed of germination. Germination is neutral photoblastic, therefore seeds germinate in both the presence and absence of light. Considering the results about seed germination, the spread of *C. grandiflora* in the caatinga is apparently unexpected, since this region faces high temperatures and extremely dry conditions.

KEYWORDS: Germination of seeds, plant invasive, caatinga

PT2.17

IMPACT OF PTERIDIUM AQUILINUM ON THE SPECIES RICHNESS, DIVERSITY AND COMPOSITION ON PLANT COMMUNITIES IN NORTHERN VENEZUELA

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Pteridium aquilinum is a cosmopolitan invasive plant of global significance characterized by litter accumulation and by reducing the amount of light reaching the understory, which could inhibit the establishment of other plant species and, thus, homogenize the flora. In Venezuela, *P. aquilinum* invades mainly in the Andean and Coastal Cordillera, in both regions this plant forms dense mono-specific patches. Although, the Andean and Coastal Cordillera regions are considerate diversity hotspot, no previous study has evaluated the changes in the plant richness caused by P. aquilinum invasion. The aim of this study was estimating the impact of *P. aquilinum* on plant community in two invaded localities (Andean and Coastal Cordillera). In each locality, we registered the plant species abundance in the understory in invaded patches and adjacent non-invaded patches. We estimated richness, diversity, plant composition and the growth form and predominant dispersal type. The results showed the richness and Shannon diversity index was higher in non-invaded plots in the two localities; in contrast, Simpson diversity index was higher in invaded plots in both areas. Thus, diversity, richness and number of rare plant species are reduced by *P. aquilinum* invasion. In the Andes region, species similarity is greater amongst invaded plots than amongst un-invaded plots, which evidences that *P. aquilinum* invasion can homogenize the flora. The negative impact on richness and diversity were more significant in the Andean, where there is greater number of rare species, than on the Costal Cordillera. In the invaded plots there are fewer species of shrubs and trees than uninvaded plots and, the anemocory is most frequent in invaded plots than non-invaded plots. These results suggest that the invasion reduces the vegetation structure, limits the succession and homogenizes the flora.

KEYWORDS: Invasive alien plant, composition of communities, species diversity, species richness

PT3.01

GENETIC VARIATION IN LITTER QUALITY INFLUENCES THE SPREAD OF AN INVASIVE WETLAND PLANT: A THEORETICAL EXPLORATION

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INTRODUCTION: Why invasive plants cause disruption in the new range but are benign in their native range may be due to post-introduction evolution that can create new trait values of introduced individuals. We investigate how changes in one trait (litter quality) can alter competition relationships and hence increase spread rate into native communities. We apply this framework an invasive plant model system, *Phalaris arundinacea* which has undergone post introduction evolution (Lavergne and Molofsky 2007).

OBJECTIVES: Our objective is to explore how variation in litter quality affects the feedback relationships between a native plant community and the spread of an invader. Here, we construct a stochastic, individual-based model with variation in a key parameter (litter quality measured as C:N ratio in leaves) following the approach developed in Eppstein and Molofsky 2007 and building on the non-spatial model developed by Eppinga et al 2011.

METHODS. We simulate competition between a genetically diverse *Phalaris* population and a native species along a nutrient supply gradient. We consider a lattice of cells, in which each cell can be occupied by one individual; a native species, or a particular genotype of the invasive species. The probability of a genotype i occupying a cell the next timestep can be described by a transition probability, which depends on the per-capita growth rate of genotype i, relative to the growth rate of all competitors (Eppstein and Molofsky 2007).

RESULTS/CONCLUSIONS: The simulation results show that trait variation in litter feedbacks increases the success of *Phalari*s in competition with native species, and this feedback expands the range of conditions where the introduced populations become invasive, enabling *Phalaris* to penetrate wetlands where it would previously not grow. Our results provide a mechanistic understanding of why *Phalaris arundinacea* successfully takes over wetlands in North America.

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Acknowledgments
Funding provided by USDA Hatch awarded to JM.

KEYWORDS: invasive spread, Phalaris arundinacea, stochastic simulation model, wetland

PT3.02

FACTORS PROMOTING DOMINANCE OF THE INVASIVE NEOPHYTE *IMPATIENS GLANDULIFERA* WITHIN INVADED COMMUNITIES

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Invasive neophyte *Impatiens glandulifera* has been spreading across Europe for more than one hundred years. It started spreading in riparian habitats, however, it has been reported from many other habitats as well in the last decades.

An investigation of habitats and vegetation with *Impatiens glandulifera* in the Czech Republic and Switzerland was performed to determine which potential environmetal factors limit the dominance of this neophyte and to suggest directions of its further spread.

Dominance was expressed as height and cover of the neophyte. Ellenberg indication values for moisture, nutrients, light, grazing, mowing, trampling and hemeroby of the present species were used to get an information about the environmental characteristics of vegetation plots with *I. glandulifera*.

The relation between the dominance of *I. glandulifera* and character of the invaded community was explored by multi-dimensional ordination method and regression trees. The relation of the alien´s dominance to basic environmental factors was tested by Spearmann´s non-parametric correlations.

The dominance of *I. glandulifera* was found to be related to site and vegetation characteristics of the plots. As expected, height of *I. glandulifera* was found to relate positively to site´s nutrient supply. On the contrary, the cover of *I. glandulifera* was found to relate to the intensity of trampeling upon a site negatively. The cover of *I. glandulifera* was also related to site´s hemeroby negatively.

The occurrence of *I. glandulifera* is clearly promoted by human activities and hemeroby (a measure of departure from naturalness), so a positive rather than negative relation can be expected. However, it is possible that the cover of *I. glandulifera* is limited by the competition of native ruderal dominants (*Urtica dioica*) on polyhemerobic sites. At the same time the , the detected relation between the dominance of *I. glandulifera* and site´s hemeroby may be deformed by the absence of truly oligohemerobic sites in the dataset.

KEYWORDS: Impatiens glandulifera, plant invasions, dominance, habitat colonization, hemeroby

PT3.03

THE EFFECT OF TEMPERATURE AND NUTRIENT LEVEL ON THE GROWTH OF THE SEEDLINGS OF *AMBROSIA ARTEMISIIFOLIA L.*

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Introduction: *Ambrosia artemisiifolia* was introduced to the Czech republic (CR) in 1883 and currently is recorded from 64 out of the total 679 grid cells of the Central-Europaean phytogeographical mapping grid. In the CR *Ambrosia* do not occur on the massive scale but mainly in the warm regions in south Moravia and Elbe lowland but due to its potential it has in CR the status of invasive species.

Objectives: Temperature and nutrient contens are the most important factors influencing the growth and the whole life cyclus of *Ambrosia*. Since the early onthogenetic stages are important for spreading of annuals, we focused on seedling performance and we studied the effect of thermal time and nutrients on the rate of plant development (RD). Plants require a certain combination of time and temperature, which is called thermal time (TT); the ontogenetic 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 expressed in degree days (DD), and the lower developmental threshold (LDT), i.e. the temperature below which the development ceases.

Methods: Thermal requirements of the seedlings were tested in growth chambers under identical irradiation and air moisture at different temperature regimes (10, 14, 18, 22, 26, 30 and 34 °C) and under different nutrition levels (10, 50 and 100 % Knopp solution). Time between the appearance of the 1st - 7th) pair of stem leaves (excluding cotyledons) was recorded and plants then harvested.

Results: The seedling growth is influenced both by temperature and nutrient levels and their interactions. Development is significantly getting longer under low temperature and nutrient limitation. The seedlings grow faster and are taller under higher temperatures. Under the low nutrients the seedlings grow slower and increase biomass allocation into the roots. R/S is significantly lower under higher temperature and low nutrients.

Conclusion: The study reveals that development of *Ambrosia* is limited not only by low temperature but also by low nutrient content. In optimal nutrient solution (50%) LTD is 5.7 °C and SET till the appearance of the 5th leaf is 270.3 DD, i.e. 17 days under CR average July temperature of 15.5°C. The results indicate that *A. artemisiifolia* can grow in CR, but the development may be slow and limited by low temperatures especially in spring months.

KEYWORDS: Temperature, nutrients, thermal time, rate of development, sum of effective temperatures

PT3.04
DIFFERENTIATION IN GERMINATION TIMING AND FROST RESISTANCE IN INVASIVE AND NATIVE IMPATIENS SPECIES

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INTRODUCTION
Traits associated with early ontogenetic stages are among the key factors determining the spread of alien plants in their secondary distribution areas (Pyšek 2007; Grotkopp 2007). Those associated with generative reproduction are of crucial importance especially in annual species reproducing exclusively by seed (Crawley 1996). Frost is an important factor in the temperate zone as it is an environmental barrier to distribution range of many plant species, including invaders (Franklin 1995, Bannister 2001; Bruelheide 2002). Invasion success of some alien plants is considered to be associated with inter-population differentiation and adaptations to local conditions (Dietz 2006).

OBJECTIVES
To obtain an insight into these processes we investigated three species of *Impatiens* (Balsaminaceae) with different origin and invasion status (*I. noli-tangere*, native to central Europe, alien highly invasive *I. glandulifera* and alien less invasive *I. parviflora*) and investigated their germination dynamics and frost resistance of the seedlings.

METHODS
Germination was tested under cold wet stratification regime in laboratory. Frost resistance of seedlings was measured in climatic chambers under conditions simulating morning frost. We used seed collected from five natural populations of each species and also from the plants cultivated in the greenhouse and experimental garden.

RESULTS AND CONCLUSIONS
Compared to the native, the alien species germinated earlier in the season and the germination was synchronised (Perglová 2009). Synchronised germination may be a competitive advantage but also a considerable risk if seedlings are damaged, for instance by spring frost, to which the alien balsams are more sensitive than the native species. Differences in the germination dynamics and frost resistance of populations were found for all the species studied, and related to climate in early spring at the seed-source localities, which indicates that individuals are adapted to local conditions (Skálová 2011). In germination timing the effect of the seed-source locality was significant even after a year of cultivation in the experimental garden and greenhouse and was stronger in the native than in invasive species. In all the species germination was delayed in seeds produced towards the end of the fruiting season. In I. parvilora there was also an effect of cultivation conditions (greenhouse/garden). In frost resistance the effect of seed-source locality was found only in *I. parvilora* and *I. noli-tangere* interacting with the date of the seed harvest and cultivation conditions. The results indicate lower differentiation of the invasive species but the differentiation may be in progress.

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KEYWORDS: Plant invasions, alien species, local differentiation, germination, seedlings

PT3.05

ANALYSIS OF GENETIC AND ECOLOGICAL SEGREGATION OF THE INVASIVE *SOLIDAGO GIGANTEA* IN THE NATIVE AND NON-NATIVE RANGE

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Introduction: There are several hypothesis which might explain the process of plant invasions. Evolution of invasiveness hypothesis state that invasive species evolved in the invaded range experience rapid changes linked to the new selection pressures by the novel environment. Different effects cause differentiation between populations from the native and the introduced range. These differences could be the effects of genetic segregation of populations, but this process is still not thoroughly investigated.

Objectives: Our target plant giant goldenrod (*Solidago gigantea*) is a rhizomatous, perennial herb native to North America and invasive to Europe. It is a serious invader of disturbed mesic sites, often forming dense monospecific stands.

Methods: In our research we measured ecological differences between populations from different regions. We collected seeds from introduced Hungarian and native North American populations (10 individuals from each populations), and germinated individuals. We established a common garden experience both the invaded and native range, where the performance of the plants was tested. We suggest that differences between native and introduced populations can also be explained on genetic level. To test our hypothesis we investigated which population genetic method could be the most sensitive for the separation of populations. We examined two methods (1) explore nucleotide sequences of the intergenic spacer regions of nuclear ribosomal or chloroplast DNA, (2) fragment length polymorphism analysis of microsatellite loci.

Results: There were significant differences among the different populations between the continents and within continents. These differences may be genetically coded, but it is hard to find the best method to test. We find that sequence analysis of intergenic spacers is not sensitive enough for finding differences. We tested 15 microsatellite markers for analysis and found 4 primers showed polymorphism between populations. This suggests that microsatellite analysis could be a useful tool for the differentiation of *Solidago gigantea* populations.

Conclusions: We suggest that rapid genetic changes are a very important factor in the invasiveness of indigenous species. For the analysis of evolution of invasiveness hypothesis both ecological and genetic tests are essential.

„This research was realized in the frames of TÁMOP 4.2.4. A/2-11-1-2012-0001 „National Excellence Program – Elaborating and operating an inland student and researcher personal support system convergence program" The project was subsidized by the European Union and co-financed by the European Social Fund." The research leading to these results has also received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement number 300639.

KEYWORDS: Solidago gigantea, microsatellite, genetic analysis, ecotype, genotype

PT3.06
IS NICHE CONSERVATISM THE GENERAL RULE DURING INTERCONTINENTAL PLANT INVASION OF *LANTANA CAMARA*?

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Lantana camara, a native plant from tropical America, is considered one of the most harmful invasive species worldwide. Several studies have identified potentially invadable areas under scenarios of global change, on the assumption that niche is conserved during the invasion process. However, several characteristics of *L. camara* and its invasion history suggest niche shifts in the invaded ranges (i.e. polyploidy, hybridization and artificial selection). We tested the hypothesis of the niche conservatism for *L. camara* by comparing its native niche in South America with its expressed niche in Africa, Australia and India using Principal Components Analyses (PCA). Niche dynamics was classified as: Overlap (O), Unfilled (*U*), and Expansion (*E*) where *O* indicated niche conservatism, *E* niche shifts and U incomplete occupancy. Potential distributions were generated in their native and invaded regions using MaxEnt. Then, we projected the model from the native region onto each invaded region and, the models obtained from those invaded regions showing niche expansions onto the rest of the invaded regions to obtain expanded-to-invaded distributions. We found that the three exotic niches are similar, but not identical, to the native niche. The niches in Africa and Australia are subsets of the native niche while, in India, we found niche expansion (E). In the latter, 34% of the occurrences were detected in novel environments with climatic conditions not found in the native range. *L. camara* is occupying only 24 % and 11 % of the suitable area in Africa and Australia, respectively. In India, however, the specie uses 68% of the suitable area. The niche expansions increment of 10% the suitable area in India and could increment the suitable area in 6% in Australia and 24% in Africa. In conclusion, we support the hypothesis that niche is conserved in Africa and Australia, but not in India. Further studies are required in India to discern which are the mechanisms that explain niche shift detected in this invaded region.

KEYWORDS: Biological invasion, climate matching, ecological niche modeling, potential distribution

PT3.07

A COMBINED ANALYSIS OF DNA BARCODES AND ECOLOGY OF INVASIVE FRESHWATER AQUATIC PLANTS IN SOUTH AFRICA.

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Invasive alien species are of major concerns when introduced to new environments. Their impacts can be detrimental not only ecologically but also economically, and therefore are ill-afforded in developing countries. In this study, we focus on invasive aquatic plants of freshwater ecosystems in South Africa. Our objectives are two-fold: testing the efficacy of DNA barcoding in early detection of invasive plants and evaluating how future climate change would affect their ranges. Our results indicate that DNA barcodes are useful tools for species identification and thus for pre-emptive actions. However, our analyses of the five most invasive plants in the country, based on climatic scenario are mixed. Our study provides useful information on potentially favourable areas for invasive plants, and therefore call for pre-emptive actions to prevent future invasion success of South African freshwater systems.

KEYWORDS: Aquatic invasive plants, DNA barcoding, ecological niche modelling

PT3.08

VARIATION IN GERMINATION CHARACTER OF BLACK LOCUST SEEDS AT DIFFERENT THERMAL REGIMES AND MOISTURE STRESS

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Introduction. The North American black locust (*Robinia pseudoacacia* L., Fabaceae) is one of "the top 100 worldwide woody plant invaders", threatening native ecosystem structure and dynamics. In Tuscany (Italy), a dedicated project (QuiT project) funded deeper insight on the status, distribution and impacts on biodiversity of some invasive target species, including black locust (Benesperi et al., *Biodiver. Conserv.* 21: 3555, 2012).

Objectives. As part of the above mentioned project, we addressed our interest towards a better understanding of the reproductive strategies of black locust, with special concern on the regeneration from seeds, important mediators in the establishment of new populations in non-invaded areas (Masaka and Yamada, *J. For. Res.* 14:167, 2009), nevertheless natural reproduction is primarily vegetative.

This study was aimed at assessing the germination capacity, hindered by physical dormancy, of the seeds from six provenances in Tuscany, under different thermal regimes and induced water-deficit conditions.

Methods. Accordingly, we ran a series of lab experiments to test the variability in germination characters of the seeds within a wide temperature range (9-21°C) and their response to ascending moisture stresses (from -0.2 to -0.8 MPa) at 21°C; to overcome physical dormancy seeds were mechanically scarified. Concurrently a morphological study of the integument was performed to identify the histological features responsible for its impermeability. Moreover possible water-deficit induced anatomical changes of the emerged roots were evaluated in comparison to unstressed seeds. Data analysis was performed with R-packages.

Results. The seeds from all the provenances showed high levels of germination from about 70% at 9°C up to 100% at 21°C, whereas the mean germination times were negatively related to the temperature increase. The ANOVA showed significant differences between the germination percentage within the same population tested at different temperatures.

The morphological study proved that seed dormancy is related to the thickness of the outer palisade layer and to the presence of lignified cell wall in the inner layer of the integument.

Under water stress conditions, different germination percentage characterized the seeds of the six populations; in particular, the cohorts of seeds from the island of Pianosa, and the Pistoia mountains invariably exhibited the highest and lowest values, respectively.

The reduction in root length and the increment in vessel wall thickness and vessel diameter of the emerged roots were proved as a result of ascending water stress as compared to the control. *Conclusions.* The seeds from all the provenances showed a significant germination capacity also under stressful conditions of temperature and water-deficit, proving the extreme adaptability of the species. Therefore, besides the vegetative propagation mechanism, the success of *R. pseudoacacia* to spread into non-invaded areas is certainly also due to the effective, co-occurring sexual process.

Acknowledgments. This study was financially supported by Tuscany Region as part of the research project QuiT (POR-FSE 2007–2013).

KEYWORDS: Seed germination, Robinia pseudoacacia, temperature, water stress, physical dormancy, seed coat anatomy, root anatomy

PT3.09

COMPARING NATIVE AND INVASIVE GRASSES RESPONSES TO ENVIRONMENTAL FACTORS.

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INTRODUCTION

Cerrado region is characterized by a vegetation gradient, climate seasonality and predominance of dystrophic soil. The biome is likely invaded by exotic species that pose risk to this ecosystem's integrity. The most common alien grass in the region is the African species *Melinis minutiflora* that is able to displace natural grasses and form monospecific stands (Pivello at al 1999). It is known that competition is the main factor influencing species dominance and plant species respond differently to stress factors, depending on environmental condition (Sato, 1996).

OBJECTIVES

This study aimed at comparing and discussing morphological and physiological responses of an invasive (*M. minutiflora*) and a native (*Schyzachyrium microstachyum*) grass to different levels of water stress, nutrient availability and clipping.

METHODS

Seedlings were submitted to different soil moisture and nutrient regimes using two methods: maintaining desired soil moisture (10, 40, 80, 120%) or suspension of watering (10, 5, 1 days or overwatering) and with or without addition of NPK (10-10-10). Independent experiments were performed in climatic chambers for 21 days at 28ºC when plants were clipped at soil level. They were then left to re-sprout in the same conditions. The morphological and physiological parameters assessed were plants' height, biomass, number of tillers, lipid peroxidation (through MDA quantification), chlorophyll content, GPOX activity.

RESULTS

The alien grass accumulated more biomass (above and below ground), produced more tillers and grew higher, reaching over twice as much the native. Under the controlled moisture method, the effect of water-stress treatment was less pronounced than in the suspended watering-stress method. The only exception was in the flooding simulating scenario, where the controlled moisture method was more harmful. Fertilization promoted growth for both species in all circumstances, but showed a stronger effect in the invasive species. Physiological parameters showed that the native species presented higher levels of chlorophyll, MDA and GPOX activity and responded differently to stress levels. Pruning favored tillering, especially for the invasive species.

CONCLUSIONS

The invasive species performed better than the native under all circumstances, what confers advantage in occupying space in the environment and competing for light. Its strong response to fertilization is in accordance to its classification as opportunistic (William & Baruch, 2000). The flood situation seems as harmful, and sometimes more harmful, that the dry situation. The physiological responses partially explained the high costs and reduced rates for growing of the native species. Plants were able to re-sprout after clipping, except in some over watered conditions. The only situation where native species performed similarly to the invasive one was under unfertilized soil after pruning. This is in accordance with natural conditions in Cerrado, where the dystrophic soil predominates, and presence of above ground removal may occur through natural fire (Salgado-Labouriau & Ferraz-Vicentini, 1994). Our data is also in accordance with other studies, supporting therefore the appliance of management (Barros et al, 2006).

ACKNOWLEDGEMENTS

This work supported by a PhD grant by FCT (SFRH/BD/64938/2009). We acknowledge IBAMA, Parque Nacional de Brasília and Universidade de Brasilia for the collaboration.

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KEYWORDS: Water stress, Fertilization, Alien grass, Management, Savanna

PT3.10

MICROSATELLITE LOCI PECULIARITIES OF IMPATIENS GLANDULIFERA POPULATIONS FROM BALTIC REGION

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INTRODUCTION. *Impatiens glandulifera* (Balsaminaceae) is an annual herb highly invasive in West and Central Europe. Also in the Baltic States, *I. glandulifera* is now a widely distributed alien species which at least partly escaped from gardening plots. However, little is known about the genetic diversity and population structure of *I. glandulifera* in the Baltic region. Patterns of genetic variation provide information about pathways of introduction or post introduction dispersal and the amount of genetic variation introduced which determines the species potential for postinvasion evolution and at the same time, the extent to which founder effects may have contributed to evolutionary change.

OBJECTIVES. The objective of present study was to evaluate the genetic variability of Lithuania populations of *I. glandulifera* and draw conclusions about factors that shape its distribution like patterns of genetic differentiation and putative founder events.
MATERIALS AND METHODS. We selected 20 populations across Lithuania and collected 15 individuals each. Samples were genotyped at nine microsatellite loci (IGNSSR101 / EF025990, IGNSSR104 / EF025992, IGNSSR106 / EF025993, IGNSSR203 / EF025994, IGNSSR210 / EF025995, IGNSSR240 / EF025997 (Provan et al., 2007) and A2, A3, A21 (Walker et al., 2009) both developed on populations of *I. glandulifera* from the British Isles.

RESULTS AND DISCUSSIONS. The average number of alleles per marker per population was 1.9, ranging from 1.4 to 2.4. Interestingly, overall variability in Lithuania was similar to that of British Isle populations for the markers of Walker et al. (2009) (mean Atotal = 3.0 vs 3.7) but much reduced for the markers of Provan et al (2007) (mean Atotal = 12.0 vs 2.3). Mean expected heterozygosity ranged from He = 0.129 to 0.439 and was not correlated to geographic or climatic variables.

Populations were strongly differentiated with 35% of variation residing among populations (AMOVA Phi-ST = 0.351). Pairwise population differentiation ranged from Phi-ST = 0.07 to 0.73, and did not follow a pattern of isolation by distance (Mantel P = 0.07). Together this indicates that although gene flow is high, as proven by the rapid dispersal and colonization ability of the species, a high level of genetic drift leads to population differentiation independent of spatial distance.
CONCLUSIONS. *Impatiens glandulifera* is a successful invader in floodplains and wetlands of Europe and thus has high levels of seed dispersal. However, patterns of genetic variation indicate that random genetic drift plays an important role. This suggests that bottlenecks occur during colonizations which often seem involve only few seeds. Also subsequently, gene flow among populations seems to be too low to homogenize gene pools.

ACKNOWLEDGEMENT. The study was funded by the Science Council of Lithuania, Project № LEK-07/2012.

KEYWORDS: Himalayan Balsam, Balsaminaceae, SSR, alien plants, invasion, molecular diversity

PT3.11

BIOMASS ESTIMATION OF *ARUNDO DONAX* L. (GIANT REED) IN THE FEDERAL DISTRICT, BRAZIL

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INTRODUCTION

Native to Southern Eurasia, giant reed (*Arundo donax*) has invaded riparian ecosystems in several regions, from tropical to temperate (Polunin and Huxley 1987). It has a high capacity to produce biomass, up to produce 20 tons of dry matter per hectare (Perdue 1958). This high producticity is related to the growth rate of the species, the high density and height, attaining a mean value of 6.5 m in Southern Californina (Cal-IPC 2011).

MATERIAL AND METHODS

Individuals of different sizes of *Arundo donax* were collected at several sites in the Federal District. The individuals were cut at the soil level and taken to the laboratory where they wee measured, separated in to componentes of leaves, culms and reprodutive structures, when present. All material was dried in ovens at 80ºC prior to weighing. The results obtained will be compared with those obtained in the United States by Spencer *et al*. (2006).

RESULTS AND DISCUSSION

The relationship between dry weight with height was not linear, however the fit of the regression equation was high (R^2 = 0,8784). This value is similar to that obtained by Spencer et al. (2006) for *Arundo* in the United States (R^2 = 0,90).

A regression analysis was also done for the variables of culm diameter and height. The data tended to be linear, but two distinct groups were observed (R^2 = 0.7852 for gruop 1 and R^2 = 0.7113 for group 2). The difference between groups was probably due to a cutting effect, the first group was formed by younger individuals, less than 1 year while the second group was formed by individuals with ramifications and more than 1 year old.

The biomass estimation for group 1 was 0.75 ± 0.50kg/m^2 and for group 2 was 4.47 ± 3.52kg/m^2. These values are within the range observed by Spencer et al (2006) for above ground biomass of *Arundo* in California, Mississippi and Texas and those reported by Sharma et al (1998) for *Arundo* in India. However, they are lower than those reported by Cal-IPC (2011) for data collected in California. These equations provide a method for estimation of biomass and other variables for *Arundo donax* from several locations in the Federal District and possibly in Brazil.

ACKNOWLEDGEMENTS

To the Graduate Program in Ecology of UnB for help with data collection, especially to Mardonio Timo.

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KEYWORDS: Giant reed, invasive grass, Arundo donax, biomass

PT3.12

ON THE RESPECTIVE ROLE OF DISPERSAL AND THE COMPLEX LANDSCAPE IN THE INVASION PROCESS: THE CASE OF THE ESCHSCHOLZIA CALIFORNICA IN CHILE

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The explosive spread of some invasive plant species worldwide is an issue of major concern for biodiversity conservation (Pimentel 2002). One aspect rarely considered in studies of biological invasions is that they occur in a context of spatial heterogeneity (With 2001, 2004). Additionally, a successful invasion is the result, among other things, of a successful dispersion in the new environments (With 2004). Quantify the dispersal ability of invasive species and to what extent dispersal and landscape heterogeneity affect genetic connectivity is an important topic in the development of a predictive theory of biological invasions. In this study, we assessed the role of invasive plant dispersal and landscape configuration on the genetic structure and connectivity. We studied the invasive plant *Eschscholzia californica* Cham, original from California and invasive in Chile and other Mediterranean ecosystems worldwide (Stebbins, 1965). Since XIX century, this plant has spread successfully across a wide latitudinal (30° S – 38° S) as well as altitudinal distribution (from 0 to 2200 m.a.s.l.). Currently, this species is in an active process of expansion process (Peña-Gómez 2013, submitted). In order to estimate the dispersal capability of the species and the effect of the landscape heterogeneity over the genetic connectivity of *E. californica*, we combined a mixed approach including (i) genetic variability analysis using 8 microsatellites in 24 local populations, (ii) Ecological Distribution Models (EDMs) based on climatic niche requirements, land cover and altitude, (iii) and spatial connectivity analyses, using the distribution model developed as an input to quantify landscape resistance distances between populations.
Our preliminary results showed large FST value between populations and a low dispersal potential (<1 km/year approx) product of a presumed constants founding effects during invasion of a new area. All models had high values of AUC (>0.7). We observed a significant spatial isolation among populations, but we cannot distinguish between isolation by distance or landscape barriers as mechanisms that shape the genetic connectivity.
We discussed about the effects of spatial variability and the dispersion capability over the invasive process. Finally, we present some caveats about the potentialities and limitations of this approach.

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This study was supported by FONDECYT1100076 to RO Bustamante and ICM P05–002

KEYWORDS: central Chile, genetic connectivity, Ecological Distribution Models, california poppy, migration rate

PT4.01

POLLINATOR SPILL-OVER FROM NON-NATIVE TO NATIVE PLANTS?

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INTRODUCTION

Non-native entomophilous plants integrate into resident plant-pollinator communities affecting natives through shared pollinators (Vilà et al. 2009). Whether these effects are positive, neutral or negative depend on the relative abundance and density of the non-native plant (Muñoz & Cavieres 2008). As many non-native plants are introduced as crops, they dominate large extensions of land that moreover, bloom simultaneously producing mass-flower effects attracting pollinators. We explore whether the effect of non-native species mass-flower can be spilled through the landscape influencing adjacent non-invaded communities. Biotic spill-over effects across the landscape have been more often described from natural ecosystems to managed ecosystems (Blitzer et al. 2012).

OBJECTIVES

a. The composition, abundance, richness, diversity and visitation rates of pollinator communities in semi-natural areas adjacent to mass-flowering crops, are affected by crop harvesting (conducted during the flowering peak)?
b. Do pollinator functional groups (bees vs. other) respond differently?
c. Is the effect observed at larger spatial scales?

METHODS

The study was conducted in Menorca (Balaeric Islands, Spain). In this island the short lived perennial *Hedysarum coronarium* L. (Fabaceae) was introduced at the end of the 18th as forage. Since then it has been cultivated as part of a traditional cyclical agro-farming system. Its inflorescences have up to 30 flowers rich in pollen and nectar that flower in April-May and are pollinated mainly by bees.
We conducted pollinator surveys during two consecutive springs. In 2009, we conducted 15' focal pollination censuses in the same 2-3 native plant species before and after the harvesting in four sites adjacent to *H. coronarium* crops. In 2010, we selected other four sites adjacent to crops (we could not repeat study sites due to the cycling crop system) and two control sites with no *H. coronarium* crops in the surrounding 500 m radius landscape. In each site we conducted 10' pollination transects exclusively focusing on bees. Data were analyzed through generalized and linear mixed models.

RESULTS

Abundance, richness and diversity of pollinators of adjacent native plants were not affected by harvesting. However, the composition of pollinator communities (mainly bees' identity) changed and was followed by a decrease of visitation rates after harvesting.
However, at larger spatial scales, bee abundance, richness, diversity and visitation rate were lower in areas adjacent to *H. coronarium* crops than in control ones.

CONCLUSIONS

We found evidence of a pollinator spill-over from crops to adjacent semi-natural areas (in terms of visitation rates) but we found the opposite trend at larger spatial scales. Therefore, pollinator communities of landscapes with mass-flowering crops might be depauperated, though that could be slightly buffered in plants adjacent to crops. In conclusion, the spill-over effect of mass-flowering crops would depend on the spatial scale considered.

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KEYWORDS: Apis mellifera, bees, Hedysarum coronarium, invasion, magnet effect, Mediterranean, Menorca, plant-pollinator interactions, spatial scale

PT5.01

DELIBERATE AND ACCIDENTAL INTRODUCTION OF ALIEN PLANTS IN THE CAATINGA, NORTHEASTERN BRAZIL

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Introduction

Both deliberate and accidental introductions contribute to the alien flora of an area, but in most cases the plant species pool of deliberate introductions differs from that of accidental introductions (Pyšek 1998). Therefore, differences between deliberate and accidental introductions may be important in determining the identity of alien plant species (APS) of an specific area, as well as in defining both taxonomic and geographical patterns of alien floras. Here, we investigate the differences in deliberate and accidental introductions of APS in Caatinga. Due to environmental and socioeconomic conditions, we expected that deliberate introductions were more frequent in Caatinga than those accidentals as a result of several attempts to find solutions and benefits to the human population.

Objective

The goal of this study was to examine the alien flora of a phytogeographical region in order to understand how deliberate and accidental introductions affect the composition of APS.

Methods

Study area

The 800,000 km² Caatinga is a mosaic of thorn scrub and seasonally dry forests. The Caatinga climate is semi-arid. Rainfall occurs at supra-annual intervals, resulting in periodic droughts. The Caatinga physiognomy is similar to semiarid vegetation of N-Colombia, Venezuela and Central America.

Alien flora of the Caatinga

We created a database on APS of Caatinga areas compiling information from literature as well as from herbaria surveys.

Taxonomy

The scientific nomenclature of APS was updated using online databases in accordance with proposals of The Angiosperm Phylogeny Group.

Native geographical range (NGR)

We grouped species by broad categories according to their NGR and by their major climate as follows: temperate (North America, Europe, and Temperate Asia) and tropical (Africa, Mesoamerican, South America, Tropical Asia, and Australasia).

Introduction mode

The introduction mode was determined from pertinent literature. For some species, there were no reports on the historical introduction. In those cases, the introduction mode was inferred by their current economic uses (current economic uses indicate deliberate introduction).

Results
The alien flora of Caatinga included 205 plant species belonging to 48 families. The number of APS deliberately introduced was 104 (50.7%) while the number of APS accidentally introduced was 101 (49.3%). There was no significant difference in the proportion of deliberate and accidental introductions ($X^2 = 0.02$, df = 1, $p = 0.9$). However, there were differences in the proportion of deliberate and accidental introductions by botanical families. Some families were dependent on human intervention, such as Poaceae, Myrtaceae, Malvaceae, Annonaceae, and Fabaceae. In contrast, Amaranthaceae, Asteraceae, Apocynaceae and other families were more strongly represented in accidental introductions. About 65% of the APS deliberately introduced presented NGR in tropical regions, while 35% of APS presented NGR including tropical and temperate climate ($X^2 = 7.9$, df = 1, $p < 0.01$). On the other hand, the proportion of APS accidentally introduced was similar between both NGR ($X^2 = 0.04$, df = 1, $p = 0.8$).

Conclusion
Both taxonomic nature and geographical origin of the alien flora of the Caatinga seem to result mainly of deliberate introductions.

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Acknowledgements
We thank to CAPES and CNPq for financial support.

KEYWORDS: Biological invasions, biogeography, taxonomy, introduction of alien plant species

PT5.02

MICRO-EXHIBITION OF INVASIVE PLANT SPECIES IN THE MAIN BOTANICAL GARDEN (MOSCOW)

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Guided by the decision of the IV World Congress of Botanical Gardens (Dublin, 2010), participants of the pan-Russian scientific conference (Yaroslavl, 2011) accepted *"The Code of Condact on Invasive Alien Species for Botanic Gardens"*. One of The Code's tasks is to alarm people on danger from alien species by installation of special information booths, creating mini-exhibitions and promoting research results through booklets and brochures.

The Commission on invasive species, established by the Council of Botanical Gardens of Russia, Belarus and Kazakhstan is working out the principles of creating exhibitions of alien invasive plant species. This is a new task for botanical gardens. The basic idea under those exhibitions is bilateral:

· to present the most aggressive invasive species in order to develop effective means of control for those species. A provisional name for that exhibition could be "Our cultivation in the garden is strongly prohibited!". It's worthwhile (for a better effect) to locate that exhibition right in front of the entrance of the botanical garden. *Oenothera biennis* and *Conyza canadensis* could be planted in background; *Galinsoga parviflora, G. quadriradiata, Chamomilla suaveolens* at al. may be kept in the front zone;

· to present species, actively running wild within the gardens' territory which are potentially invasive. In fact, the species mentioned in the previous passage (e.g., *Conyza* and *Galinsoga*) has escaped from the botanical gardens a few centuries ago. A provisional name for that exhibition could be "Do not let us escape!". *Helianthus tuberosus, Solidago canadensis, Echinocystis lobata, Aster novi-belgii* could be planted in background; *Oxalis stricta* and *Bellis perennis* may be kept in the front zone.

Plants for those exhibitions should be planted in portable containers (juvenile plants to be put in containers). Cultivating plants from seeds is strongly prohibited (especially from the alien sources) because each subsequent generation adapts better to the conditions of the new environment. Containers could be put near invasive trees and shrubs (for example, *Acer negundo* or *Robinia pseudoacacia*), quite often being cultivated in introduction centers. The main rule, while composing an exhibition is to use only the plants, growing nearby, not creating new centers of invasive species distribution.

One of the key advantages of this approach is minimizing the cultivation efforts: invasive species are the most adapted for changing conditions of the environment. The utmost attention should be paid to the colourful labels, describing dangerous features of those species.

It is necessary to prohibit plants from fructification. Inflorescences and flowers, immediately upon end of flowering should be cut down. The label should contain a picture of the blossoming plant. At the end of a vegetative season all plants have to be eliminated (not wasted in compost/weeds heaps).

As the first step a prototype "micro – exhibition" of invasive species was created in Main botanical garden Russian Academy of Sciences. This exhibition comprises strictly invasive species (*Solidago gigantea, Bidens frondosa, Impatiens parviflora*), and those, actively running wild (*Geranium phaeum, Veronica filiformis, Adenocaulon adhaerescens, Impatiens glandulifera, Lupinus polyphyllus, Geum macrophyllum*). The second group of species is potentially invasive.

KEYWORDS: exhibition, botanical garden, invasive species

PT5.03

ESTIMATING ALIEN PLANT INVASION RISK IN SPACE AND TIME USING A DYNAMIC BAYESIAN NETWORK

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Introduction

Predicting plant invasion risk through space and time is critical to management and requires quantification of the likelihood of a plant arriving, the ability to establish and the impact it would have if established. For actively invading plants, current distribution is not necessarily a good predictor of potential distribution and risk models are constrained by uncertain knowledge about habitat requirements and dispersal mechanisms.

Objectives

Developing a modelling framework for estimating alien plant invasion risk where data and expert knowledge are integrated to make predictions, combining the main components of risk, likelihood and impact, into a causal probabilistic model (Fenton and Neil 2012).

Methods

We applied our framework to Sardinia (Italy) for *Acacia saligna*. *Acacia* presence/absence was surveyed across the study area (Brundu et al. 2003). Spatial data for elevation, mean annual rainfall, habitat type and three anthropogenic pressure indicators (Angelini et al. 2009) were used as environmental variables (100 x 100 m grid). Euclidian distance from existing *Acacia* locations was determined for each cell. Relationships between *Acacia* presence and environmental variables were tested by stepwise logistic regression in R. Using Netica™, a Dynamic Bayesian Network (DBN) (Nicholson and Flores 2011) was created to model invasion risk. The DBN used empirical data to probabilistically relate *Acacia* presence to significant variables. The DBN also related *Acacia* suitability, introduction, establishment and impact to environmental variables using subjective probability estimates. The DBN was expanded over 10 time steps (each time step = 1 year) and linked to spatial environmental data in ArcGIS (Smith et al. 2011), to model the propagation of *Acacia* introduction, establishment and impact probabilities over space and time.

Results and Conclusions

Of the total area of Sardinia (24,000 km^2), we estimate *Acacia* will establish on 114 km^2 with >=50% certainty, 76 km^2 with >=90% certainty, or 68 km^2 with >=99% certainty, over the next decade if not contained or eradicated. We also estimate *Acacia* will have high ecological impact on 73 km^2 with >=50% certainty, 67 with >=90% certainty, or 60 with >=99% certainty. Finally, we estimate it will have high agricultural impact on 27 km^2 with >=50% certainty, 3 with >=90% certainty, or 3 with >=99% certainty.

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KEYWORDS: Mediterranean islands, Bayesian networks, Acacia saligna, invasion risk

PT5.04

AUSTRALIAN ACACIAS IN BRAZIL: ARE THEY HERE TO STAY?

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INTRODUCTION

Species of the genus *Acacia*, originally from Australia, recently started being registered in areas neighboring introduction sites in Brazil. Since they present a consistent history of invasion in other countries and are being broadly used in Brazil, this fact raises concern.

OBJECTIVES

We aim to estimate the invasive potential of *Acacia mangium* and *A. mearnsii* in Brazil.

METHODS

To estimate the species' invasive potential we gathered information on introduction sites, main forms of use and their potential distribution based on species distribution models and related it to their known invasion success. Occurrence records in the native and exotic range were gathered from herbariums, digital databases and literature. To characterize the environmental conditions of studied areas we used 26 bioclimatic variables from digital databases. We selected the 8 most relevantcharacteristics for the native distribution pattern of each species using PCA. To estimate the environmentally suitable areas for each species we used an ensemble of three machine learning algorithms for Species Distribution Modeling (GARP, SVM and Maxent). Models were generated in Oceania and projected in South America. Lowest Presence Threshold was used to delimitate presence and absence areas. Sensitivity, Specificity and True Skill Statistics values were used to evaluate the predictive performance of models.

RESULTS

For *A. mangium* we gathered 150 native records and 24 invasions out of 86 exotic records in Brazil. For *A. mearnsii,* we gathered 116 native occurrence records and 12 invasions out of 231 exotic records in Brazil. Records point out that the main form of introduction of both species is commercial cultivation. *Acacia mangium* records are distributed in the Eastern and Northern Brazil, mainly in the coastal region and the Northern Amazon. Meanwhile, *Acacia mearnsii* is concentrated in the Southern region of the country. Based on an ensemble of the suitability values of each model, we evaluated the invasive potential of both species. The predictive performance of *A. mearnsii* invasions records by the ensemble model was very good (Sens.=0.92; Spec.=0.82;TSS=0.73). For *A. mangium* however, the predictive performance of the was fair to moderate (Sens.=1; Spec.=0.16;TSS=0.24).

CONCLUSIONS

Acacia mearnsii introduction sites are concentrated in areas of high environmental suitability where it already shows invasive behavior. The fact that most of these occurrences represent commercial cultivation sites with strong propagule pressure and additional growth resources could justify their invasion success. We believe that cultivation sites inside the estimated potential distribution could harbor more invasive populations and need special attention and management to prevent future damage.

We can observe invasion records of *A. mangium* in areas of high and low environmental suitability. Hence, the potential distribution predicted by the models is consistent with the plastic biology of these species.

The moderate performance presented by the *A. mangium* model may be justified by the broad area of potential invasion predicted, leading to low rate of true absences for this species. Our results justify our concern with these species invasive potential in Brazil as they seem to be here to stay. **FUNDERS:** Capes, CNPq, FAPERJ, Prociência/UERJ

KEYWORDS: Acacia mangium, Acacia mearnsii, Potential distribution, Invasive potential, Invasion index

PT5.05

ASSESSING THE RISK OF INVASIVE ALIEN PLANTS IN THE TUSCAN ARCHIPELAGO (CENTRAL MEDITERRANEAN): THE EPPO PRIORITIZATION OR THE AUSTRALIAN WRA?

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Introduction

Plant invasions are often resulting in a significant loss in the biological diversity, functions and economic value of invaded ecosystems (Lloret et al., Global Ecol Biogeogr 13: 37, 2004). As management opportunities for invasive alien species are mostly restricted to early stages of invasion the early detection and prediction of invasive behavior have high priority (Gassó et al., Biol Invasions 12: 463, 2010). Thus it is critical to determine which non-native species may cause significant negative impacts. This way we can prioritize the most harmful species for prevention and management to protect native species, ecological communities and human activities.

Objectives

The present study aims to compare the outcomes of two different tools for risk assessment, i.e. the EPPO Prioritization process and the Australian WRA, used as prioritization tools for IAS already present on a given area. Outcomes in sense of groups and by means of a scoring will be evaluated for these two risk analysis methods.

Methods

We selected a set of 204 alien plant species known to be present in the Tuscan Archipelago by an accurate screening of all the reports of alien species, from literature or internal information, between 1950 and 2012. All reports of established, occasionally and also cultivated species were included. We run the EPPO prioritization process for IAS [PM5/6(1) EPPO Bulletin 42, 463-474, 2012] restricting the area under assessment to the Tuscan Archipelago. The uncertainty given to each answer was combined in a Bayesian network to produce a ranking of priority value. As a comparative methodology we used the well known Australian WRA (Pheloung et al., J Environ Manage 57: 239, 1999) readapted for the Mediterranean basin (Gassó et al., Biol Invasions 12: 463, 2010). The outcomes of the two risk assessment methodologies have been compared, by analyzing the differences in the groups' composition and in the score output between the two methodologies.

Results

The EPPO prioritization procedure allows as to include 43 species in the list of invasive alien plants, 64 in the observation list and 97 in the minor concern list, whereas the readapted Australian WRA listed 82 species in the reject list, 33 in the evaluation list and 89 in the accepted list. 133 species where ranked similarly (41, 18 and 75 respectively in higher, medium and lower risk groups) while 70 species in a different way. The rankings obtained by this two methodologies show to be significantly highly different.

Conclusions

The EPPO prioritization produced a lower number of high risk species and this could be extremely helpful in prioritizating management actions. A benchmark against which to compare the two models is problematic because there are no absolute values for invasiveness of individual taxa and the only proxy could be the distribution and abundance of the taxa in the area under assessment and expert opinion on the actual or potential invasiveness.

Acknowledgments

This project has been possible thanks to funds from CoREM – CUP E79E10000120000 - Tuscan Archipelago National Park.

KEYWORDS: Islands, Weed Risk Assessment, EPPO prioritization

PT5.06

DEMOGRAPHIC RESPONSES OF *ESCHSCHOLZIA CALIFORNICA* (PAPAVERACEAE) ALONG ALTITUDINAL GRADIENT, AN INVASIVE PLANT OF CENTRAL CHILE.

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Altitudinal gradients constitute appropriate scenarios to analyze invasive plant responding to environmental gradients because many abiotic factors change simultaneously across rather small geographical scales (Arévalo et al. 2005). One way to examine whether altitude is a barrier to plant invasion is to assess demographic constraints at higher altitude. *Eschscholzia californica* is a perennial herb original from California and very invasive in Central Chile. Since its early introduction during XIX s. it has spread across central Chile, ranging from 0 to 2200 m altitude and from 30° to 38° latitude S.

The objective of this study was to compare demographic response of E. californica populations located at the coast and at the mountain ranges, in Central Chile, and assess

During a lapse of three years, we compared demographic response of *E. californica* populations along altitudinal range, Andean mountains. Between 2010 and 2012, we visited 7 populations of *E. californica* in Central Chile across an altitudinal gradient, ranging from 0 to 2200 altitude. Using a matrix population model approach, we constructed a three-stage matrix-model (seed, seedling, adult) for each population. In this way we conducted prospective as well as retrospective analysis (Caswell 2001) and we estimated the finite population growth rate (λ), and LTRE comparing these parameters between coastal an mountain populations.

λ decreased significantly with altitude a relation that was consistent between years. Coastal population expressed λ higher than 1 while mountain populations λ was not different than 1. LTRE indicated that seed survival was the process that affected more significantly to λ differences between coastal and mountain populations. Our results suggest that although this species is expanding at lower altitude, it is in a demographic equilibrium at higher altitudes. Moreover, seed stage seem to be more sensitive than adult stage to abiotic constraints occurring at higher altitudes.

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Acknowledgments: FONDECYT 1100076, PROYECTO ICM P05-002

KEYWORDS: Eschscholzia californica, matrix-model, finite rate of increase

PT5.07

NATURAL EXPANSION OF EUCALYPTUS GLOBULUS IN COMPARISON TO THE NATIVE SPECIES PINUS PINASTER: DO WE HAVE A POTENTIALLY INVASIVE SPECIES?

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The introduction of exotic forest species has resulted in major economic benefits for many countries. However, one concern that has gained special importance in recent years is related to the potential of natural spread of these species outside their planted areas (Richardson, Cons. Biol., Vol.12 pp. 19, 1998).In Portugal, the large growth of forest area is mainly due to the planting of two species, *Pinus pinaster* (native species) and *Eucalyptus globulus* (exotic species). Over last years, there has been a growing national worry about the possible risks of invasiveness of *E. globulus*.
In this study we aim to compare and evaluate the natural expansion of *P. pinaster* and *E. globulus* species in the surrounding areas to commercial plantations, in order to assess the presence or not of an invasive behavior of *E. globulus* in Portugal. Moreover we aim to identify the main factors (different land-uses, climatic conditions, soil types, water availability, vegetation density and composition) that promote natural expansion of these forestry species.
In this sense, surveys were carried out in the surrounding areas of the plantations of *E. globulus* and *P. pinaster* to document the natural establishment in the vicinity of planted stands. We sampled a total of 35 commercial plantation areas from north to south of Portugal. The sites were characterized in terms of planted stands characteristic, topography, surrounding land-uses types, climatic conditions and soil types. The sampling design was adapted from Callaham et al. (Inter. Journal of Forestry Research, pp. 5, 2013) and it is transect based. Each transect consisted of 8 sampling plots of 3m x 3m. The first sampling plot was randomly established from 0 to 15 meters inside the stand boundary and then remaining plots were systematically sampled every 15 m from this initial plot through out the length of transect (115 m). Transects were oriented perpendicular to the boundary edge and evenly spaced around the entire stands area.
Within each sampling plot we characterize the vegetation type and the tree canopy cover; and the number of plants of *E. globulus* or *P. pinaster* established by natural regeneration was also registered. The sampling effort resulted in the detection of 444 *E. globulus* and 1399 P. pinaster by natural regeneration, a density of 76 plants/ha and 1238 plants/ha, respectively. Of these, 60% E. globulus were established within the boundaries of planted stands and the rest were observed to a maximum distance of 30m away from stand boundaries and 35% P. pinaster were detected within the boundaries of stands with a decreasing number further away from stand boundaries. The land cover types with higher percentage of *E. globulus* regeneration were observed at stand boundaries and roadsides, whereas *P. pinaster* higher frequency was observed at the roadsides, and also inside *E. globulus* stands and open shrublands.
In conclusion, the results indicate that *E. globulus* have a lower seed dispersion and lower natural regeneration capacity in the stand surrounding areas when compared to the native species *P. pinaster*. Thus, under these circumstances, we did not find any evidence for an invasive behaviour by *E. globulus.*

KEYWORDS: Planted forest, Tree invasion, Natural regeneration, Land-use

PT5.08

MISMATCHES BETWEEN CLIMATIC NICHE AND GEOGRAPHIC DISTRIBUTION: THE ROLE OF CUSHION PLANTS ON THE ALTITUDINAL SPREAD OF TARAXACUM OFFICINALE, ACROSS ANDEAN ECOSYSTEMS

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The climatic requirements of invasive plants have been widely considered to predict their potential geographic distributions (Peterson 2003, Petitpierre *et al.* 2012). However, biotic interactions may be as important or even more important than climate to shape plant geographic distribution (Bullock et al, 2000, Meier et al., 2010, Kearney & Porter, 2009). We tested this idea in invasive plant, assessing the role of plant facilitation on altitudinal range shift of *Taraxacum officinale*, an invasive plant of Central Chile.
For this, we used Ecological Distribution Models (EDMs) comparing native range and the distribution in Chile for two pool of occurrences: (1) *Taraxacum officinale* only and *Taraxacum officinale* associated to cushion plants.
Our result indicated that the climatic factors were not sufficient to understand the geographical distribution of this species. It expands significantly its upper altitudinal range when we considered the influence of cushion plants. Moreover, this expansion has the potential to cover the whole distribution of cushion plants.
Facilitation of cushion plants occurs at local spatial scale, however, we sustain that it has the potential to scale up, thus allowing a shift of the altitudinal range beyond that expected by climatic requirements. The role of biotic interaction in shaping the geographic distribution of species is an issue that deserves serious consideration.
ACKNOWLEDGE: This study was supported by project FONDECYT 1100076 to RO Bustamante and project ICM P05 – 002; Pablo Guerrero is a Ph. D. fellow of CONICYT (D-21070301, AT-24090076, 75100024) and Fulbright (15103515).
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KEYWORDS: altitudinal range, biological invasions, climatic niche, cushion plants, geographic distribution, Taraxacum officinale

PT5.09

DEVELOPMENT OF AN 'INVASIVE ALIEN SPECIES PATHWAY MANAGEMENT TOOLBOX'

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INTRODUCTION

Human activity surpasses the biogeographical barriers. This promotes the establishment of alien species in new places. Due to the negative impact generated by these situations, many management programs and governmental resources have been focused on stopping their introduction and spread (Ruiz & Carlton 2003).

The Invasive Species Specialist Group (ISSG) is working in a public prototype resource to aid managing the introduction pathways of invasive alien species. The advantage of preventing the establishment of these species helps to avoid or reduce negative impacts.

OBJECTIVES

The collection of records about introduction pathways of exotic invasive species, to contribute to the prevention of potential new invasions.

METHODS

During seven weeks it was conducted a review in the University of Auckland's library browser. Were used keywords such as 'pathways/vectors of introduction'; focusing the search on pet and aquarium trade.

The records were recompiled into a pre-existing Excel spreadsheet. Additional annotations were also recorded.

Experts were contacted for suggestions on the collation and compilation of information.

RESULTS

8269 new records have been documented. 'Fishes' was the principal group. Then 'Reptiles and 'Birds'. It was added 486 new records of plants.

The majority of species have not become established in their new region.

Into the subcategory 'Pet/ Aquarium Trade', with 7251 new records, 'Reptiles' was the principal group. It was followed by 'Plants' with most of the records relating to the aquarium freshwater trade.

DISCUSSION

Due the heterogenic availability of resources and the short time of research, there may be an underestimation for other taxonomic groups.
Despite the proportion between 'Invasive' and 'Introduced' species, it was found a higher degree of successful establishments than expected (Williamson & Fitter 1996).
There are confusions within the groups 'Birds' and 'Fishes'. Some authors catalogue them into the group 'Pets', although for most of the cases they have been transported as 'Ornamental' organisms.
The category 'Plants' need to be revised because there is no clear distinction between 'Macrophytes', 'Plants', 'Aquatic Plants' and 'Seaweeds'.
Involvement of authors who were contacted to assist with this research was unexpectedly low.

CONCLUSIONS

The contribution to the resource 'Invasive Alien Species PATHWAY MANAGEMENT Toolbox' was achieved satisfactorily.
To avoid confusion from the users of the prototype resource it is suggested that the category plants should be separated into 'Marine' and 'Freshwater' plants. Also it is suggested that the confusion within the groups 'Fishes' and 'Birds' may be resolved by creating a new category which could be called 'Recreational Purposes'.

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ACKNOWLEDGES to The University of Auckland, Faculty of Sciences for finance my research and the ISSG for the supervision during the completion of the project.

KEYWORDS: Pathways Introduction, Vectors Introduction, Invasive Introduced Exotic Species, Global Database

PT6.01

PL@NTINVASIVE-KRUGER: COMPUTER-BASED IDENTIFICATION AND INFORMATION TOOLS TO MANAGE ALIEN INVASIVE PLANTS THE KRUGER NATIONAL PARK, SOUTH AFRICA

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Introduction

Invasive plant species are a major threat to the biodiversity of protected areas and South Africa's Kruger National Park (KNP), which covers some 20,000 km^2, is no exception. A river network that drains highly invaded catchments outside the park, makes KNP highly susceptible to alien plant invasions. Efficient control requires correct species identification, dissemination of current data and knowledge to increase awareness.

Methods

Pl@ntInvasive-Kruger project, a case study of the Pl@ntNet programme funded by the Agropolis Fondation, aimed to develop a suite of science-based, computer driven tools for use by KNP managers, researchers and teams involved in alien plant control. Three applications were developed, each of which is supported by the global, multi-user database:

i. The *PUBLISH* tool, which provides synthesised species information;
ii. *IDAO*, a computer-aided plant identification system; and
iii. *IDENTIFY*, an image recognition system.

Results

The online *Pl@ntNet-DataManager* database allows data management by members for field surveys and development of automated synthesis of species information. These syntheses are available as HTML pages through the *PUBLISH* tool, which provides detailed descriptions and imagery, and include information on ecology, biology and management. These data support the two identification tools.

PlantInvKruger-IDAO constructs unknown species in a step-wise manner from prominent characteristics selected by the user from pictorial multiple-choice menus. The suggested identification is expressed as the similarity of the unknown specimen to a matrix of taxa x characters. *PlantInvKruger-IDENTIFY* assists, through image recognition algorithms, with the identification of images of plants and plant parts submitted to the database through a web interface. In this case the suggested identification is expressed as the similarity of the unknown specimen to a database of images divided into four categories (entire plant, flower, fruit, leaf).

All tools are used from a collaborative web platform (Pl@ntNet), where members can also share information, documents, and manage discussions (see http://community.plantnet-project.org/pg/groups/561/plntinvasivekruger/).

Conclusions

Correct identification is an essential aspect of alien plant control programmes, but is difficult and time consuming, especially where large numbers of alien and indigenous species occur. The *Pl@ntInvasive-Kruger* database currently contains information on almost 400 alien plant species, with the identification tools focussing on the 113 most important species.

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KEYWORDS: biodiversity conservation, data sharing, database, IDAO, image recognition, information synthesis, protected area

PT6.02

NATURAL REGENERATION IN A 20-Y REFORESTATION AFTER FOUR YEARS OF *MEGATHYRSUS MAXIMUS* MANUAL REMOVAL

Mantoani MC[1], Dias J[1], Azevedo JB[1], Andrade GR[1], Torezan JMD[1] - [1]Universidade Estadual de Londrina-PR

INTRODUCTION

Introduced in Brazil to feed cattle, *Megathyrsus maximus* (Jacq.) B. K. Simon & S. W. L. Jacobs has expanded to the country and, in restoration sites it causes many problems, like growth depression and preventing the regeneration (Mantoani et al. 2012; Ammondt et al. 2013). This study aimed to evaluate the responses of regeneration to the weeding of *M. maximus* using hoes in a reforestation of 20 years.

MATERIAL AND METHODS

The study was conducted in a 20-y reforestation site dominated by *M. maximus*. We evaluate 45 plots of 5x5 m for four years, divided into three groups: control, manual removal for a year and abandonment for three years, and manual removal for two years and abandonment for two years. All individuals of woody species > 10 cm were sampled and we collected data on abundance and species richness, canopy cover, coverage and number of seedlings of *M. maximus*.

RESULTS

M. maximus coverage decreases only after two years in control, and the number of Guinea-grass seedlings uprooted decreased with repeated removals in the removal treatments. Canopy cover varied during the four years and was positively correlated with regeneration and negatively with the exotic grass.

We registered an increase in abundance and richness of exotic species until the second year. After four years, the total abundance and richness of pioneer species were higher in both removal treatments, but with the improvement in control group, there was no difference in total species richness.

DISCUSSION

M. maximus is causing the slow ecological succession in the area, like see in others studies (Mantoani et al. 2012; Ammondt et al. 2013). Although its decrease is slow, the local vegetation is suppressing it, indicating the importance of the tree structure, the proximity to the forest fragment to arrival of new propagules and isolation of fire, confirming that for forest cover, the model planting with the use of pioneer species and few deciduous species is an important factor to aid in the control of grasses, by the rapid increase in canopy (Souza & Batista, 2004).

The manual removal is efficient, becoming even more effective than the use of herbicides or other techniques in some cases (García-Orth; Martínez-Ramos, 2011). However, it must be used in small-scale or in areas that requires control point (Mantoani et al. 2012), due to its high cost in large-scale.

CONCLUSION

The technique can be used to accelerate the succession area, although some variables do not show improvement, and the removal of *M. maximus* for two years is more efficient, favoring more pioneer species.

ACKNOWLEDGMENTS

Authors thank the IAP, for authorizing this study, the CNPq by the research grant granted to JMDT (grants 313854/2009-2 and 503836/2010-9), and CAPES scholarships to JD and MCM.

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KEYWORDS: Invasive species, adaptive management, Panicum maximum Jacq

PT6.03

PROSPECTS FOR INITIATING A BIOLOGICAL CONTROL PROGRAMME AGAINST GIANT REED, ARUNDO DONAX (POACEAE) IN SOUTH AFRICA

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Introduction

Giant reed, *Arundo donax* (Poaceae) is a robust, perennial grass native to Mediterranean Europe that has become naturalised and invasive in South Africa, where it is widespread, invading all climatic regions and terrestrial biomes. *Arundo donax* is invasive in catchments and riparian zones as well as areas away from water, particularly disturbed habitats such as roadsides. The reed's most significant negative environmental impact is its high water consumption. Infestations also alter normal ecological processes, cause an increase in siltation, a narrowing of water channels and a reduction in flow. In South Africa, *A. donax* is currently managed using chemical and mechanical methods but these are unsuccessful in the long term due to rapid regrowth of the canes from rhizomes.

Arundo donax is also noxious in North America and a biological control programme was initiated by the United States Department of Agriculture-Agricultural Research Service (USDA-ARS) in 2005. This programme has had impressive success in its early stages and two highly specific biocontrol agents, a stem-galling wasp *Tetramesa romana* (Hymenoptera: Eurytomidae) and a diaspidid armoured scale, *Rhizaspidiotus donacis* (Hemiptera: Diaspididae) are already established and damaging to populations of *A. donax* in the Rio Grande River Basin (Goolsby, pers. Comm)

Objectives

The *A. donax* biocontrol programme in North America offers South Africa an invaluable opportunity to initiate a programme under the guidance of well-developed expertise in the USDA. With the high degree of specificity of the candidate agents and a lack of native *Arundo* species, a biocontrol programme in South Africa has substantial promise for good progress and success.

Methods

The author has visited the USDA's *A.donax* biocontrol programme on two occasions for improved knowledge of testing and rearing the candidate agents. These exploratory visits also assisted in determining the necessary infrastructure and budget demands for developing an *A. donax* biocontrol programme.

Results and Conclusions

This interaction with the USDA regarding prospects for developing a programme in South Africa, led to the discovery of the stem-galling wasp, *T. romana* on A. donax infestations, its presence in South Africa previously unknown and unrecorded. The Agricultural Research Council – Plant Protection Research Institute is planning to initiate a biocontrol programme against *A. donax* in 2014. Initially, other genotypes of the wasp *T. romana* and the scale, *R. donacis* will be considered for release. Host specificity testing will focus on native Poaceae closely related to *A. donax*, according to a test plant list devised by experts in grass phylogeny (USDA-ARS). Other natural enemies of *A. donax* that are currently being tested by the USDA-ARS may also be considered during later stages of the programme.

Acknowledgments

The author sincerely thanks Dr John Goolsby (USDA-ARS) and his research team for hosting her at the Arundo lab in Texas. The Drakenstein Trust and the KwaZulu-Natal Department of Agriculture – Invasive Alien Species Programme (KZN DAEA-IASP) are gratefully acknowledged for funding these trips and the Drakenstein Trust for financial support to attend EMAPi 2013.

KEYWORDS: biological control, giant reed, Arundo donax (Poaceae), South Africa

PT6.04

LESSONS LEARNED ERADICATING INVASIVE ALIEN PLANTS IN KWA-ZULU NATAL, SOUTH AFRICA

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INTRODUCTION

As part of a national initiative to focus on eradication (see talk by Nänni *et al*), I report here on three years progress with clearing invasive alien plants in KwaZulu-Natal (KZN), South Africa (SA), specifically three species that are too widespread for eradication, *Campuloclinium macrocephalum* (Pompom weed), *Lilium formosanum* (Formosa lily) and *Parthenium hysterophorus* (Famine weed), and three species where eradication might still be possible *Furcraea foetida (*Mauritius hemp), *Hypericum pseudohenryi* (Henry's St John's wort) and *Sagittaria platyphylla* (Delta arrowhead).

OBJECTIVES

i) Clear outlier populations of pompom weed, Formosa lily and famine weed. ii) Clear all populations of Mauritius hemp, Henry's St John's wort and Delta arrowhead iii) Survey un-infested areas for the target species iv) Collect data while clearing and surveying v) create jobs, as the project is funded by a government poverty alleviation programme providing temporary work for the unemployed.

METHODS.

Teams of twelve people in a utility vehicle survey for outlying populations of target species and apply registered herbicides to plants that are discovered. Follow up treatments are conducted. Data is collected using hand held computers and CyberTracker, which has been specifically tailored for the target species.

DISCUSSIONS

About 300 jobs were created in the period of 3 clearing seasons (Sept- March in each season) with about 29 000 person-days achieved in total. Experience and training received by the beneficiaries has assisted some of them to be more competitive on higher positions (with one beneficiary appointed for a field manager position in one of our stakeholder organisations).

POMPOM WEED Populations prevalent along road verges and around cemeteries (flowers are placed on graves) are sprayed annually. Awareness raising is increasing the reporting of new populations, but there is still a huge lack of appreciation of the dangers this species poses to the Grassland Biome.

FORMOSA LILY Winged seeds that are produced in profusion make containment very difficult but annual cut stump chemical control is undertaken. Anecdotal evidence suggests that mature plants are being killed, as populations sprayed previously appear to consist of small young plants, possibly seedlings.

FAMINE WEED Teams walk along road verges spraying all plants seen, with special effort around bus stops and car washing areas.

MAURITIUS HEMP Leaves and flowering stalks of mature plants are hacked and treated with herbicide. Bulbils are collected, placed in plastic bags, treated and stored to rot.

HENRY'S ST JOHN'S WORT Catchment stream-flow dynamics are threatened by this species but the more we survey the more populations we find and it may not be possible to eradicate. Cut stump treatment is being tried.

DELTA ARROWHEAD Foliar spraying with three follow-ups at 3-week intervals. Submerged plants are removed mechanically once the extent of infestation has decreased by 70% as there is no registered herbicide for submerged plants.

LESSONS LEARNED

- It is possible to use unskilled teams to survey for outlying populations of invasive plants
- Teams should have previous experience – the best option is to appoint the same team as the previous season but this is not always possible with the SA supply chain management system
- Training at the start of each flowering season is crucial
- Close monitoring of teams important
- Data collected using hand held computers is much more accurate than data collected manually

ACKNOWLEDGEMENTS

This work was funded by the South African Working for Water Programme of the Department of Environmental Affairs. Team members H. Sithole, R. Lalla, V. Mkhize, N. Mhlambi, J. Wilson, P. Ivey and I. Nänni contributed valuable insights.

KEYWORDS: south africa, KwaZulu, Campuloclinium macrocephalum, Pompom weed, Lilium formosanum, Formosa lily, Parthenium hysterophorus, Famine weed, Furcraea foetida, Mauritius hemp, Hypericum pseudohenryi, Henry?s St John?s wort, Sagittaria platyphylla, Delta arrowhead

PT6.05

BEASTS FOR THE BEAUTY - PROGRESS ON THE BATTLE TO TAME WILD GINGERS

Djeddour DH[1], Pratt C[1], Shaw RH[1] - [1]CABI - Invasive Species

INTRODUCTION

Kahili ginger, *Hedychium gardnerianum* (Sheppard ex J. B. Ker Gawler), yellow ginger, *H. flavescens* (W. Carey ex W. Roscoe) and white ginger *Hedychium coronarium* J. Koenig (Zingiberaceae) are stunning and fragrant ornamental herbs native to the Eastern Himalayan foothills, which have escaped cultivation to become aggressive colonizers of indigenous and intact forest habitats, smothering unique and delicate ecosystems and threatening specialised communities. In the worst affected countries such as the US (Hawaii) and New Zealand, large monotypic infestations of Kahili ginger the "queen of the genus", are deemed lost causes with management efforts concentrating on outlier populations and further range expansion is caused by seeds vectoring to new pristine sites. A new approach to management was needed.

OBJECTIVE

To determine whether classical biological control is feasible for the control of wild gingers using field observations in the native range coupled with laboratory study under quarantine conditions

METHODS

In 2008, consortium funding facilitated an exploratory survey to the States of Assam, Meghalaya and Sikkim in India, with reviews of the scientific and botanical literature, as well as historical herbarium records providing the geographical focus. Since then six more field trips have been conducted in Sikkim where the most natural populations of Kahili ginger were identified. Selected natural enemies were exported from India to UK quarantine after a long approval process and the techniques for rearing of these challenging species are still being assessed and improved upon. Initial host range testing has begun against test plant lists provided and approved by the New Zealand and USA authorities.

RESULTS

Whilst literature studies highlighted a dearth of damaging species associated with Wild gingers in the introduced range, the plant was always subject to significant natural enemy pressure in India occupying a range of niches/guilds. Potential biocontrol agents include a shoot mining chloropid fly, *Merochlorops dimorphus* and a striking weevil, *Tetratopus* sp. which are currently under investigation under lab conditions as well as in the field thanks to the collaboration of Sikkim University. Many of the species found are new to science and whilst the fly and weevil hold the most promise, there may still be potential agents not yet discovered.

CONCLUSIONS

It would appear that wild gingers have a much wider range of natural enemies in their native range than was expected and that some of these, such as the chloropid fly which has only been associated with *H. gardnerianum* to date, may hold promise for biocontrol in New Zealand and Hawaii. Whilst no funding has yet been sought from Brazil *H. coronarium* is a serious invader of wet ecosystems in Brazil and the natural enemies of this species are regularly encountered and identified as part of the survey work and the possibility of "piggy-backing" the current research project is highlighted.

Acknowledgements – Thanks are given to the funders Landcare Research, the State of Hawaii and Nature Conservancy of Hawaii as well as our collaborators in India, ICAR and the Department of Forests, Environment and Wildlife Management, Sikkim.

KEYWORDS: wild ginger, Hedychium garnerianum, coronarium, falavascens, biological control, biocontrol

PT7.01

ACTIONS OF THE STATE OF BAHIA ENVIRONMENTAL AGENCY TO INVASIVE ALIEN SPECIE'S MANAGEMENT.

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INTRODUCTION

Invasive alien species: alien species whose introduction or spread threatens ecosystems, habitats or species and cause negative environmental, economic, social or cultural impacts (CONAMA, 2011). According to CONABIO Resolution n° 05/2009, invasive alien species are considered the second greatest threat to biodiversity loss worldwide, threatening the integrity and balance of natural landscapes. The State Decree n° 14.024/12, in its art. 60 establishes that "The executive organ of the State Policy Environment should identify and monitor the occurrence of invasive alien species which threaten ecosystems or natural habitats by adopting control measures wherever possible." Aiming to perform what is required by that legislation, the Instituto do Meio Ambiente e Recursos Hídricos - INEMA, environmental agency of the state of Bahia, has planned activities as the development and implementation of action plans for the management of invasive alien species of plants in two protected areas of Bahia, the Rio Preto Ecological Station and the Serra do Conduru State Park, and preparation of the official list of invasive species in the state of Bahia.

OBJECTIVES

Describe the activities involved in the preparation and implementation of action plans for the management of alien plants invasions in two (2) protected areas of Bahia, the Rio Preto Ecological Station and the Serra do Conduru State Park, and in the publication of the official list of invasive alien species in the state of Bahia.

MATERIALS AND METHODS

The work's first step was the training of technicians from INEMA and from SEMA through the Technical Seminar Invasive Alien Species held from 23 to 25/07/2012, covering the following topics: biological invasions science; impacts of invasive alien species; biological invasion; preventive measures, risk analysis, plants and animal's management and priority setting control. The second step was the formulation of terms of reference - TR for elaboration and implementation of action plans for the management of invasive alien species of plants in the Rio Preto Ecological Station and in the Serra do Conduru State Park. The third stage involves the construction of term of reference - TR for hiring consultancy aiming at development, validation and dissemination of the Official List of Invasive Alien Species in the state of Bahia. INEMA will be responsible for product analysis and monitoring of the activities during the execution of the steps set out in TR.

RESULTS

Through the Seminar were trained 39 technicians INEMA and SEMA. The expected results through outsourced services are: 1) preparation of the work plan, diagnosis, elaboration and implementation of the action plan and monitoring of managed protected areas, 2) elaboration of the preliminary list, consultation of the institutions of education and research, technical and researchers to expand the database and validate the list of invasive alien species in the state of Bahia.

CONCLUSION

The proposed work will contribute to the control and/or eradication of invasive alien species, helping to reduce pressure on native species and will subsidize the state for future discussions, policies, plans and projects for the prevention, control, management or eradication of invasive alien species.

KEYWORDS: Invasive alien species, management, official list

SS1.1
IMPACT IN RISK ASSESSMENT: STATE OF THE ART AND FUTURE

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INTRODUCTION

Species introduced outside of their native range can have manifold impact on environment and economy. This is now widely recognised by scientists as well as officials, and measures to prevent such impact are asked for. Risk assessments (RA) for border control were developed to hinder potentially harmful species from entering a country while not completely preventing global trade of living organisms (Kumschick & Richardson 2013). Usually, in RAs and applications thereof it is emphasised that by conducting border control RA, impact can be reduced. However, many of these RA do not explicitly assess the impact potential, but look at "invasiveness" or "weediness" instead. However, there is evidence that impact is not correlated with invasiveness (Ricciardi & Cohen 2007). Therefore, when only assessing the likelihood of a species establishing and spreading in a new region, one might miss the potential for impact.

OBJECTIVES

The aims are to unravel how impact has been incorporated in border control RA for alien species to detect weaknesses and strengths. Furthermore, we suggest improvements for impact incorporation in RA and argue how they can be achieved.

METHODS

We searched for the most relevant publications on species based (as opposed to pathway based) border control RA for alien plants and animals on Web of Science. For this review on impact in border control RA we only considered the original publications unless the derived RA was widely used or developed for a different taxon.

RESULTS

Of the 19 RA schemes assessed, impact is considered in 13 (68.42%) of the RA, ranging from a single question out of 12 being on impact to the whole scheme being based on impact. Also the level of information and detail on how to assess impact varies greatly between the systems.

CONCLUSIONS

Impact assessment in border control RAs for invasive alien species is generally rather arbitrary. We largely still lack a predictive understanding of alien species' impact, which contributes to this problem. To increase the predictive power of RA, we need to conduct more studies on impact of alien species in general to improve our general understanding thereof.

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ACKNOWLEDGEMENTS
We acknowledge funding support from the DST-NRF Centre of Excellence for Invasion Biology and the Working for Water Programme through their collaborative project on 'Research for Integrated Management of Invasive Alien Species', the Department of Environmental Affairs, the Global Invasions Network RCN and the Swiss National Science Foundation.

KEYWORDS: Risk assessment, impact, invasiveness, prediction

SS1.2

DOES INVASIVENESS OF PLANT INVADERS ALSO PREDICT THEIR IMPACT?

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INTRODUCTION

Despite increasing number of studies on impacts of biological invasions we know little about to what extent are the invasiveness of plant species and the impact they cause related (Vila et al. 2011, Pyšek et al. 2012). On global scale, it seems that these two measures of invasion are poorly correlated (Ricciardi & Cohen 2007) which implies that invaders' traits involved in the two processes may differ. At the local scale, the knowledge is constrained by most studies addressing the two questions separately which constrains meaningful comparison.

OBJECTIVES

To explore, by comparing three congeneric taxa of Fallopia (Polygonaceae) differing in their invasiveness in central Europe, whether their ranking according to this measure differs from that based on their impact on native land snail communities associated with invaded vegetation.

METHODS

We compared pairs of invaded and uninvaded plots in 64 sites in floodplain forests, recording the richness and abundance of living land snail species separately for all species, rare species listed on the national Red List, and small species with shell size below 5 mm.

RESULTS

We found that invasions by plants significantly affect species composition and structure of land snail communities, but the strengths of impacts differ among particular invading plants and vary with respect to what is measured as a response variable. The significant impacts ranged from 16–48% reduction in terms of snail species numbers, and 65–90% reduction in their abundance. Overall, however, the impacts on snails were invader-specific, differing among plant taxa.

CONCLUSIONS

The ranking of Fallopia taxa according to the strength of impacts on snail communities differs from ranking by their invasiveness, and the impacts they cause are taxon-specific. This indicates that invasiveness does not simply translate to the impact of invasion, neither can the impact be inferred from the knowledge of that of a closely related species. This needs to be borne in mind by conservation and management authorities.

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KEYWORDS: Impact, invasiveness, land snail community, plant invasion, river floodplain

SS2.1

IMPACT OF NINE INVASIVE PLANT SPECIES IN SOME ECOSYSTEMS IN VENEZUELA

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Globally, it is well known that invasive plants can reduce species richness and modify soil nutrient pools. The quantification of these changes will allow us to predict the long-term impacts that could be caused by plant invasion. There are some studies quantifying these impacts in temperate and subtropical areas, but in the Neotropic these studies are scarce, in spite of invasive plants being significant threats for the rich biodiversity existing in the tropics. The objectives of this study were to quantify the effect of nine invasive plant species on plant species richness and biogeochemical properties of the soil. We located at least one population of each invasive species, in northern Venezuela. We collected soil samples and we registered the plant species in the understory in invaded patches and adjacent non-invaded patches. We estimated richness and some soil properties (texture, moisture, pH, organic matter, microbial biomass carbon, nutrient content and biological activity) in each site, and compared their differences. Invasive species, *Melinis minutiflora*, *Pteridium aquilinum* and *Kalanchoe daigremontiana* decreased plant species richness by more than 50%, while *Leucaena leucocephala* and *Salsola kali* by 30%. The impact of *M. minutiflora* and *P. aquilinum* was significantly higher in the Andean cordillera (with higher plant diversity) than in the coastal cordillera. The three species with the highest impact on richness generated the highest impacts on soil properties as well. In arid ecosystems, *K. daigremontiana* invasion increased soil organic matter and thus the biological activity. The impact on soil caused by *P. aquilinum* and *M. minutiflora* varied in magnitude and sign depending on the sampling location. In conclusion, the impact of study invasive plants on richness and soil properties is significant, but it seems to be modulated by the recipient habitat characteristics rather than by functional traits of invasive plants.

KEYWORDS: Neotropic, plant invasion, receptor habitat characteristics, richness, soil properties

SS2.2
INVASIVE ALIEN SPECIES: A MAJOR THREAT FOR THE LAST REMNANTS OF SOUTH AMERICAN GRASSLANDS

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INTRODUCTION
The Pampas biome comprises ca. 893,000 km² of subtropical and temperate grasslands in Southern South America. Climate and soils lead to severe and extensive landscape changes in early colonization times, initially for cattle husbandry and latter for agriculture (Fonseca et al. 2013). Invasive alien plants, especially trees and shrubs, are the main threat for the last remnants of native vegetation growing in areas of low aptitude for agriculture (Zalba and Villamil 2002).

OBJECTIVES
Assess ecological changes associated to the spread of alien woody plant in remnants of native Pampas grasslands.
Identify the main drivers of invasion.
Design effective control actions.

METHODS
The work was developed at a medium height (up to 1200 mASL) mountains in Southern Pampas (lat 38°S, long 61°W). Some of the most widespread invasive alien woody plants in the area were classified in three groups according to main biological characteristics: pines (wind-dispersed seeds, disturbance dependent recruitment), legume shrubs (fire resistant, long lived seed bank) and rosaceous (seeds dispersed by birds and mammals). An adaptive management strategy was implemented to assess population parameters relevant to the management of the species by the implementation of control actions. Effects of disturbance on invasion and efficiency of different treatments were also tested.

RESULTS AND CONCLUSIONS
Invasive alien shrubs and trees are responsible of significant reductions in plant species richness and changes in bird communities, and they also interfere with water runoff in high catchment areas. Invasive pines (*Pinus halepensis* and *P. radiata*) increase recruitment in response to wild fires and overgrazing, but prescribed fires could be used for control depending on their frequency. Invasive legumes (*Spartium junceum* and *Genista monspessulana*) grow in close association to riparian habitats where they increase fire intensity and frequency. Fire, in turn, promotes massive seed germination. A combination of mechanical and chemical control appears as an appropriate option for their control. Rosaceous invasives (*Prunus mahaleb* and *Rosa* spp.) depend on native bird and mammal species for long-distance dispersal and local colonization. *P. mahaleb* exhibits a lag-phase of 8-18 years between the establishment of the founder individual and local recruitment, representing an opportunity for the prevention further spread. Control efforts resulted in the recovery of grassland structure and composition, without complementary restoration actions.

CONCLUSIONS

Invasive woody plants have proved their ability to spread and colonize pristine grasslands in the Pampas. Their presence is associated to biodiversity losses and alteration of ecosystem services. Effective control is feasible and essential for preserving the last remnants of the biome, with adaptive management as the strongest option for both identifying the key components of the process and reducing its impact.

AKNOWLEDGEMENTS

This work was supported by CONICET (National Research Council, Argentina) and Universidad Nacional del Sur. The main author received the support of Departamento de Ciencias Ecológicas, Universidad de Chile, to attend the congress.

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KEYWORDS: Grasslands, invasive woody plants, adaptive management

SS2.3

EXOTIC TREE PLANTATIONS IN MEXICO: THE WAR THAT OUR OAK ARMY MAY LOSE BECAUSE OF NOVEL WEAPONS

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During the 20th century, plantations of *Eucalyptus* spp. were implemented as productive alternative for American landowners. In Mexico, plantations were introduced in small deforested areas used by local farmers, generating mosaics of *Eucalyptus* patches surrounded by native forests. Several plantations are now abandoned, but their effects on native biota are unknown. This study assesses whether *Eucalyptus* affects the recruitment of native oaks (genus *Quercus*) that surround plantations. Although *Eucalyptus* seems to invade the forest, no oaks are observed in plantations. It was firstly proposed that this occurs because propagule pressure of oaks is reduced within plantations because acorn dispersers avoid this habitat. Nevertheless, field samplings indicated that acorns are actually being dispersed inwards plantations. Thus, other factors would restrict oak recruitment. Because *Eucalyptus* species produce secondary metabolites that inhibit germination of other plants, it was proposed that oaks would not tolerate these allelopathic compounds. Greenhouse experiments were then conducted by watering acorns with aqueous extracts of *Eucalyptus* leaves and distilled water. This experiment indicated lower germination rates for acorns watered with *Eucalyptus* extracts. Later, a field experiment was performed to assess whether environmental conditions predominating in plantations also affect oak establishment. Here, acorns were sowed in pots containing substrate from forest and plantations, and this experimental design was implemented these two habitat types. The highest germination rate was obtained for pots located in the forest and filled with forest substrate; they were followed by pots located in plantations and filled with forest substrate; pots filled with substrates collected from plantation displayed lower germination rates irrespectively of the habitat type they were placed. These results then suggest that commercial plantations of exotic species may endanger native biota and impede natural succession in affected areas once they are abandoned, especially when management programs are inappropriate.

KEYWORDS: alellopathy, Eucalyptus, germination, Quercus

SS3.1
PRIORITIZING WEED TARGETS FOR CLASSICAL BIOLOGICAL CONTROL: A CASE STUDY ON BRAZIL

Tanner RA[1], Shaw RH[1], Trivellato G[2] - [1]CABI, [2]UNESP

Introduction

Brazil has one of the largest agricultural economies in Latin America and is one of the mega-biologically diverse countries in the world. Many of the more invasive non-native plant species introduced into Brazil have the potential to damage both natural environments and agricultural and pastoral systems thereby reducing endemic biodiversity and threatening food security. Classical weed biological control (CBC) targets non-native invasive plant species in their exotic ranges through the introduction of natural enemies (arthropod or fungal pathogens) from the native range of the target plant species. As a management tool, CBC constitutes an environmentally friendly and less labor-intensive approach to weed control compared with the more traditional methods of mechanical and chemical efforts.

Objectives

To prioritize the long list of potential targets for CBC to ensure the best use of limited resources against those species where CBC may have significant beneficial impacts.

Methods

A recently developed prioritization tool originally developed for Australia, was used to rank over 140 non-native invasive plant species in Brazil according to the feasibility of their biocontrol. This technique takes into account the economic and ecological impact of the species, both in the area of concern and other geographical regions, the feasibility of surveying and identifying potential biological control agents in the plant's native range and if the species has been a successful target for biological control in other geographical regions as well as considering the likelihood of non-target effects and public acceptance.

Results and conclusions

This paper will describe the process and present the ranked list of prioritized non-native plant species for CBC in Brazil that can be used by stakeholders within the region and overseas to develop collaborative biological control programmes on targets where the potential for success, at the outset, is likely to be high. In addition, we will highlight the top 10 target species detailing their ecology, impact and the natural enemies that may have potential for use within Brazil.

Worldwide, there has been significant advances and success in controlling highly invasive species like *Cryptostegia grandiflora* and *Prosopis juliflora*, both of which are present in Brazil. Thus, the potential to use 'off-the-shelf' natural enemies to control invasive plant species is a feasible option for consideration for Brazil.

Acknowledgments

The authors are grateful to Quentin Paynter for allowing use of the prioritisation tool for weed targets and biological control. We are also grateful to the CABI Development Fund (CDF) for providing funding to undertake this research.

KEYWORDS: Classical biological control, non-native invasive weeds, natural enemies

SS3.2

PRIORITIZING WEED TARGETS FOR CLASSICAL BIOLOGICAL CONTROL: A CASE STUDY FOR BRAZIL

Tanner RA[1], Trivellato G, Shaw RH[1] - [1]CABI - Invasive Species

INTRODUCTION

Brazil has one of the largest agricultural economies in Latin America and is one of the mega-biologically diverse countries in the world. Many of the more invasive non-native plant species introduced into Brazil have the potential to damage both natural environments and agricultural and pastoral systems thereby reducing endemic biodiversity and threatening food security. Classical weed biological control (CBC) targets non-native invasive plant species in their exotic ranges through the introduction of natural enemies (arthropod or fungal pathogens) from the native range of the target plant species. As a management tool, CBC constitutes an environmentally friendly and less labor-intensive approach to weed control compared with the more traditional methods of mechanical and chemical efforts.

OBJECTIVES

Due to the high number of potential targets, prioritizing for CBC is essential to focus effort and limited resources on those species where CBC may have significant beneficial impacts.

METHODS

Based on a recently developed prioritization tool for Australia, we ranked the feasibility of biocontrol for over 140 non-native invasive plant species in Brazil. This technique takes into account the economic and ecological impact of the species, both in the area of concern and other geographical regions, the feasibility of surveying and identifying potential biological control agents in the plant's native range and if the species has been a successful target for biological control in other geographical regions as well as considering the likelihood of non-target effects and public acceptance.

RESULTS AND CONCLUSIONS

This paper describes the process and presents the ranked list of prioritized non-native plant species for CBC in Brazil that can be used in by stakeholders within the region and overseas to develop collaborative biological control programmes on targets where the potential for success, at the outset, is likely to be high. In addition, we highlight the top 10 ranked species detailing their ecology, impact and the natural enemies that could be used to control the species within Brazil. Worldwide, there has been significant advances and successes in controlling highly invasive genera like *Cryptostegia* and *Prosopis*, both of which are present in Brazil. Thus, the potential to use 'off-the-shelf' natural enemies to control invasive plant species is a feasible option for consideration for Brazil.

ACKNOWLEDGMENTS

The authors are grateful to Quentin Paynter for allowing use of the prioritisation tool for weed targets and biological control. We are also grateful to the CABI Development Fund (CDF) for providing funding to undertake this research.

KEYWORDS: Biocontrol, biological control, prioritisation, rubbervine, Cryptostegia , Prosopis

SS4.1

ECOLOGICAL IMPACT, DISTRIBUTION AND BIOLOGICAL CONTROL OF INVASIVE ALIEN *TECOMA STANS* IN SOUTH AFRICA AND BRAZIL

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INTRODUCTION: *Tecoma stans* (L.) Bignoniaceae is an evergreen tree or shrub and native from southern USA to Argentina. It is highly morphologically variable in native range, and it appears to consist of many geographically restricted but intergrading biotypes. It was introduced as an ornamental plant throughout the world. Currently, it is invasive throughout the tropics and sub-tropics, including South Africa and Brazil. OBJECTIVES: Use biological control as a viable option because is sustainable, inexpensive and environmental friendly. METHODS: Classical Biological control programme of *T. stans* was initiated in South Africa in 2003. In Brazil a project (no classical), looking for natural enemies associated with *T. stans* was initiated in 2002. RESULTS: Currently, two insect species (*Pseudonapomyza* sp. and *Mada polluta*) and a rust fungus (*Prospodium transformans*) have been successfully developed as suitable and potential agents in South Africa. The two insects are awaiting for the release application approval whilst the rust fungus has been released since 2010. According to the pre-release impact study results showed that they have a potential to reduce plant biomass and competitive ability of the weed. The rust fungus induces galls on leaves and stems and it has a potential to reduce growth and seed production. A rust fungus *Prospodium appendiculatum* was spotted associated with this weed in north of Paraná – Brazil inducing galls on leaves stems and flowers, but the damages were not sufficient to control the infested areas. CONCLUSIONS: As a result a management plan was proposed which comprises classical biological control. We hope to introduce from South Africa, some of the agents cited above in future in collaboration with ARC - PPRI. This study was both funded by Agricultural Research Council and Department of Environmental affairs- *Working for Water* programme (WfW) in South Africa and in Brazil the study was funded by PROBIO/MMA/CNPq.

KEYWORDS: Tecoma stans, invasive, biological control, host specificity, biology

SS4.2

THE LONGHORN BEETLE *RECCHIA PARVULA*: A SUITABLE BIOLOGICAL CONTROL AGENT FOR *CHROMOLAENA ODORATA* IN SOUTH AFRICA?

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A biotype of *Chromolaena odorata* (Asteraceae) from Jamaica or Cuba is invasive in the eastern parts of southern Africa. *Recchia parvula* (Coleoptera: Cerambycidae) was collected off *Chromolaena hookeriana* in north-western Argentina in the early 2000s and brought into quarantine in South Africa, as a potential biocontrol agent for the closely related *C. odorata*. One of the motivating factors for collecting potential biocontrol agents from this region is that it is climatically similar to the invasive range of *C. odorata* in South Africa; most other parts of the native range of *C. odorata* are wetter and more tropical. *R. parvula* is a univoltine species which lays eggs near the stem tips in spring, and whose larvae bore down the stems into the root crown of the plant during summer and diapause there in winter. It is extremely destructive, typically killing the plant in which it is feeding. It has been successfully cultured on the southern African biotype of *C. odorata* in quarantine for 10 years, and extensive host-range testing indicates a high degree of specificity. Given that *R. parvula* was collected on *C. hookeriana* in Argentina for use on *C. odorata* originating in the Caribbean, laboratory trials to compare preference and performance of the insect on the target weed and *C. hookeriana* are planned. Further survey work in the region of origin is also planned, and particularly in Brazil. While *R. parvula* has a native range from central Brazil to north-western Argentina, *C. hookeriana* is restricted to the eastern foothills of the Andes in north-western Argentina and Bolivia. It is desirable to determine what species *R. parvula* uses as host plants where *C. hookeriana* is not present.

KEYWORDS: Argentina, Asteraceae, biological control, biotype matching, Brazil, Cerambycidae, climatic matching, host plants, host range

SS4.3

A BRAZILIAN INSECT COULD BE THE SOLUTION TO AN INVASIVE WEED IN SOUTH AFRICA

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INTRODUCTION

Pereskia aculeata (Cactaceae) is an invasive alien plant that has a negative impact on native plant biodiversity in South Africa. Mechanical and herbicidal control of *P. aculeata* are exorbitantly expensive, ineffective and unsustainable, so biocontrol is considered the only possible solution. *Pereskia aculeata* is native to South and Central America but climatic matching and genotype matching has indicated that the most appropriate region to source potential biocontrol agents is southern Brazil. Several potential biocontrol agents have been collected and identified from that region, including the Pereskia stem-wilter, *Catorhintha schaffneri* (Coreidae), which was imported into quarantine in South Africa during 2013. IBAMA export permit numbers 11BR006202/DF; 13BR010102/DF.

OBJECTIVES

The aim of this study was to determine if *C. schaffneri* is a safe and effective potential biocontrol agent.

METHODS

No-choice nymph survival trials were conducted by placing ten recently hatched, unfed nymphs on test plant species or *P. aculeata* controls. The percentage survival and developmental stage was recorded daily. This process was repeated for twenty-seven test plant species.
Adult no-choice survival trials were conducted by placing recently moulted *C. schaffneri* onto test plant species or *P. aculeata* controls and recording the number of days of survival.
Impact studies were conducted by placing 10 newly hatched nymphs on *P. aculeata* plants for 10 days. Controls were not exposed to the insects. The change in shoot length, number of shoots and number of leaves were recorded.

RESULTS

Catorhintha schaffneri only developed to the adult stage on *P. aculeata* and the closely related *Pereskia grandifolia*. Survival to the adult stage on *P. aculeata* was 80% while only 2% of the individuals survived to the adult stage on *P. grandifolia*. Survival to the adult stage was not possible on any other test plant species.
Duration of survival of adult *C. schaffneri* on *P. aculeata* was significantly greater than on other test plant species.
The feeding of *C. schaffneri* nymphs significantly impacted *P. aculeata* with an average reduction of 37 leaves (SE ±4.89) and 36.5cm (SE ±7.86) of shoot length over the ten day period of exposure to the nymphs.

CONCLUSIONS

Catorhintha schaffneri is safe for release because it is monophagous and is therefore no threat to native or economically important plants in South Africa. *Pereskia grandifolia*, a congener to the target weed, is the only plant on which development is possible and even on this species, survival is dramatically reduced. *Pereskia grandifolia* is a declared weed in the country, so any feeding on *P. grandifolia* is of no concern. Impact studies indicate that *C. schaffneri* is likely to be an effective agent if released. The insect should therefore be released for the control of *P. aculeata* in South Africa.

Collaboration between Brazilian and South African scientists has been essential for the success of this project. The collaborative effort will hopefully result in the control of *P. aculeata* in South Africa and further collaborations of this nature could improve control of invasive alien plants in both South Africa and Brazil.

KEYWORDS: Biocontrol, host specificity, impact studies

SS5.1

COMMUNITY AND ECOSYSTEM ECOLOGY AND IMPACTS OF ARUNDO DONAX

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Arundo donax, commonly called giant reed in North America, is a highly invasive perennial grass originating in the Mediterranean Basin to the Indian sub-continent and now infesting low-gradient Mediterranean-climate and sub-tropical riparian ecosystems throughout the world. In coastal California and along the Rio Grande of Texas and northern Mexico, *Arundo* forms monotypic stands and displaces native vegetation, particularly cottonwood/willow (*Populus/Salix*) gallery woodlands, often where elevated nitrogen accelerates growth and expansion. *Arundo* dominance reduces habitat suitability for native fauna by simplifying structural complexity, and its low-quality litter is also poor habitat and food for aquatic organisms. Based on high leaf surface area and high photosynthetic rates, we estimate *Arundo* transpires approx. 4 times as much groundwater to the atmosphere as do native riparian taxa. It also changes erosion and sediment deposition dynamics in ways that alter flood risk. Finally, *Arundo* is highly flammable, particularly in autumn and winter when moisture content is low, and rapidly recovers from fire to the detriment of native woody plants, thereby changing riparian corridors from barriers to fire movement to pathways of wildfire spread. Restoration is reversing some of these impacts, giving hope to efforts to manage this abundant invasive plant in many landscapes, as will be discussed by other presentations in this session. On the other hand, increasing interest in commercial use of *Arundo* for fiber and biofuel could greatly impede efforts to bring this weed under better control.

KEYWORDS: Arundo donax, giant reed, riparian, invasive grass

SS5.2

IS ARUNDO DONAX AN INVASION RISK IN THE FEDERAL DISTRICT OF BRAZIL?

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One of the key requirements for effective management of invasive plants is the capacity to identity, map and monitor invasions. Ground truth surveys and use of aerial photographs are commonly used techniques for mapping and evaluating the eradication of invasive plants. The objective of this study was to map the occurrences of *Arundo donax* in the Federal District of Brazil. The localization of sites where this species was present in the Federal District of Brazil was done from March 2010 to October 2012. The sites of occurrence of the species were georeferenced with a GPS and data were analyzed using GIS methodology. The highest concentration of *A. donax* was in the central, urbanized region of the Federal District. It was principally found near disturbed areas, such as highways, landfills, and construction sites and almost all of the sites were terrestrial. The probable mechanism of dispersal of this species in the Federal District is by grass cutting machines. This survey is the first realized in the Federal District and in Brazil and can be used as a baseline for the monitoring of expansion of this species aside from its importance for subsidizing future management strategies.

KEYWORDS: Spatial distribution, dispersal mechanisms, monitoring, conservation units

SS5.3

REPRODUCTION AND GENETIC DIVERSITY OF ARUNDO DONAX AND PHRAGMITES AUSTRALIS

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Genetic diversity and reproductive characteristics may play an important role in the invasion process. Common reed (*Phragmites australis* Cav.) and giant reed (*Arundo donax* L.) are two of the most aggressive large-statured invasive grasses in wetlands and riparian areas of North America. Common reed reproduces both sexually and asexually and has a complex population structure, characterized by three subspecies with overlapping distributions of which one is introduced, one native, and a third that has recently been introduced to new habitats where it is behaving more aggressively than in its historical distribution. These three subspecies show varying levels of genetic diversity with introduced common reed having high levels of nuclear diversity, indicating that multiple introductions have likely occurred. In contrast, giant reed has low genetic diversity and appears to reproduce solely via asexual fragments, yet is highly aggressive in parts of its introduced range. Both species are well adapted to growth in human-dominated landscapes which is facilitated by their rhizomatous growth habit.

KEYWORDS: large-statured invasive grass, clonal, rhizome, plant dispersal, hybridization

SS5.4

A JOINT CFIA-USDA WEED RISK ASSESSMENT OF *ARUNDO DONAX*

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INTRODUCTION: Due to mutual interest in *Arundo donax* in Canada and the United States, the Canadian Food Inspection Agency (CFIA) and the United States Department of Agriculture (USDA) collaborated on a trial joint weed risk assessment in 2012. This species was of interest to Canada due to proposals to import and cultivate it for ethanol and pulp and paper production. In the U.S., this species is considered by some a major invader, but others are considering it as a potential source for biofuel.

OBJECTIVES: The objective of the weed risk assessment was to evaluate the entry potential, invasive potential (establishment/spread and impact) and geographic potential of *Arundo donax*. In addition, the risk assessment was used to explore opportunities for joint risk assessments.

METHODS: The joint weed risk assessment was completed by a CFIA weed analyst using the USDA's weed screening tool. The tool consists of a series of mostly yes/no questions that are grouped into two risk elements: establishment/spread and impact. The outcomes of the two risk elements are used in a logistic regression model to assess the invasive potential of the species. A Monte Carlo simulation evaluates the sensitivity of the risk scores to uncertainty.

Entry potential and geographic potential are evaluated apart from the logistic regression model. In the case of *Arundo donax*, entry potential was not assessed because the species is already present in both countries. Geographic potential was evaluated based on the species' distribution elsewhere, using a simple GIS intersection of three climatic variables: USDA plant hardiness zone, Köppen-Geiger climate class and annual precipitation.

RESULTS: The risk scores for establishment/spread and impact potential of *Arundo donax* were both high. Factors increasing the establishment/spread risk score included: invasiveness elsewhere, ability to form dense thickets, tolerance to loss of biomass and propensity for unintentional dispersal. For impact potential, impacts to natural systems (e.g., ecosystem processes, community structure and composition), and to a lesser extent, impacts to anthropogenic areas, contributed to the high risk score. The analysis indicated a 71.4% probability of this species being a major invader. Uncertainty was low for both risk elements as there was direct evidence for many of the questions.

In the analysis of geographic potential, it was estimated that about 2% of Canada and 57% of the U.S. is suitable for the establishment of *Arundo donax.*

CONCLUSIONS: Considering the well-known impacts of this "transformer" species in riparian areas of the southwestern U.S., it comes as little surprise that its invasive potential is "high". The model results, based on establishment/spread and impact, are equally applicable to both countries. Geographic potential differed significantly, with only a small portion of Canada's land mass at risk, compared to over half of the U.S.

Joint risk assessments offer a number of benefits, including increased collaboration, reduction of duplicated work, and a wider review process. Challenges include the style of presentation to risk managers and the possible need for separate analyses of entry potential. Risk assessment is only one stage of risk analysis and any subsequent risk management or policy decisions would lie solely with the individual country.

KEYWORDS: Arundo donax, establishment, impact, spread, weed risk assessment

SS5.5
THE POTENTIAL FOR BIOLOGICAL CONTROL OF THE GIANT REED, ARUNDO DONAX IN SOUTH AFRICA.

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Arundo donax L. (Poaceae) is a tall reed-like grass native to the warmer parts of the Old World. It has been spread around the world due to its useful properties and has since become invasive in many areas. *A. donax* is widespread in South Africa, where it transforms riparian ecosystems and competes for habitat with indigenous plant species. Traditional control methods have proven insufficient to control the spread of *A. donax,* therefore biological control is seen as the most viable solution. A pre-introductory survey was carried out in the Free State province, South Africa; herbivores associated with *A. donax* were investigated during monthly samples over a two-year period. A total of 21 herbivores were found feeding on *A. donax* with only seven herbivores being abundant and damaging across sites. The most significant of these species were two non-native herbivores, the stem-boring wasp, *Tetramesa romana* (Hymenoptera: Eurytomidae) and the aphid, *Melanaphis donacis* (Passerini). *T. romana* is a stem-boring wasp that is a biological control agent in the U.S.A. and was therefore prioritised for further study in South Africa. *T. romana* field populations were inferred from sampling which found 22,48% of lateral shoots were damaged with an average of one hole per shoot. The impact of *T. romana* on *A. donax* populations was then assessed by establishing insecticide exclusion field plots to generate damage curves. Results suggest that *T. romana* does not significantly impact *A. donax* based on plant parameters including height and stem diameter. *T. romana* alone is unlikely to bring *A. donax* under significant control; for effective control of *A. donax* other biological control agents should be considered.

KEYWORDS: biological control, Arundo donax, Tetramesa romana, Melanaphis donacis, damage curve

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