Council of Australasian Weed Societies Inc.

Department of Environment and Conservation

Australian Government
Defeating the Weed Menace

www.cabi.org

WEED OF NATIONAL SIGNIFICANCE

CRC Weed management

WMSSA

EMAPi9

9th International Conference on the Ecology and Management of Alien Plant Invasions

17 - 21 September 2007
Hyatt Regency Perth
Western Australia

EMAPI9

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WELCOME

On behalf of the Organising Committee and the EMAPI team, I welcome you all to Perth.

Perth used to be named as the most isolated capital city in the world. While this might still be the case geographically, with modern technology we are in "instant" contact across the globe. Perth is very clean and safe compared to many other places in the world and, thanks to the foresight of the founders of the city; we also have a huge piece of bushland (Kings Park) right on our doorstep. I encourage you all to visit Kings Park and also to take a walk along the Swan River foreshore.

This Conference is the culmination of communications that started in early 2003. There have been many ups and downs since then. For example, while the strong Australian dollar is good for Aussies who wish to travel overseas, it is not so good for people from developing countries who wish to come here. Currently Western Australia is in an economic boom, yet we found it somewhat difficult to attract sponsors for EMAPi9. On behalf of the organising committee, I would like to thank all those who helped financially or in-kind, including: Defeating the Weed Menace – Community and Industry Engagement Program (CIEP), the Department of Agriculture and Food Western Australia (DAFWA), the Department of Environment and Conservation (DEC), the Weeds CRC, Blackwell Publishing, Regent Instruments, CABI, the Council of Australasian Weed Societies (CAWS) the Weeds of National Significance (WoNS), Weed Management Society of South Australia Inc and Bunnings.

This is the first time that EMAPi has been held in the Southern Hemisphere. In addition to the normal networking opportunities created at an international meeting, I hope this meeting in Perth leads to a greater understanding of how we deal with invasive plants "Down Under", and that you can take some useful techniques back home with you. One of the main differences I perceive is that we have closer cooperation between scientists working on weeds of agriculture, and those who work on the invasive plants of natural ecosystems (scientists, volunteers, park managers etc.) than in some other countries.

We have a very full program, plus some field trips which I hope you take advantage of. In addition, I hope you get to sample plenty of our local food and wine here at The Hyatt and in the local restaurant district of Northbridge.

Sandy Lloyd
Conference Convenor
slloyd@agric.wa.gov.au

WESTERN WEEDS

A guide to the weeds of Western Australia (Second Edition)

By BMJ Hussey, GJ Keighery, J Dodd, SG Lloyd and RD Cousens

(published by the Weeds Society of Western Australia)

Western Australia – the Wildflower State! But not all the 'wildflowers' are truly native to Western Australia: some were brought, in recent times, by human beings. There are more than ten thousand named species of flowering plants growing wild in Western Australia – 90% of them are natives, the other 10% have been introduced. '**Western Weeds**' will help you to identify the many agricultural, environmental and common garden weeds found throughout the State.

Based on the highly successfully first edition of '**Western Weeds**', this new edition is more comprehensive and up-to-date. It has 312 pages and describes about 1,050 weeds, with 625 illustrated in colour. There are diagrams to explain plant structures and to help you identify weed species. '**Western Weeds**' also has a comprehensive index with both common and scientific names of weeds. A plain English glossary of botanical terms is included. The book also has a long-lasting stitched binding.

Weeds are listed under four major groups - Ferns - Gymnosperms (conifers) - Monocotyledons (lilies, grasses, sedges or 'narrow-leaves') and Dicotyledons (other flowering plants or 'broad-leaves'). Plants are organised into families within each group. The descriptions concentrate on the characters that distinguish a species from closely-related ones, but also include flowering time, distribution and region of origin. It should be possible to identify most of the weed species in WA using this information.

'**Western Weeds**' is a comprehensive guide to weeds from all types of land use and from all parts of Western Australia. An essential reference book for:

Farmers Environmentalists Gardeners Horticulturalists Students

----------Order form----------

To order your copy of **Western Weeds 2nd edition**, complete and return this order form with your payment to:

Jo Brown
Department of Agriculture and Food
Locked Bag 4
BENTLEY DELIVERY CENTRE WA 6983

Enquiries: Tel: (08) 9368 3710
Fax: +61 8 9474 2405
E-mail: jbrown@agric.wa.gov.au

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Prof David M. Richardson, SOUTH AFRICA
Dr Randy Westbrooks, UNITED STATES

CONFERENCE MANAGERS

MEETING VENUE

IMPORTANT INFORMATION

Registration Desk

The Registration Desk at the Conference will be open as follows:

Sunday 16 September	1500 - 1900
Monday 17 September	0800 - 1730
Tuesday 18 September	0800 - 1730
Wednesday 19 September	0800 - 1730
Thursday 20 September	0800 - 1500

The Registration Desk can be contacted on 0439 912 333 during these hours.

Name Badges

A name badge is supplied for all delegates in your registration envelope. These badges must be worn ay all times to access the sessions and social functions.

Speaker Preparation Room

The Speakers Preparation Room is located in the Mosman Bay Room and will be open from Monday 17 September at 0800 to load your PowerPoint presentation and meet with our Audio Visual Technicians – Corporate Theatre Productions. If you are loading your presentation on Sunday please see the Registration Desk for assistance.

Registration Entitlements

Fully registered delegates are entitled to:

- attend all Conference sessions
- a Conference satchel
- a Program & Abstract Book
- a Welcome Function ticket
- all morning, afternoon teas and lunches at the Hyatt Regency Perth

Day delegates are entitled to:

- attend all sessions on nominated day/s
- a Conference satchel
- a Program & Abstract Book
- all morning and afternoon teas and lunches on nominated day/s at the Hyatt Regency Perth

Tickets may be purchased from the Registration Desk for delegates and guests to attend the Conference Dinner and Friday Field Trips.

Field Trips – Friday 21 September

The following Field Trips will be held on Friday 21 September. Coaches will pick-up and drop-off from the following hotels. See the bus timetable at the Registration Desk for times.

Hyatt Regency Perth (guests at Goodearth Hotel and Perth Ambassador Hotel should board here), Saville Park Suites Perth, Novotel Langley Perth, *Crowne Plaza Perth. Please see the Registration Desk staff if you have not booked.

Rottnest Island Tour 0830 – 1745 *Cost: $155.00*
Includes: • Hotel Pick-up/Drop-off • Ferry • Lunch

Yanchep Field Trip 0830-1730 *Cost: $70.00*
Includes: • Hotel Pick-up/Drop-off •Lunch

Nursery Field Trip 0900-1200 *Cost: $40.00*
Includes: • Hotel Pick-up/Drop-off •Morning Tea

Darlington Trail and Nursery Field Trip 0900-1500 *Cost: $40.00*
Includes: • Hotel Pick-up/Drop-off •Afternoon Tea

GENERAL INFORMATION

Accommodation Accounts

All accommodation accounts must be settled on check out. Neither The Weeds Society (WA) nor Congress West will be responsible for accommodation accounts.

Catering

All morning and afternoon breaks will be served within the Exhibition located in the Southern Ballroom Foyer. Lunches will be served in the Terrace Ballroom located outside on the lower level of the Hotel.

Conference Dinner Table Seating

There is allocated seating for the dinner. If you or a guest holds a ticket, please ensure you select your seating by the end of the lunch break on Wednesday 19 September. Guests who have not made a selection by this time will be allocated a seat by Congress West. See the seating plan near the Registration Desk for more details.

Delegate List

The Delegate List is located at the rear of this book.

Disclaimer

All information disclosed in the Conference Program is correct at the time of printing. The Organising Committee reserves the right to alter the Program in the event of unforseen circumstances.

Exhibition

The Exhibition will be held in the Southern Ballroom Foyer. A full listing including a floor plan on located on page 11.

Free Central Business District (CBD) Transport

You are able to travel around Perth CBD free of charge when your use the Central Area Transit (CAT) buses for travel within the Free Transit Zone (FTZ). The buses run frequently and routes take in the major attractions of the area. The CAT stops have distinctive stands and are easily recognisable. Alternatively you may jump on any Public Bus along Adelaide and St George's Terrace at no charge.

Internet Access

Internet access is available through the Hyatt's Business Centre. See the Hotel Reception for details.

Messages

If you need to receive messages, the contact number 0439 912 333 can be used for all messages during the opening hours of the Registration Desk. Messages will be displayed on the board at the registration and we remind delegates to check the board regularly as sessions will not be interrupted to convey messages.

Poster Displays

Posters will be on display from Monday 17 September in the Southern Ballroom. The room will be available for set-up from 0800 and posters must be removed at the close of afternoon tea on Thursday 19 September.

Smoking

The Hyatt Regency Perth is a non-smoking venue.

Special Dietary Requirements

We have arranged for special meals to be prepared for those delegates who have pre-registered their special requirements. Please check your envelope for further details and make yourself known to staff at Social Functions.

SOCIAL PROGRAM

Welcome Function

Sunday 16 September 2007

Hyatt Regency Perth, Poolside, 1700 – 1900

Additional Tickets: $55.00 Dress: Smart/Casual

Conference Dinner

Thursday 20 September 2007

Government House Ballroom, St George's Terrace (opposite Irwin Street), 1900 – 2400

Tickets: $110.00 Dress: Semi-Formal

Held in the magnificent Government House Ballroom, which was built in 1863 and is on the State's heritage register, the Conference Dinner will be a perfect way to mark the end of the Conference.

Australian Government

Defeating the Weed Menace

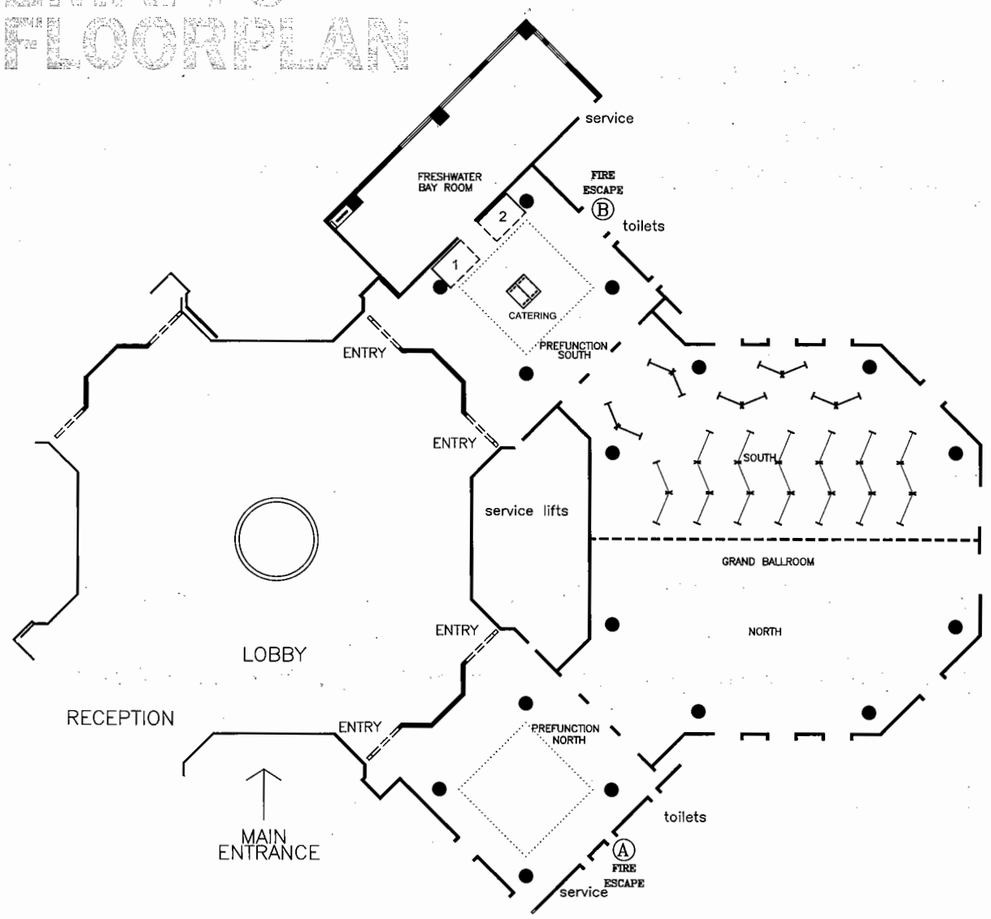
This spring the Defeating the Weed Menace (DWM) Programme, the Australian Government's $44.4 million commitment to national action on Australia's most threatening weeds, will launch a new website - www.weeds.gov.au - in mid September to help people identify which plants can be a problem in their local area and to provide advice on how to manage these plants.

A print advertising and editorial campaign targeting gardeners and hobby farmers in peri-urban areas will run from September 2007 to March 2008. Copies of the advertisements and other resource materials will be available on the website.

While the majority of people targeted by the campaign will be directed to the website www.weeds.gov.au for further information, enquiries are also likely to be received by state, regional and local governments and nursery retailers for information about weeds issues specific to their local area.

WEED ? Check your plants

EMAPI'9 FLOORPLAN



TRADE EXHIBITORS

1	**Weeds of National Significance (WoNS)** John Thorp Australia Contact Person – John Thorp 16 Flowers Court, Launceston TAS 7250 Phone: (03) 6344 9657 Fax: (03) 6343 1877 Email: jthorp@jta.com.au Web www.weeds.org.au and www.jta.com.au	The Weeds of National Significance (WoNS) Program was agreed to by all States and Territories in 2000. Twenty weeds were selected as WoNS. This focused approach has led to improved weed management. The WoNS program enables increased communication, coordinated research and funding for weeds, development of best practice information, strengthened stakeholder networks and strategic on-ground weed control across Australia.
2	**CABI** Sarah Simons, Global Director - Invasive Species ICRAF Complex, United Nations Avenue, Gigiri, PO Box 633-00621, Nairobi, Kenya Phone: +254 20 72 24450 Fax: +254 20 71 22150 E-mail: s.simons@cabi.org Web: www.cabi.org	Established nearly 100 years ago, CABI is a not-for-profit organisation whose scientific publishing, research and communication work is helping to improve agriculture, the environment and people's lives around the world. Invasive species are a focus of CABI's work and we are currently researching over 60 invasive plants to find ways to control and manage them in order to reduce their impact. Come and find out more by visiting our stand!

Venue Key : Each session A is in NORTH BALLROOM | Each session B is in FRESHWATER BAY ROOM | Each session C is in PLAZA BALLROOM 1

MONDAY SEPTEMBER 17 2007

0800-0900	**Registration**		
0900-1000	**Opening Session** *CHAIR SANDY LLOYD* Venue North Ballroom		
0900-0930	**Welcome and Conference Opening**		
0930-1000	**McFadyen** Managing Invasive Plants in Australia: A Decade of Achievement		
1000-1030	MORNING TEA		
1030-1200	Session 1C **Documenting Alien Floras and Other Invasive Species** *CHAIR: JON DODD*	Session 1B **Weed Risk Assessment** *CHAIR: ROD RANDALL*	Session 1A **Impacts of Alien Plant Invasion** *CHAIR: SALLY PELTZER*
	Venue Plaza Ballroom 1	Venue Freshwater Bay Room	Venue North Ballroom
1030-1050	**Keighery** Current and Potential Geophyte Weeds of Southwest Australia	**Stone** X Environmental Weed Risk Mangement in Pasture Improvement Programs: Recent Initiatives to Minimise Pasture Species Escape into Natural Ecosystems Using the CRC for Plant-based Management of Dryland Salinity as an Example	**Downey** Assessing the Impact of Alien Plants on Biodiversity: Which Alien Plants Pose a Threat, What Species are at Risk and Where do We Implement Management?
1050-1110	**Öpik** The Importance of Human Mediation in Species Establishment: Analysis of the Alien Flora of Estonia (North-europe)	**Fukuda** Investigation of the Weed Risk Assessment Model Using Data Mining	**Scott** X The Environmental Impact of Weeds in Australia: A Review of Impact on Rare and Threatened Species and Ecological Communities
1110-1130	**Popay** A Rare Success Story from New Zealand: No New Agricultural Weeds for Many Years!	**Brunel** Pest Risk Analysis of *Solanum elaeagnifolium* and International Management Measures Proposed	**French** X Impacts of Invasion of Bitou Bush on Coastal Communities
1130-1150	**Sellers** Global Invasive Species Information Network: Developing a Pilot System to Share Invasive Species Checklist Information Globally	**Steel** Victorian Weed Spread Pathways Risk Assessment	**Winter** X Functional Homogenization Within the Flora of Germany
1150-1200	Chair Summary & Poster Digest	Chair Summary & Poster Digest	Chair Summary & Poster Digest
1200-1320	LUNCH		
1320-1450	Session 2A **Biology and Ecology of Invasive Plants** *CHAIR: JON DODD*	Session 2B **Prioritisation, Policy and Programs** *CHAIR: SANDY LLOYD*	Session 2C **Demonstrations of Online Tools**
	Venue North Ballroom	Venue Freshwater Bay Room	Venue Plaza Ballroom 1
1320-1340	**Brown** X Invasive Geophytes of Southwest Australia; Recent Studies on Biology, Ecology and Management	**Agar** Saving Our Species: A Major Initiative for Environmental Weed Management Across Western Australia	**Lander** X FloraBase Demonstration
1340-1400	**Walsh** X The Ecology and Biology of Freesia as a Naturalised Weed In Australia	**Platt** An Asset-based and Outcome-driven Approach to Managing the Environmental Impacts of Weeds on Public Land in Victoria, Australia	
1400-1420	**Warner** X An Ecological Study of the Invasive Geophyte *Lilium formosanum*	**Anderson** Tackling Weeds on Private Land	**Batory** Accessing and Recording Weed Distribution Over the Web in WA
1420-1440	**Konlechner** X *Ammophila arenaria* Dispersal and Invasion in Southern New Zealand	**Sheppard** A Strategic Approach to Biosecurity Threats Posed by Invasive Plants in Australia	
1440-1450	Chair Summary & Poster digest	Chair Summary & Poster digest	
1450-1550	AFTERNOON TEA AND ATTENDED POSTER SESSION		
1550-1710	Session 3C **Evaluating Invasiveness, Eradication and Management of Invasive Plants** *CHAIR: LOIS CHILD*	Session 3A **Genetics, Phylogeny and Invasive Species** *CHAIR: PETR PYSEK*	Session 3B **Impacts of Alien Plant Invasion** *CHAIR: PETER TURNER*
	Venue Plaza Ballroom 1	Venue North Ballroom	Venue Freshwater Bay Room
1550-1610	**Panetta** Evaluating Progress in Weed Eradication Programs	**Kotanen** X Are Phylogenetically Isolated Invaders More Likely To Escape Their Enemies? Darwin's Naturalization Hypothesis Revisited	**Norgrove** Changes in Ecosystem Function in Savannahs and Fields Invaded by *Chromolaena Odorata* in Central and Southern Cameroon
1610-1630	**Cherry** The Value of Eradication Programs for Outlier Populations of Widespread Alien Plants	**Wilson** X Phylogenetic Patterns in Plant Invasions in South Africa	**Lowe** Evidence for Demographic Swamping of the Australian Native, *Senecio pinnatifolius*, Following Hybridization with an Invasive, *S. madagascariensis*
1630-1650	**Wannenburgh** A Systematic, Spatial Prioritisation for Invasive Alien Plant Control in South Africa	**Diez** X Do Phylogenetic Relationships Help Explain Shifts in Native and Non-native Species Composition?	**Williams** Impact of Pinus radiata in Australian Eucalypt woodland
1650-1700	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest

Venue Key : Each session D is in NORTH BALLROOM | Each session E is in FRESHWATER BAY ROOM | Each session F is in PLAZA BALLROOM 1

TUESDAY SEPTEMBER 18 2007

0800-0820	**Registration**		
0820-0830	**Housekeeping**		
0830-1000	**Keynote Session** *CHAIR: SANDY LLOYD* Venue North Ballroom		
0830-0900	**Glanznig** Towards a Robust National Regulatory Framework to Prevent and Control Invasive Weeds: An Australian Case Study		
0900-0930	**Keogh** Defeating the Weed Menace		
0930-1000	**Pysek** What determines the invasibility of habitats by alien plants: propagule pressure, climate, historical factors or habitat identity?		
1000-1030	MORNING TEA		
1030-1200	Session 1F **Predictive Modelling** *CHAIR: JOHN SCOTT*	Session 1D **Prioritisation, Policy and Programs** *CHAIR: JOHN VIRTUE*	Session 1E **Distribution and Impact of Invasive Plants: Implications for Management** *CHAIR: DANE PANETTA*
	Venue Plaza Ballroom 1	Venue North Ballroom	Venue Freshwater Bay Room
1030-1050	**Dunn** X Predictive, Spatially Explicity Modelling of Blackberry Dispersal	**Martin** A Broad Framework for Reviewing Weed Ideas, Policy and Action at a National Scale	**Downey** Conserving Biodiversity by Abating the Threat of Alien Plants: Turning Theory into Reality
1050-1110	**Stokes** X Predictive Spread Models for Lippia *(Phyla canescens)* in Australia	**Thorp** The Value and Future of National Weed Icon Species in Australia	**Yokomizo** Incorporating the Cost of Impact into Optimal Management Strategies for Invasive Species: the Value of Knowing the Impact Curves
1110-1130	**Sims** X Modelling the Potential Future Distribution in Australia of Groundsel Bush, an Invasive Weed *(Baccharis halimifolia)*	**Glanznig** Weed Proofing Australia: a Way Forward on Invasive Garden Plants	**Cuneo** Landscape Scale Detection of Woody Weeds by Remote Sensing - Mapping Invasive African Olive *(Olea europaea ssp cuspidata)* in South-west Sydney, Australia
1130-1150		**Lane** Herding Feral Cats 'Coordinating Invasive Species Management Activities Among Various Agencies In the Everglades Ecosystem'	
1150-1200	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest
1200-1330	LUNCH		
1330-1440	Session 2F **Biological Control** *CHAIR: JOHN SCOTT*	Session 2E **Managing Alien Plant Invasions** *CHAIR: IAN POPAY*	Session 2D **Invasibility of Ecosystems** *CHAIR: ROD RANDALL*
	Venue Plaza Ballroom 1	Venue Freshwater Bay Room	Venue North Ballroom
1330-1350	**Taylor** Non-target Effects of Weed Biological Control Agents in Australia	**Wearne** Is Management Effective? The Results of an Adaptive Experimental Management Program to Determine Best Practice Chemical Control on *Cytisus scoparius* and Impacts on Native Vegetation	**Metcalfe** X Weed Recruitment Following Landscape-scale Disturbance to Primary Rain Forest
1350-1410	**Medal** Biological Control of *Solanum viarum* (Solanaceae) in the USA: Current Status and Perspectives	**Gous** Reducing Herbicide Rates in Temperate Central North Island Forests of New Zealand	**Murphy** X Ecological Role and Impact of Invasive Species in Rainforest Habitats Following Cyclone Larry
1410-1430	**Schooler** Classical Biological Control of Invasive Aquatic Plants, Cabomba and Alligator Weed	**James** Control of the Tuberous Weeds *Anredera cordifolia* and *Tropaeolum pentaphyllum*	**Daehler** X Effects of Non-native Slugs on Invasive and Native Plant Establishment: Evidence from the Hawaiian Islands
1430-1440	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest
1440-1530	AFTERNOON TEA AND ATTENDED POSTER SESSION		
1530-1740	Session 3D **Managing Alien Plant Invasions** *CHAIR: RACHEL MCFADYEN*	Session 3E **Modelling Plant Invasion and Management** *CHAIR: GIUSEPPE BRUNDU*	Session 3F **Traits of Invasive Species** *CHAIR: JOHN BROCK*
	Venue North Ballroom	Venue Freshwater Bay Room	Venue Plaza Ballroom 1
1530-1550	**Witkowski** South African Working for Water Alien Clearing of Bugweed *(Solanum mauritianum)*: Reinvasion Through Seed Dispersal, Seed Banks and Resprouting	**Gallagher** X Climate Change and Alien Plant Invasions: Predicting Future Impacts to Biodiversity	**Monaco** Combining Research in the Mechanisms of Weed Invasion and Autogenic Weed Resistance
1550-1610	**Yeoh** X Management of the Invasion of Rubus Species Within South Western Australia	~~**Hulme**~~ Climate Change and Plant Invasions: Mechanisms Versus Models	**Meyer** Invasion Dynamics and Management of the Invasive Tree *Casuarina equisetifolia* in the Atoll of Moruroa (French Polynesia), a Former Nuclear Test Site in the South Pacific
1610-1630	**Child** X Practical Approaches to the Management of Fallopia Japonica in the Uk	**Renton** Using the Weed Seed Wizard to Understand and Manage the Weed Seedbank	**Gous** The Management of Introduced Wilding Conifers in New Zealand
1630-1650	**Pergl** X The Role of Long-distance and Random Dispersal in Population Dynamics of *Heracleum mantegazzianum* at a Landscape Scale	**Kriticos** Understanding Target Weed Population Dynamics Can Improve Our Ability to Select Effective Agents Against Weeds	**Motard** The Impact of *Ailanthus altissima* on the Floristic Diversity and New Protocol of Eradication
1650-1710	**Jahodova** X Reconstructing Invasion of Tall *Heracleum* Species in Europe at Different Geographical Scales Using AFLP Molecular Markers	**Ferdinands** Habitat Heterogeneity or African Monoculture? Modelling the Risks Associated with Para Grass Invasion in a Tropical Wetland in Northern Australia	**Denslow** *Psidium cattleianum*: Ecology & Impacts of an Invasive Tropical Tree
1710-1720	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest

Venue Key : Each session G is in NORTH BALLROOM Each session H is in FRESHWATER BAY ROOM Each session I is in PLAZA BALLROOM 1

WEDNESDAY SEPTEMBER 19 2007

0800-0820	**Registration**		
0820-0830	**Housekeeping**		
0830-1000	**Keynote Session** *CHAIR JOHN VIRTUE* Venue North Ballroom		
0830-0900	**Westbrooks** CAWS Oration: 2007 Update on Development of a National Early Detection and Rapid Response System for Invasive Plants in the United States of America		
0900-0930	**Grice** Tackling Contentious Invasive Species		
0930-1000	**Richardson** Mutualisms – Key Drivers of Invasions... Key Casualties of Invasions		
1000-1030	MORNING TEA		
1030-1200	Mechanisms and Pathways of Weed Invasion *CHAIR: JEFF DYSEK*	Session 1H **Early Detection and Rapid Response** *CHAIR: RANDY WESTBROOKS*	Session 1G **Restoration** *CHAIR: PETER TURNER*
	Venue Plaza Ballroom 1	Venue Freshwater Bay Room	Venue North Ballroom
1030-1050	**Andersen** X Regional Differences in Habitat Invasibility – A Case Study From Denmark	**Fox** Optimising Surveillance for Invasive Plants Using an Integrated Landscape Modelling Tool	**Hilton** Morphologic And Vegetation Changes Associated With *Ammophila arenaria* Invasion and Eradication, Doughboy Bay, Stewart Island
1050-1110	**Randall** X How Many Weeds Are There?	**Smith** The Victorian Weed Alert Program	**McDaniel** Replacing *Tamarix chinensis* (Saltcedar) Communities With Desired Riparian Habitat Along the Rio Grande And Pecos Rivers in Southwesten United States
1110-1130	**Van Der Meulen** X How Are Weeds Spreading Within Australia?	**Joubert** Determining Victorian Alert Weeds	**Downey** Establishing Monitoring Protocols to Assess the Recovery of Native Species Following Widespread Alien Plant Control
1130-1150		**Westbrooks** IUCN Invasive Species Specialist Group (ISSG) Plans for an International Early Detection & Rapid Response (EDRR) Network	Discussion on Restoration - Led by Peter Turner
1150-1200	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary
1200-1330	LUNCH		
1330-1500	Partnerships *CHAIR: DAMIAN GOLLEDGE*	Session 2H **Managing Plant Invasions** *CHAIR: HILLARY CHERRY*	Session 2G **Biology and Ecology of Invasive Species** *CHAIR: HELEN SPAFFORD*
	Venue Plaza Ballroom 1	Venue Freshwater Bay Room	Venue North Ballroom
1330-1350	**Hurley** Woady Yaloak River Community Project - A Case Study in the Development of Successful Partnerships in the Delivery of Community Education in Weed Control	**Stock** Controlling Lantana – The Importance of Integrated Control	**Gosper** X The Role of Fruit Traits of Bird-dispersed Plants in Invasiveness and Weed Risk Assessment
1350-1410	**Barnett** Collaborative Approaches to Invasive Plant Management: The Invasive Plant Council of British Columbia, Canada	**Ainsworth** Management of Japanese and Giant Knotweed in Australia; An Example of Successful Intervention at an Early Stage of Invasion	**Hardesty** X Melastome Dispersal and Recruitment in Tropical Rainforests
1410-1430	**Adkins** Australian Parthenium Weed Research Aids Management of this Weed in the Agro-ecosystems of Ethiopia and Pakistan	**~~Weame~~** Ponded Pasture Species in Northern Australia: the Complexities of Control and Management	**Ward** X Reproductive Biology of Invasive Asclepiads in South-east Queensland
1430-1450	**Watt** Supporting Community Led Weed Programs with Compliance	**Morris** Invasive Alien Plant Clearing By "Working For Water" Along the Sabie River in the Kruger National Park, South Africa	**Bebawi** X Seed Longevity of Bellyache Bush *(Jatropha gossypiifolia L.)* in North Queensland
1450-1500	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest
1500-1530	AFTERNOON TEA AND ATTENDED POSTER SESSION		
1530-1730	Mechanisms and Pathways of Weed Invasion *CHAIR: JEFF DYSEK*	Session 3G **Monitoring, Evaluation, Prioritisation** *CHAIR: TONY GRICE*	Session 3H **Traits of Invasive Species** *CHAIR: JOHN SCOTT*
	Venue Plaza Ballroom 1	Venue Freshwater Bay Room	Venue North Ballroom
1530-1550	**Brock** Plant Invasion of an Urban Landscape on the Tempe Campus of Arizona State University	**Foxcroft** Patterns of Alien Plant Invasion in the Kruger National Park, South Africa: Perspectives From Multiple Spatial Scales	**Jarosik** X Species Traits as Determinants of Invasion Success: Global Analysis Using Source Species Pool and Some Methodological Insights
1550-1610	**Dawson** What Determines Plant Species Invasiveness? A Case-study Using Amani Botanic Garden, East Usambara Mountains, Tanzania	**Erhart** Monitoring And Evaluation Tools for Large Scale Weed Management Projects	**Popay** Sneaker Weeds: Slow-creeping Sleeper Weeds
1610-1630	**Howison** Reconstruction and Mechanisms of the Invasion of a Diverse African Savanna Game Reserve by the Alien Plant *Chromolaena odorata*	**Norgrove** Distribution And Abundance of the Grasses *Imperata cylindrica* (Speargrass), *Andropogon gayanus (Gamba grass)* and *Pennisetum sp* in Central African Savannahs	**Leak-garcia** Evolutionary Genetics of Invasive Artichoke Thistle in California
1630-1650	**Crosti** Potential Invasivity of Alien Species Introduced as Bioenergy Crops in Italy: Cultivation Criteria to Reduce Risk of Weed Proliferation	**Ossom** Problems of Alien Weed Invasions in Southern Africa: The Swaziland Situation	**Ebeling** Does Local Genetic Adaptation to Frost in the Invasive Range Facilitate the Spread of *Buddleja davidii* Franch?
1650-1710	**Fletcher** Applying Dispersal Data from Natural Systems to the Management of Rainforest Invasions	**Brundu** Evaluating Threats to Conservation Posed by Alien Plants on Soil-growing Bryophyte and Lichen Communities in Coastal Sand Dunes by Quantile Regression	**Sheppard** The Role of Resistance And Tolerance As Invasion Mechanisms: A Tale of Three Alien *Senecio* Species
1710-1730	Chair Summary & Poster digest	Chair Summary & Poster digest	Chair Summary & Poster digest

THURSDAY SEPTEMBER 20 2007

0800-0820	**Registration**			
0820-0830	**Housekeeping**	**Housekeeping**	**Housekeeping**	**Housekeeping**
0830-1030	Workshop 1 **Invasive Garden Plants** *CHAIR: ANDREAS GLANZNIG*	Workshop 2 **Aquatic Weeds** *CHAIR: SIMON MEREWETHER AND ANDREW PETROESCHEVSKY*	Workshop 3 **Early Detection/ Rapid Response** *CHAIR: RANDY WESTBROOKS*	Workshop 4 **Defeating the Weed Menace - Invasive Plants: Changing Ecosystems Processes** *CHAIR: HELEN SPAFFORD*
	Venue North Ballroom	Venue Traders Lounge	Venue Plaza Ballroom 1	Venue Freshwater Bay Room
0830-0850	**Reichard** Can Voluntary Codes of Conduct Prevent Plant Invasions?	**Chandrasena** Managing *Ludwigia peruviana* (L.) Hara and *Ludwigia longifolia* (DC) Hara Infestations in NSW: Progress and Prospects	**Sellers** A National Framework for Early Detection, Rapid Assessment, and Rapid Response to Invasive Species	**Leishman** Comparison of the Leaf Trait Relationships of Invasive Species in their Native and Invaded Ranges: A leaf carbon strategy approach
0850-0910	**King** Impact Evaluation of the Tackling Weeds on Private Land Inititiative on the Garden Industry in Victoria	**Mead** Alligator Weed Control in the Waikato Region, New Zealand	**Wilkinson** Early Detection: A Good Idea so Now What? Four Models from Hawaii	**Rossiter** Exotic Grass Alters Nitrogen Dynamics in the Tropical Savanna In Northern Australia
0910-0930	**Chin** We are NOT the Enemy– Recent Initiatives on Invasive Plants by the Nursery and Garden Industry	**Velvin** Distribution and Early Detection of the Freshwater Invader *Didymosphenia geminata* (Didymo) in New Zealand	**Blood** Weed Spotters Assist Detection of New Incursions	**Turner** Invasion by *Asparagus asparagoides* Provides a Positive Feedback by Alerting Soil Nutrient Properties
0930-0950	**Thomson** Empowering Gardeners to Make Informed Choices when Buying Garden Plants	**Champion** A Proactive Management Approach to Aquatic Weed Control In New Zealand	**Schoenig** Integration of Formal Weed Eradication Programs with Local Weed Management Areas for Early Detection and Rapid Response for Invasive Weeds	**Fisher** Invasion of *Ehrharta calycina* and *Pelargonium capitatum* in Banskia woodland is associated with different changes to ecological processes
0950-1010	**Robilliard** Sustainable Gardening Australia	Question time and discussion moderated by the Chairs	Question time and discussion moderated by the Chair	Question time and discussion moderated by the Chair
1010-1020	Chair Summary & Poster digest	Chair Summary	Chair Summary	Chair Summary & Poster digest
1020-1100	MORNING TEA			
1100-1230	GROUP WORK	GROUP WORK	GROUP WORK	GROUP WORK
1230-1330	LUNCH			
1330-1430	**Closing Session** *CHAIR SANDY LLOYD*			
	Venue North Ballroom			
1330-1345	**Keynote Address**			
1345-1400	**Prizes/Presentations**			
1400-1420	**Richardson** EMAPi10 Launch			
1420-1430	**Lloyd** Closing Address			
1430-1530	AFTERNOON TEA			

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Claire	Norris	03	WEED MANAGEMENT PRACTICE CHANGE WITHIN THE VICTORIAN FODDER INDUSTRY
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MONDAY
SEPTEMBER 17

MANAGING INVASIVE PLANTS IN AUSTRALIA: A DECADE OF ACHIEVEMENT

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The first Cooperative Research Centre (CRC) for Weeds started in 1995 and the National Weeds Strategy was launched in 1997. The first national eradication campaign against an invasive plant started in 1994, and a 'Permitted List' system was adopted in 1998 for entry of new plant species into Australia, using a Weed Risk Assessment System. These were major advances in the management of invasive plants in Australia, and this paper discusses the critical policy issues and turning points along the way. It also considers where policy has failed and the critical challenges for the future.

CURRENT AND POTENTIAL GEOPHYTE WEEDS OF SOUTH-WESTERN AUSTRALIA

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South Western Australia is an internationally recognised biodiversity hotspot for flowering plants, containing over 6,000 species of which 75% are endemic. Altered land use since European settlement has lead to 1234 naturalised plants becoming established. These now pose a major threat to this biodiversity.

Unlike SE Australia shrubs are a minor component of this weed flora, major weeds are grasses, annuals (Peas, Daisies and Brassicaceae) or geophytes. The 107 geophytic weeds present in Western Australia come from 18 families of plants, both Monocots and Dicots, although nearly half are cormous Iridaceae from southern Africa. Unlike many other areas of similar climates, Southern Western Australia is depauperate in geophytes, with about 200 species in our flora of c. 6,000 (< 4%), compared to southern Africa with 1500 (17%). Most geophytes in WA are Tuberous Orchids, compared to other regions where true bulbs or corms predominate.

The "worst" geophytic weeds are from the Hyacinthaceae (Lachenalia), Araceae (Zantedeschia), Asparagaceae (Asparagus), Iridaceae (Babiana, Freesia, Gladiolus, Moraea, Romulea, Sparaxis and Watsonia) and the Oxalidaceae (Oxalis). A wide variety of common and rare habitats are seriously impacted by these species.

Virtually all geophytic weeds are confined to the south west, especially around Perth where 98 species have been recorded. Most of these weeds are still actively expanding their ranges. There are currently none recorded for the Kimberley or Desert regions of Western Australia. However, numerous species occur overseas in similar climates and several are locally naturalised on offshore islands (Cocos and Christmas).

Since nearly all these weeds were introduced as ornamentals we must be aware that many highly desirable species not yet commonly cultivated are potentially weedy. Although there are many potential geophytic weeds in North and South America, Asia and Africa, trade and horticultural links to these regions have been rare in the past. We need to be alert to new introductions of such geophytes, especially where such weeds are currently absent. Another major priority is preventing continuing spread and impact of established serious geophytic weeds in southern Western Australia.

THE IMPORTANCE OF HUMAN MEDIATION IN SPECIES ESTABLISHMENT: ANALYSIS OF ALIEN FLORA OF ESTONIA (NORTH-EUROPE)

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Widely appreciated approach to explain mechanisms of crossing invasion phases uses analyses of alien species databases of certain recipient territory. We compiled a comprehensive list of alien species ever recorded in Estonian vegetation using various data sources: herbarium specimens, vegetation inventories etc. We expected that deliberately introduced species (pre and after introduction selected, repeatedly escaped from cultivation) have advantages in passing the reproductive and environmental barriers.

The database consists of 787 neophytes from 87 families. We estimated invasive status of each species and differentiated species according to the mode of introduction (accidental versus deliberate, Figure 1). We also added species biological and ecological data for analysis.

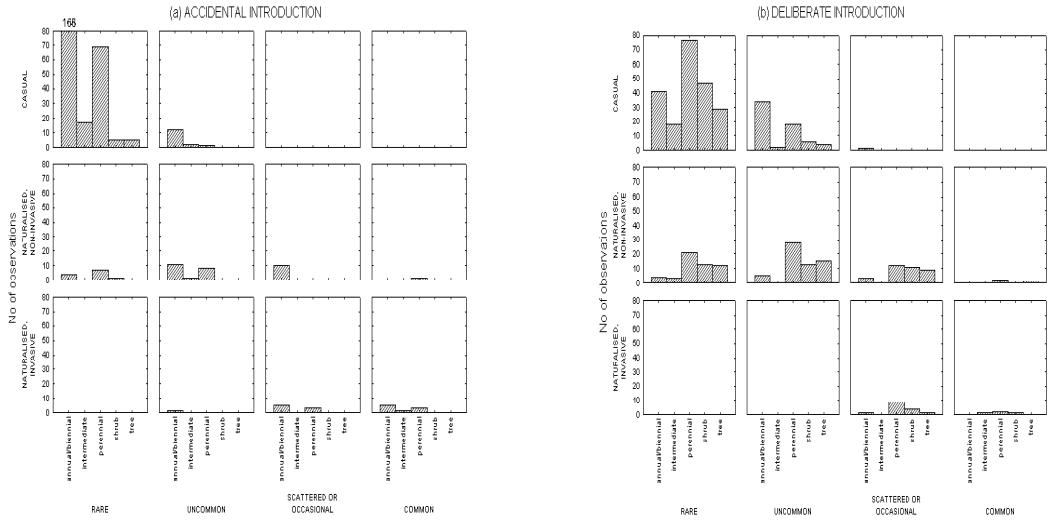

Figure 1. Herbaceous perennials show higher probability to achieve wider distribution than short-lived species. The pattern in achieved invasive status differs significantly between accidentally introduced (a) and deliberate species (b), and depends obviously on whether a species is a long-lived or not.

Almost 70% of all alien species achieve only rare distribution but those species which originate from deliberate introduction tend to become more spread compared to accidentally introduced ones. Pre-selected perennial species escaping from cultivation have better opportunities to pass different barriers and naturalise especially in (semi-) natural communities. We shall discuss the alien flora also in respect of residence time in Estonia.

A RARE SUCCESS STORY FROM NEW ZEALAND: NO NEW AGRICULTURAL WEEDS FOR MANY YEARS!

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New Zealand has gained an international reputation for its efforts in controlling weeds, especially for the potential impact of recent biosecurity legislation. There is, however, little information on how effective past legislation has been in managing existing weeds and preventing the invasion of new ones. We seem to delight in demonstrating the rising number of newly naturalised exotics. But all of these new weeds are problems in environmental habitats, and it is many years since any new agricultural weeds appeared. Most of our agricultural weeds were introduced in the early days of New Zealand's European settlement and the number of newly declared species declined considerably from about 1970 onwards. Some of the reasons for this may have been the more stringent regulations of the 1978 Noxious Plants Act (including enhanced surveillance for new species and quicker action in containing them), but other reasons may include gradually improvements of controls of the purity of imported agricultural seed, greater care in preventing the importation of potentially dangerous plant species, increasingly effective seed cleaning equipment and better weed control practices.

We describe the patterns of importation, and details of the legislation dealing with invasive alien weeds. We discuss the effective containment of potentially serious agricultural weeds like nassella tussock, cape tulip and Johnson grass, and the probable effects of improved import and seed purity standards.

GLOBAL INVASIVE SPECIES INFORMATION NETWORK: DEVELOPING A PILOT SYSTEM TO SHARE INVASIVE SPECIES CHECKLIST INFORMATION GLOBALLY

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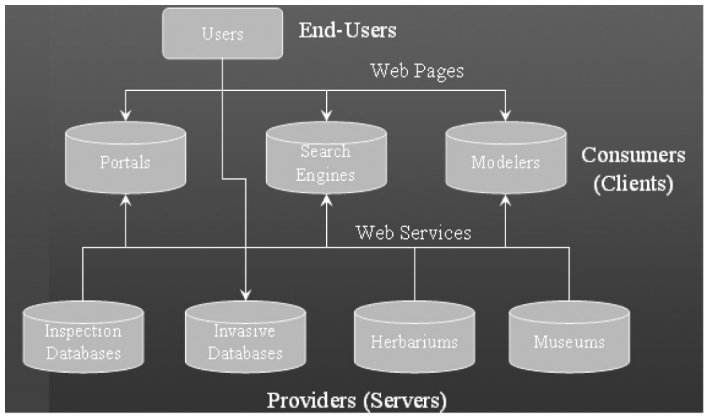
The transport, translocation, and introduction of invasive alien species (IAS) are issues of global concern. Successful early detection, prevention, and management of IAS and their impacts on the environment require global cooperation on IAS information exchange. The Global Invasive Species Information Network (GISIN) was proposed at the 6th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD), The Hague, 2002. It is a network of IAS researchers, experts, information managers, and computer scientists sharing knowledge and experience, adopting standards and protocols for information exchange, and increasing availability of IAS information at local, national, regional, and global levels. In 2004, experts from 26 countries attended the first GISIN meeting to establish goals and a Steering Committee to move the network forward. In 2005 a Web site was established for the GISIN <http://www.gisinetwork.org> and an extensible markup language (XML) schema for invasive species profiles was developed with support from the CBD Secretariat. The schema will establish a standard method for global IAS information exchange and cross-search of unconnected databases. In 2006 a Taxonomic Databases Working Group (TDWG) Invasive Species Information Systems interest group was formed in order to take the draft Invasive Alien Species Profile Schema through a formal standards adoption process. In 2007, the GISIN, the Global Biodiversity Information Facility (GBIF), and TDWG are developing a prototype Web system to share invasive species checklist information among diverse types of online information systems, in order to prevent and/or manage incipient invasions. The enclosed figure is a representation of the pilot system.



Related products (in brief) that members of the GISIN plan to produce:

- Tools for implementation of a data registry and cross search using a standard protocol
- Improved Invasive Alien Species Profile Schema for standardized species pages
- Interactive maps of existing invasions
- Predictive models of potential invasions

Keywords: invasive alien species, IAS, invasive species, invasives, alien species, exotic species, introduced species, bioinvaders, cyberinfrastructure, biological informatics, information exchange, databases, information systems, Internet, global invasive species information network, GISIN, extensible markup language, XML, information management.

ENVIRONMENTAL WEED RISK MANGEMENT IN PASTURE IMPROVEMENT PROGRAMS: RECENT INITIATIVES TO MINIMISE PASTURE SPECIES ESCAPE INTO NATURAL ECOSYSTEMS USING THE CRC FOR PLANT-BASED MANAGEMENT OF DRYLAND SALINITY AS AN EXAMPLE

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A substantial number of pasture or potential pasture species have become environmental weeds in Australia. The need for appropriate weed risk management in pasture research has been discussed in weed circles for many years, and a strategy has recently been adopted in a national pasture improvement program. The weed risk strategy for the CRC for Plant-Based Management of Dryland Salinity was developed in collaboration with weed risk experts in the CRC for Australian Weed Management, and is now in operation throughout Western Australia, South Australia, Victoria and New South Wales. The strategy aims to effectively identify and manage environmental risk from potential pasture species and raise weed risk awareness among researchers. Components of the strategy are still under development, but will include pre-trial weed risk assessment, pre-release weed risk assessment, trial site hygiene protocols and post-trial hygiene protocols. The development of this strategy, coupled with recent federal policy changes regarding importation of new plant species has greatly strengthened the ability of pasture research organisations to identify and manage environmental risk in their research. The strategy as it currently stands is described, and future challenges are discussed.

INVESTIGATION OF THE WEED RISK ASSESSMENT MODEL USING DATA MINING

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Machine learning is a very powerful prediction and knowledge discovery tool and is becoming increasingly popular among environmental scientists. Environmental datasets, which often are incomplete and involve multiple factors, can be efficiently analysed using machine learning algorithms such as data mining. In this study, we illustrate the potential of machine learning techniques for environmental science using a decision tree algorithm for assessing weed risk in two areas. The recently-developed matrix attribute selection method was applied to identify important factors for different weed-risk classes. The decision-making structures of risk assessment profiles are compared. The overall classification accuracies of the decision trees were assessed at 79% and 83%. Within-risk class accuracies were higher, for example, prediction recall for high risk or reject was between 86% and 93%. Significant factors in the decision structure for identifying high risk species were: whether the species was a weed elsewhere, whether the species was highly domesticated, and whether the species produced viable seed. Other significant factors that differed between the risk assessment profiles were whether the propagules were buoyant, and whether the species was naturalized beyond its native range. Identification of important risk assessment factors can help in designing cost effective weed risk assessment models. The number of questions for the decision making process can be reduced to a minimum. Comparison of weed risk assessment profiles between different areas provides information on relative risk.

PEST RISK ANALYSIS OF SOLANUM ELAEAGNIFOLIUM AND INTERNATIONAL MANAGEMENT MEASURE PROPOSED

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Solanum elaeagnifolium (Solanaceae) originates from the Americas and is considered invasive worldwide. Within the Euro-Mediterranean area, Solanum elaeagnifolium has already been introduced in several countries (Algeria, Morocco, Tunisia, Croatia, etc.) and there is a risk of establishment in other countries where it is scarcely present or absent.

The European and Mediterranean Plant Protection Organization (EPPO) is the Regional Plant Protection Organisation for Europe under the International Plant Protection Convention (IPPC) and is the major focal point for Pest Risk Analysis (PRA) development in the region. The EPPO PRA scheme is based on a sequence of questions, for deciding whether an organism has the characteristics of a quarantine pest, and, if appropriate, to identify potential management options. The EPPO Panel on Invasive Alien Species performed a Pest Risk Analysis on Solanum elaeagnifolium which has officially been approved, this plant now being included in the List of pests recommended for regulation directed to the 48 EPPO member countries.

This Pest Risk Analysis was done at the scale of the EPPO region, indicating the countries at risk from the studied organism, and aimed to identify recommendations on measures to limit introduction and spread of pests via international exchanges.

Different international pathways of introduction from countries where S. elaeagnifolium occurs have been evaluated as representing a risk:

-consignments of plants with growing media (ornamental plants, olive trees, etc.),

-consignments of seeds for planting,

-consignments of grain,

-soil as a contaminant on machinery and footwear,

-consignments of soil and growing medium as a commodity,

-containers and packing.

VICTORIAN WEED SPREAD PATHWAYS RISK ASSESSMENT

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Weed spread pathways are any means that lead to entry or spread of pest plants. The methods by which weeds enter or spread (or pathways of distribution) throughout the country, state or region need to be prioritised, so resources can be directed appropriately toward prevention strategies.

The primary objective of pathway analysis is to assess the risk of priority weed species being introduced and spread along a particular pathway by industries or organisations during their business activities.

10 potential pathways of weed spread were identified and a matrix then developed to denote intersections of 28 industries and organisations which may introduce and spread weeds by one or more of these pathways.

A decision support system, Analytic Hierarchy Process (AHP) was used for this study. AHP, an expert system employing multi-criteria analysis, enables complex issues to be broken down into a set of related criteria. The AHP is a well known method that assists with decisions about priorities using qualitative and quantitative information.

15 criteria were developed to assess 93 industry-pathway combinations for their risk of introducing and distributing 53 high priority weeds into Victoria. An issue of concern in this risk assessment process was how to deal with uncertain or missing data. To overcome this limitation, a separate measure known as a confidence score was used. This indicated the uncertainty and availability of data for each criterion. These confidence scores can be used as a gap analysis for information on specific industries or pathways.

The analysis indicated a number of industries, (seed, aquarium, landscaping and nursery) and specific pathways (deliberate introduction via business, deliberate introduction via community and contaminated equipment and vehicles) were amongst the highest risk for introducing these high priority weeds into Victoria.

ASSESSING THE IMPACT OF ALIEN PLANTS ON BIODIVERSITY: WHICH ALIEN PLANTS POSE A THREAT, WHAT SPECIES ARE AT RISK AND WHERE DO WE IMPLEMENT MANAGEMENT?

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Alien plants are widely acknowledged as a major threat to biodiversity, however, until recently little has been done to determine which alien plant species are posing the problem and the native species most at risk. Three main initiatives have been developed for the state of New South Wales, Australia to: (i) determine which alien plants are posing the problem, (ii) what is their impact on biodiversity (ie to threatened species), and (iii) how do we then use this information to deliver on-ground management. The first stage assessed the 1380 naturalised plant species in NSW for their impact on biodiversity and came up with a list of 300 alien plants. The second stage assessed all the species listed under the NSW Threatened Species Conservation Act 1995 (TSC Act) to determine which were threatened by alien plants. This process identified 427 native species at risk (or 46% of everything listed as threatened) and 127 alien plant species posing the threat. Lastly, the Chrysanthemoides monilifera (L.) Norl. Threat Abatement Plan (TAP) establishes a process to determine the impact to non-threatened species as well as prioritising sites for on-ground control. This process identified 158 species at risk; 65% of which are not listed as threatened under the TSC Act. Based on information about the locations of the species at risk, 169 priority sites were identified in the TAP for control. The TAP process is being applied to *Lantana camara* L. nationally, and these three initiatives are also being applied to the 13 major Catchments within NSW.

THE ENVIRONMENTAL IMPACT OF WEEDS IN AUSTALIA: A REVIEW OF IMPACT ON RARE AND THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

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After land clearing and climate change, the invasion of alien species, in particular alien flora or weeds, represents one of the greatest threats to the biodiversity of Australia. Since 1995 the number of quantitative studies of the impact of weeds on the Australian environment has more than doubled with at least 43 additional studies covering 23 species completed. This presentation reports on an analysis of published and unpublished information on the weed threats to rare and endangered species in Australia. Some 1600 species were assessed. Weeds were found to negatively affect 543 species. Weed species names were mentioned in 299 of the profiles of rare and endangeres speceis. This represents at least a ten fold increase over previous estimates of about 40 weed species causing an impact on rare and endangered species. Weed threats were spread throughout Australia with up to 21 weed species threatening individual endangered species. This information was used to develop a risk assessment approach to determining the impact of weeds on natural assets.

IMPACTS OF INVASION OF BITOU BUSH ON COASTAL COMMUNITIES

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Bitou bush, introduced from South Africa, dominates coastal communities along the east coast of Australia. It is one of Australia's top 20 weeds. We present a summary of 12 years of research investigating the broadscale impacts of bitou bush on flora and ecosystem processes. We show that plant species are affected differentially, however invasion does not seem to strongly affect survivorship and reproduction in established adults. Rather we have strong evidence that impacts of bitou invasion are mostly mediated at the seedling establishment phase through a number of processes. We review these lines of evidence. Finally using a meta-analysis, we find that woody weeds in general (including bitou bush) have strong negative impacts on a range of different plant life forms.

FUNCTIONAL HOMOGENIZATION WITHIN THE FLORA OF GERMANY

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One effect of plant invasions is considered to be biotic homogenization, i.e. the replacement of local biotas by non-indigenous and locally expanding species. But almost all of the conducted studies related to this topic, focused on species level, i.e. taxonomic homogenization. However, homogenization effects on functional diversity (functional homogenization – FH) seem to be very important for ecosystem functioning but are very rarely analysed for plant species. The term FH is used for increasing similarity of different species assemblages by increasing the proportion of species with similar ecological "roles", i.e. species sharing similar most likely dominant traits. Hence FH could be amplified by the loss of species with rare traits. An increasing proportion of common "winning" traits and a loss of rare "loosing" traits would thus lead to a shift in the trait composition of a species assemblage, which could have severe impacts on ecosystem processes. Shifts in trait composition may lead to shifts in niche occupations of species or even at a community level.

Here we will present results of plant functional homogenization pattern at three different spatial scales in Germany. Therefore we analysed different plant traits (e.g. flowering phenology, ploidy level, occupied vegetation units). With this study we want to answer the following questions. Do alien plant species contribute to homogenization of the considered traits and does this contribution vary across spatial scales in Germany?

INVASIVE GEOPHYTES OF SOUTHWEST AUSTRALIA; RECENT STUDIES ON BIOLOGY ECOLOGY AND MANAGEMENT

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There are 40 species of geophytes from the family Iridaceae recorded as naturalised in bushland of Western Australia. All 40 are garden escapes and ninety-eight percent are native to the Cape Province of South Africa. Although they comprise one of the largest and most serious groups of weeds in the southwest Region of WA, for many species there is little known about how they invade undisturbed bushland, the role of fire in the invasion process, the persistence of populations once established and effective control methods in the species rich native plant communities they invade.

Detailed studies have recently been undertaken on aspects of the biology of several invasive geophytes including *Sparaxis bulbifera*, *Freesia alba* x *leichtlinii*, *Lachenalia reflexa*, *Gladiolus undulatus* and *Ferraria crispa*.

Seed burial trials in bushland of the Perth Region have established both *S. bulbifera* and *F. alba* x *leichtlinii* have a short lived (less than 12 months) soil seed bank, while studies on *L. reflexa* have shown its soil seed bank can persist for at least two years.

Studies on the fire response of *G. undulatus* found hot fires will kill almost fifty percent of the adult population while releasing dormancy in juveniles and causing a five-fold increase in their numbers. Additional work on life cycle and biology indicates *G. undulatus* flowers 2-3 months after corm exhaustion and does not set seed in southwest Australia.

Herbicide trials, particularly involving 2-2DPA, have shown promise in controlling a number of invasive geophytes including *F. crispa* and *Watsonia bulbillifera*. The results indicate this herbicide has minimum impact on co-occurring native plant species and preliminary studies indicate application rates could still be effective if reduced.

While it is has been necessary for these studies to focus on individual species the information gained has implications for informed and effective management of a wide range of invasive geophytes across southwest Australia and beyond.

THE ECOLOGY AND BIOLOGY OF FREESIA AS A NATURALISED WEED IN AUSTRALIA

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Geophytes are rated highly as threats to Australia by AQIS in the Weed Risk Assessment system. Many genera of the Iridaceae have become weedy in southern Australia and have become abundant locally in native communities or more disturbed urban habitats. Freesia is a geophyte already dominating many sites and actively invading relatively intact bushland throughout south eastern Australia. This project uses *Freesia* as a case study to provide general information on invasive geophytes.

Why is it that *Freesia* has become dominant at some sites and not others? Will it pose a far greater threat in the future, either under present or climate-change conditions? Like many clonal perennials, they reproduce by both sexual and asexual means. Clonal offspring become independent from the parent by the next season. The way in which population structure forms, including the spatial distribution of genetically identical individuals, that the species avoids intense competition with plants of its own genotype (thereby decreasing its fitness), and the impact of neighbours, are issues that will add to ecological understanding in general.

This aim of this project is to better understand the factors governing the abundance of Freesia, both as a particular weed threat and as a case study of a member of the Iridaceae. Data has been collected over three years at a State Park site at Warrandyte, a suburb on the outskirts of Melbourne, Victoria, Australia. The population has been mapped and "satellite" plants identified and followed. This data will give an indication as to the rate of spread correlated to the site conditions.

AN ECOLOGICAL STUDY OF THE INVASIVE GEOPHYTE LILIUM FORMOSANUM

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Geophytes are plants whose shoots die off during unfavourable seasons then regrow using resources stored in below-ground organs. They are becoming increasingly acknowledged as a major group of environmental weeds and have the potential to detrimentally affect native ecosystems. Very little research has been done on weedy geophytes in Australia.

This current research focuses on *Lilium formosanum* (Taiwan lily), an invasive, bulbous geophyte of eastern Australia. This species is often found in bushland, road verges, creek lines and dune systems along the New South Wales, Victorian and south-east Queensland coasts. It also occurs on Lord Howe Island (LHI), a small island 720km off the coast of New South Wales, where it has been declared a noxious weed. On LHI Taiwan lily is considered a threat to at least three endemic plant species, as well as the eight vegetation types in which it occurs. Very little is known of the life cycle and ecology of Taiwan lily as a weed. Current ecological research is being undertaken as a basis for its management on LHI.

The study involved ten populations of Taiwan lily on LHI spread over an area of 16 kms2, from coastal to mountainous populations. The research suggests seed production, seed viability and bulb dynamics are the most important life-history traits contributing to the invasive nature of this species on LHI. Seed production and viability are extremely high (600 – 1500 viable seeds per plant); as the seed are wind dispersed and have the ability to establish in forest gaps this provides a means for further spread and establishment. However, it has been found that seed is extremely short lived in the soil seed bank and this may be exploited in attempts to control this species.

Taiwan lily also reproduces vegetatively from segments of the bulb (scales). When scales are disturbed they produce bulblets, which detach and produce new plants, providing a means for survival of pre-existing infestations. In addition the bulb dynamics of Taiwan lily are important in regulating shoot, flower and seed production. Resources captured in a geophyte's underground storage organ ensure rapid growth during favourable conditions and give them a competitive advantage over slower growing species. The removal of shoots in early development severely affects re-supply of resources to the bulb. This results in a carry over effect to the next season, which causes a reduction in shoot growth, and prevents seed-set in the season of treatment.

To effectively manage these invading plant species we need to increase our understanding of their ecology and biology in order to find and exploit weak links in their life cycle. The research undertaken in this project will provide valuable information about the ecology and potential management options available for this weedy species. The results will be useful for management of this species on LHI, mainland Australia and other countries where it has become naturalised.

AMMOPHILA ARENARIA DISPERSAL AND INVASION IN SOUTHERN NEW ZEALAND

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Ammophila arenaria (marram grass) is a major threat to the geomorphology and ecology of temperate dune systems in Australia and New Zealand. It was planted widely during the late1800s to stabilise mobile dunes, but became naturalised and spread to otherwise pristine dunes, primarily by marine transportation of rhizome. This dispersal process can be divided into three phases: (1) the entry of rhizome into the marine environment, during episodic dune erosion; (2) transportation of rhizome by surface drift; and (3) the deposition of rhizome and establishment of new plants on beaches. This paper presents the first systematic examination of phase two of this sequence.

The marine transport of *Ammophila* depends on the ability of rhizome to retain viability and buoyancy while immersed in seawater. The tolerance of rhizome to salt water was established by excavating rhizome from a foredune in summer and winter; immersing the rhizome for periods of between 1 and 60 days in both seawater and in freshwater; then growing rhizome in trays of beach sand in the glasshouse. Buoyancy was assessed by floating rhizome of various morphologies in seawater.

The tolerance of *Ammophila* rhizome to seawater immersion differed seasonally. During summer months rhizome remained viable up to 22 days in seawater. During winter experiments rhizome remained viable up to 60 days immersion. There was some decline in viability as the length of immersion increased. Rhizome exhibited considerably higher viability when immersed in freshwater than in seawater. Ammophila dispersal is not limited by rhizome buoyancy – most rhizome floated in seawater for longer than 60 days.

The potential exists for long distance alongshore dispersal of *Ammophila* rhizome, especially if dispersal occurs during winter. The exact distance will depend on the speed, direction and consistency of wind-forced surface drift. A persistent surface current of 0.1ms-1, for example, would be capable of transporting rhizome 518 km over 60 days. We report observations of viable rhizome stranded in isolated locations within Fiordland and Rakiura National Parks. These parks contain half the remaining dune systems of national significance in New Zealand. We also describe the extensive redistribution of viable rhizome within an embayment (Doughboy Bay, Rakiura National Park).

SAVING OUR SPECIES: A MAJOR INITIATIVE FOR ENVIRONMENTAL WEED MANAGEMENT ACROSS WESTERN AUSTRALIA

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Western Australia contains both nationally and internationally recognised biodiversity hotspots. Increasingly, these areas are at threat from a number of processes, including invasion by alien plant species.

In recognition of these threats, in 2006 the State government introduced the Saving Our Species biodiversity conservation initiative. DEC is funding and facilitating the projects across land tenures, involving a range of land managers, including other state government agencies, local government, indigenous communities and community volunteers.

The two-year, $15 million program comprises over 70 strategic projects each with a strong operational focus. The program commenced in June 2006 and included actions targeting pest animals, weeds, biological survey and research, dieback and the recovery of threatened native plants, animals and ecological communities. Under the initiative, $1.7 million has been allocated to assist in controlling 40 weed species, including species on the Weeds of National Significance and Alert lists, and others that are significant threats to biodiversity across the State.

The major outcome to date has been implementation of on-ground actions to control known populations of these species. Other outcomes achieved for key species include establishing trials to identify effective control techniques, raising awareness among land managers and the wider community and mapping across Regions where the distribution is poorly known. In addition to working toward eradicating select species, the initiative provides the framework for a coordinated and cooperative approach to allow for strategically managing these weeds into the future.

AN ASSET-BASED AND OUTCOME-DRIVEN APPROACH TO MANAGING THE ENVIRONMENTAL IMPACTS OF WEEDS ON PUBLIC LAND IN VICTORIA, AUSTRALIA

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Public land managers often face complex decision-making processes when protecting environmental assets. In Victoria there are over 280 ecological vegetation classes (a mappable unit of vegetation variation), and 3140 species of vascular plants, of which 1826 are rare or threatened. Weed invasion threatens many of the State's biodiversity assets and is listed as a potentially threatening process under the Flora and Fauna Guarantee Act 1988. In response, 'Interim Guidelines and Procedures for Managing the Environmental Impacts of Weeds on Public Land in Victoria 2006' have been developed. They outline the objectives, legislation, principles, program logic, priorities and a monitoring approach for managing the threat of environmental weeds. The highest priority for action is a preventative approach directed at the eradication of new and emerging weeds. This is complemented with an asset-based approach designed to protect important sites from the impacts of established weeds.

The framework has been implemented in a pilot program in the Otway region of south-western Victoria. Weed risk pathways and high value asset areas are identified, together with the weeds that threaten them. Weeds are ranked according to the level of threat posed to assets. Community engagement assisted in identifying weed threats and supporting management actions. New monitoring and evaluation protocols are developed to measure changes in vegetation condition over long time frames. A state-wide model of biodiversity assets identifies key regions of importance for biodiversity conservation and the environmental weeds that threaten them.

This paper outlines the framework that facilitates strategic and outcome-based management of environmental weeds in Victoria.

TACKLING WEEDS ON PRIVATE LAND

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Weeds don't respect boundaries. Successful long term management requires a multidisciplinary approach and collaborative coordinated action. By developing and maintaining effective partnerships with the many land custodians whose activities impact on or influence the management of weeds on private land, Victoria can prevent the introduction of new weeds and reduce the cost and impacts of existing weeds.

Tackling Weeds on Private Land (TWoPL) is a $9 million, three-year, Victorian Government initiative encouraging land managers to work collaboratively to manage weeds. Over the past three years TWoPL has worked with five stakeholders whose activities significantly influence how weeds impact on and are managed on private land; Local government, linear managers (road and rail), Catchment Management Authorities, the garden industry and the fodder industry.

TWoPL has built on the momentum of a range of existing programs by lifting the profile of weed management as a core component of business operations. A range of tools including; information, education, engagement, research and legislation have been combined to promote weed management responsibilities, share knowledge, build capacity that will extend beyond the life of the initiative and ensure integrated and cooperative approaches to preventing new weeds and managing existing problems.

Significant measured increases in stakeholder awareness, acceptance and action on weeds have been achieved. As a small sample, working through partnerships has achieved; development of industry standards for weed management along Victorian rail corridors, development of a 'Hygiene Code of Practice' by the Fodder Industry, production of a booklet on suitable alternatives to invasive garden plants by the Garden Industry, identification of 410 Victorian Alert Weeds and implementation of some 89 weed projects by Local Government including; community education and awareness; weed spread prevention training; weed mapping and marker systems; development of weed hygiene protocols, planning guidelines and local laws.

A STRATEGIC APPROACH TO BIOSECURITY THREATS POSED BY INVASIVE PLANTS IN AUSTRALIA

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Weed management in Australia was historically the responsibility of the affected primary industry, with government representation through State agriculture and forestry departments and the Australian Weeds Committee (a sub-committee of Federal standing committees). Environmental weed research priorities were set by an Australian & New Zealand Environment & Conservation Council through limited pooled funding from State bodies. The inadequacy of this situation for addressing research and stakeholder needs of a $4B agricultural and huge environmental problem was recognised in the 1990's setting the stage for national policy in a context of Federal responsibility for the international border and incursion prevention and State responsibility for legislative and on ground management. With significant support for agricultural weeds from rural industry research councils, this national focus was directed more towards environmental weeds. The National Weeds Strategy launched in 1997 was the catalyst to implement and coordinate national management strategies across Australia and included the establishment of the 20 Weeds of National Significance (WONS), icon species. Initial funding came from the Natural Heritage Trust (a Federal Government – DAFF & DEH - investment in NRM issues). In 2004 weeds were allocated a dedicated source of Federal government funding under the "Defeating the Weed Menace" programme. Since 1995 the science ministry (DEST) has also supported two sequential Weed Management Cooperative Research Centres. This paper describes how Australia has effectively raised awareness and support of invasive plants at the Federal level that has led to significant improvements in Australia's weed management and a revised Australian Weed Strategy under an overarching Federal Australian Biosecurity System (AusBIOSEC), which will arguably be the best in the world.

FLORABASE DEMONSTRATION

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FloraBase is the authoritative source for information about the Western Australian flora. Originally developed in 1995 and launched on the Internet in 1998, FloraBase has now been refined and extended to incorporate even more quality botanical information about our State's unique plants.

FloraBase integrates data from a number of fundamental datasets including the Census of Western Australian Plants, the Western Australian Herbarium specimen database of over 650,000 vouchered plant collections, and descriptive data for the families, genera and species of vascular plant in Western Australia. Significantly, all these datasets are regularly maintained and updated, providing the FloraBase user with immediate information about the many discoveries and advances regarding Western Australia's world-renowned flora.

With the release of the latest version of FloraBase in July 2003, this information is even more readily available. Only the specimen data, which includes localities for many rare and threatened species that must be protected, requires registration for access. Information on the names, plant images, distribution maps and descriptions are all freely available.

EVALUATING PROGRESS IN WEED ERADICATION PROGRAMS

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Because weed eradication programs commonly take 10 or more years to complete, there is a need to evaluate progress towards the eradication objective. Using a number of current Australian weed eradication programs as examples, we discuss indicators that can be used to assess conformity to key criteria (e.g. delimitation and extirpation) for eradication. Next we present a simple model, based on information that should be readily obtainable, that can be used to assess progress towards eradication. It is emphasised that the degree of confidence that can be placed in any measure of eradication progress is a function of the effort that has been invested in both surveillance and monitoring. Often the detection of new foci of infestation is fortuitous, rather than resulting from a targeted survey program. Determining eradication endpoints is particularly difficult for weeds, since plants may be extremely difficult to detect when at low densities and it is virtually impossible to demonstrate seed bank exhaustion. Recent work has suggested that an economic approach should be taken to the problem of when to declare eradication: the decision when to cease an eradication program can be informed by a mathematical model that balances the cost of continued surveillance against the cost of weed escape if the program is terminated prematurely. How to design decision making 'trigger points', such as could be used to determine whether to continue with an eradication strategy or switch to an alternative management strategy, remains problematic.

THE VALUE OF ERADICATION PROGRAMS FOR OUTLIER POPULATIONS OF WIDESPREAD ALIEN PLANTS

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Successful eradication of alien species is dependent on several criteria, including; (i) a well-resourced plan, (ii) commitment from all stakeholders, (iii) good understanding of the target organism's biology, (iv) suitability of target organism to eradication, (v) availability of effective controls, (vi) ability to put entire target population at risk and (vii) ability to prevent re-invasion. Although many alien plant invasions meet these criteria, eradication is rarely considered due in part to the large commitment required. With the exception of islands, there are few documented examples of successful plant eradications, especially on a regional scale. While eradication of widespread alien plants is seldom contemplated, eradication of strategic outlier populations is frequently undertaken. Programs to control outlier populations are not generally recognised as eradication strategies in their own right, although they often meet the above criteria for eradication. Documenting outlier population eradication programs can provide valuable information for future eradication efforts. This paper documents a strategic eradication program for a Weed of National Significance in one Australian State. *Chrysanthemoides monilifera* subspecies *monilifera* (boneseed) is widespread in south-eastern states, but is limited to 25 small (i.e. majority <2 ha) isolated populations in Western Australia. Potential distribution predictions indicate that these small populations could expand to impact the entire southwest of the state, an area of several hundred thousand hectares encompassing an internationally recognised biodiversity 'hotspot', the Southwest Botanical Province. Program success depends on support from the National Boneseed Program, long-term commitment from all stakeholders, enhanced community awareness and continued coordination. Documenting case studies such as this may provide insight for larger eradication efforts, while success of such small-scale programs may encourage managers to undertake eradication of outlier weed populations.

A SYSTEMATIC, SPATIAL PRIORITISTION FOR INVASIVE ALIEN PLANT CONTROL IN SOUTH AFRICA

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Current funding of one of the world's largest programmes dealing with invasive alien plant control, South Africa's Working for Water (WfW) programme, is insufficient to tackle the problem with equal urgency in all parts of the country. It is therefore faced with the challenge of setting priorities for action, and maximising the efficiency of its efforts. In order to determine whether the choices made on where resources are invested to control invasive alien plants in South Africa are valid/defensible, a systematic prioritisation was conducted and compared to the prioritisation in place in WfW. Using weighted linear combination within a spatial multi-criteria decision analysis approach, several criteria of the complementary species and area objectives were combined to identify areas where opportunities to meet individual goals for invasive alien plant control are synergistic. The evaluation criteria chosen for this study were: range, abundance and effect of terrestrial, transformer species; disturbance; terrestrial biodiversity value; river biodiversity value; water resource value and natural agricultural resource value. Annual operational project expenditure was used to represent the WfW prioritisation. At a national scale, a weak positive correlation of 0.274 was obtained between the systematic and WfW prioritisations. The highest correlation between the systematic and WfW prioritisations was for the range criterion (0.796) and the lowest for the disturbance criterion (-0.349). The conclusion of this study is that a systematic data-driven, prioritisation is weakly correlated with the prioritisation in use by WfW. Also, while there has been good targeting of infestations of invasive alien species with clear ecosystem impacts, there is room for improvement in targeting these species in areas where the opportunities to meet individual goals are synergistic, particularly with regard to areas of low disturbance and high conservation or production value. The approach adopted in this study could guide similar initiatives in other parts of the world.

ARE PHYLOGENETICALLY ISOLATED INVADERS MORE LIKELY TO ESCAPE THEIR ENEMIES? DARWIN'S NATURALIZATION HYPOTHESIS REVISITED

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Darwin's Naturalization Hypothesis proposes that exotic plants lacking relatives in non-native regions may be more successful invaders than exotic plants closely related to indigenous species. One possible mechanism underlying this pattern could be that phylogenetically isolated exotics are unlikely to encounter competent natural enemies in new regions, while non-isolated exotics are rapidly colonized by enemies adapted to their native relatives. Here, I synthesize new experiments by my lab with published results to test whether phylogenetically isolated exotics experience less damage by herbivores and pathogens than exotics with congenerics in the native flora. Field experiments in Ontario, Canada found that exotic plants with congeneric natives did not suffer consistently lower damage by insect herbivores or seed pathogens than their native relatives. Comparisons of exotics with vs. without native congenerics found high levels of interspecific variation in damage by insect herbivores, but this variation did not consistently differ between exotics with vs. without native relatives. Finally, field experiments found that losses to seed pathogens were not consistently greater for non-isolated than for isolated exotics. These results suggest that, while biotic resistance varies greatly among potentially invasive taxa, phylogenetic isolation is a poor predictor of this variation. Truly novel taxa may enjoy low levels of damage, but phylogenetic isolation is not correlated with damage for the majority of invaders.

PHYLOGENETIC PATTERNS IN PLANT INVASIONS IN SOUTH AFRICA

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It has been suggested that alien species with close indigenous relatives may have reduced chances of successful establishment and invasion (Darwin's naturalization hypothesis). Studies trying to test this have in fact been addressing four different hypotheses, and the same data can support some while rejecting others. We argue that the phylogenetic pattern will change depending on the spatial and phylogenetic scale considered. To test this we used a phylogeny of angiosperm families and a phylogeny of Fabaceae species, and spatial data on the co-occurence of species at the scale of a quarter-degree grid cells, and at a scale of approximately 1ha. The cumulative evolutionary age (CEA, a measure of phylogenetic diversity (PD)) of the observed assemblages was compared to that of assemblages generate using a random swapping algorithm. The results broadly support the idea that at the spatial scale relevant to competitive interactions, closely related species will be spatially separated, whereas at the regional scale species in the same genera or families will tend to co-occur more often than by chance.

DO PHYLOGENETIC RELATIONSHIPS HELP EXPLAIN SHIFTS IN NATIVE AND NON-NATIVE COMMUNITY COMPOSITION?

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Species invasions have been recognized as a multi-stage process, from initial introductions, subsequent naturalisation and different possible patterns of spread. Concurrent with increasing abundances of naturalised species have been shifts in native community composition and species abundances, which may be directly or indirectly associated with the increasing abundances of naturalised species. Phylogenetic relatedness to native species has been suggested as a useful metric for predicting invasion success of introduced species, but the degree to which relatedness is important may vary among the different stages of invasion. While close relatedness to native species might be expected to increase the likelihood that introduced species would have traits well suited to naturalising in the introduced landscape, relatedness may also leave species more susceptible to pathogen transfer or competitive exclusion by native species at subsequent stages of invasion. We use a 114 year dataset of the changing flora of the urban Auckland area to explore the question of how patterns of shifting community composition are shaped by phylogenetic relationships. We use data on changes in both occurrence and relative abundance of native and naturalised species to discern the importance of phylogenetic relatedness at different stages of the invasion process.

CHANGES IN ECOSYSTEM FUNCTION IN SAVANNAHS AND FIELDS INVADED BY CHROMOLAENA ODORATA IN CENTRAL AND SOUTHERN CAMEROON

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Chromolaena odorata King & Robinson is a perennial, heliophilous asteraceous shrub native to South America and invasive elsewhere. *Chromolaena odorata* was introduced to western Africa around 1930 and into Cameroon from Nigeria in the early 1960s. It is now a major weed in cropped fields, a dominant fallow type after field abandonment, and an invader of uncultivated savannah. Yet, it is considered a preferred fallow type by farmers in southern, central and north western Cameroon who claim that it renders soil more fertile although possible processes by which this can occur have not been thoroughly investigated.

The ability to decompose plant residues of various qualities is one relative measure of ecosystem function versus degradation. Invasive species may alter the bacterial and fungal soil assemblies which control decomposition processes in the soil as well as causing a change in the nutrient inputs into the system, factors which interact synergistically.

Here, the impact of *C. odorata* invasion on aboveground biomass, flammability, decomposition rates of plant residue of differing qualities, and soil chemical properties was assessed in contrasting situations: uncultivated savannah versus *C. odorata* invaded- savannah; *C. odorata* invaded fallows versus grass-dominated fallows; and, within cropped fields, areas with strong *C. odorata* growth (7 Mg ha-1) versus weak *C. odorata* growth (3.4 Mg ha-1). Ex-situ soil bioassays using maize as the test crop were also conducted.

Residue decomposition rates were generally higher in *C. odorata* invaded plots than in the equivalent non-invaded plots. Maize grown on soil from *C. odorata* invaded sites resulted in higher plant biomass production and chlorophyll concentrations than maize grown on soils from non-invaded sites. Residue decomposition rates were higher in the areas with strong rather than weak *C. odorata* growth. Analysis of potassium dynamics in cropped fields with five-month old growth of *C. odorata* revealed that 9% of the system potassium was present in the *C. odorata* regrowth. Implications of these results for soil fertility dynamics are discussed.

EVIDENCE FOR DEMOGRAPHIC SWAMPING OF THE AUSTRALIAN NATIVE, SENECIO PINNATIFOLIUS, FOLLOWING HYBRIDIZATION WITH AN INVASIVE, S. MADAGASCARIENSIS

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The outcome of interspecific hybridization between native and invasive species depends on the relative frequencies of parental taxa and the viability of hybrid progeny. We investigated individual and population level consequences of hybridization between the Australian native *Senecio pinnatifolius* and the exotic *S. madagascariensis* with AFLP markers and used this information to simulate the expected outcome of hybridization. A high frequency (range 8.3-75.6 %) of hybrids was detected in open pollinated seeds of both species, but mature hybrids were absent from sympatric populations. Hybridization was not related to flower density, with *S. madagascariensis* siring significantly more progeny than expected based on proportional representation of the two species in sympatric populations. Simulations indicated *S. pinnatifolius* would be replaced in sympatric populations if hybridization was density dependent. For this native-exotic pair, prezygotic isolating barriers are weak, but low hybrid viability maintains a strong postzygotic barrier to introgression. Due to asymmetric hybridization, *S. pinnatifolius* appears to be under threat from demographic swamping leading to local extinction where it occurs in sympatry with *S. madagascariensis*.

IMPACT OF PINUS RADIATA IN AUSTRALIAN EUCALYPT WOODLAND

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Pinus invasions are considered major ecological problems in New Zealand and South Africa where wildlings are beginning to dominate natural areas and suppress native vegetation. We investigated the impact of *Pinus radiata* (Monterey Pine) invasions into Eucalypt woodland. *Pinus radiata* is the most common plantation species in Australia with over 740 000 ha planted by 2005, but there is little known about the level of threat it may pose as an invasive species. A comprehensive field survey of *P. radiata* plantations in New South Wales was conducted to determine the extent of spread and to investigate the influence of vegetation, soil type, dispersal from the prevailing wind direction, and propagule pressure on pine invasibility.

Pine spread was most severe in the world heritage listed Blue Mountains region where pine densities reached up to 1000 individuals per hectare in areas adjacent to the plantation and isolated pines were recorded up to 4 km from the source. Invaded areas are subjected to three fold increases in canopy cover and substantial pine needle fall rates equivalent to those recorded in plantations (1800kg/ha). The influence of litter and reduced light levels on native and pine establishment was investigated in a series of field and glasshouse experiments. Pine germination and survival rates in Eucalypt woodland, and evidence of further reproduction by wildlings, suggests that in the absence of adequate control measures pines may become established invaders in the Australian landscape.

TUESDAY
SEPTEMBER 18

TOWARDS A ROBUST NATIONAL REGULATORY FRAMEWORK TO PREVENT AND CONTROL INVASIVE WEEDS: AN AUSTRALIAN CASE STUDY

Glanznig A

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The increasing international attention on biosecurity issues has prompted many countries to strategically audit their current border and post border policy, legislative and administrative arrangements.

In Australia, the development of a coherent biosecurity system, commonly referred to as AusBIOSEC, combined with invasive species group strategies such as the Australian Weeds Strategy, are putting a more coherent and robust policy architecture in place. A key part of the challenge is now to put an effective national regulatory framework in place to operationalise the weed related goals and objectives of the AusBIOSEC system and weeds strategy.

In relation to weeds, an independent audit has shown that the existing national regulatory framework, comprising Commonwealth, State and Territory weeds legislation is poorly harmonized, and does not adequately capture and control key human weed spread pathways that operate at national scales. This is particularly the case for largest intentional weed spread pathway – the national scale movement of invasive garden plants. This situation arises from an approach that is generally reactive, focused on a relative small set of weed species, and poorly harmonized weed categories and lists.

In contrast, a strategically designed regulatory framework is needed that addresses three major inherent attributes to the weed problem:

• the large pool of invasive plants in Australia. The most efficient policy response is implementation of an iterative and reliable instrument triggered by the proposed import of a new plant species across most State or Territory border, combined with strategic pathway based interventions. This approach enables risk assessments to be mostly demand driven, which results in a far more efficient allocation of staff resources spread over many years.

• decisions to introduce new serious weeds are irreversible once the weed has naturalised and eradication is no longer feasible. The most effective and efficient policy response to manage the inherent irreversibility of invasive plants increasing their range and impacts, once eradication is no longer feasible, is implementation of a comprehensive instrument that subjects all proposed imports of new plant species to a Weed Risk Assessment; and

• the uncertainty of predicting which plant species will become serious weeds in Australia. The most effective policy response to manage this inherent uncertainty is implementation of a conservative and precautionary instrument.

The paper outlines and discusses an effective national regulatory framework built on a pathways based approach, and which incorporates design features to address the above weed problem attributes.

DEFEATING THE WEED MENACE

Keogh K.

Weeds are one of Australia's most prevalent natural resource management issues, impacting the natural environment and agricultural sector. The Weeds Cooperative Research Centre (Weeds CRC) has estimated that weeds cost Australian agriculture over $4 billion per annum

As an island continent, Australia has an advantage in preventing new species entering our country; however we have introduced over 28000 species, many of these to develop our agricultural sector and for our urban gardens and parks. Unfortunately many have escaped and are now significant problems in many parts of Australia and it is estimated that Australia is gaining 10 new weeds each year.

The Australian Government has worked with states and territory governments to revise the Australian Weed Strategy to guide future weed management. The Government is also working with State and Territory Governments to manage national action against Australia's worst weeds.

Some of the most important steps that the Government is taking is to prevent the entry of new weeds into Australia by updating the list of plants allowed into the country and encouraging the community to reduce the spread of weeds within Australia. Starting in mid September this year there will be a public awareness campaign which aims to raise awareness of weeds as an issue and encourage the community to think about the plants they have or may be about to choose, the way they manage their garden waste and how they can help to reduce the spread of weeds.

In taking this national approach the Government has created a platform for long-term action to tackle Australia's worst weeds.

WHAT DETERMINES THE INVASIBILITY OF HABITATS BY ALIEN PLANTS: PROPAGULE PRESSURE, CLIMATE, HISTORICAL FACTORS OR HABITAT IDENTITY?

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Within the EU project ALARM, invasions by alien plants were related to habitats classified according to the EUNIS system, at the European and national scales. Large data sets from vegetation plots sampled for phytosociological purposes were used to determine the level of invasion (proportional number and/or cover of alien species) and produce maps reflecting the risk from invasions by alien plants in Europe. On national scale of the Czech Republic, the habitat invasibility was investigated. To distinguish the level of invasion from habitat invasibility requires to factor out the effect of propagule pressure and compare the habitats under the assumption of it being equal. We combined a data set of 20,468 vegetation plots from all major habitats of the Czech Republic with the national database of alien plants and land-cover and with environmental data obtained by using GIS. Minimal adequate models and regression trees were used to relate the proportion of archaeophytes (historic invaders introduced since the beginning of Neolithic agriculture until the end) and neophytes (modern invaders introduced after that date) to variables representing habitat properties, climate and propagule pressure, the latter expressed through proportion of surrounding urban/ industrial or agricultural land and human density. Most variance in the proportion of aliens was explained by habitat types (76% for archaeophytes and 39% for neophytes), while propagule pressure variables explained only 2.8% and 3.7% and climate 0.9% and 1.6%, respectively, for each group of aliens. Between-habitat comparisons of the gross and net effects of habitat properties suggest that the most important determinants of the level of invasions are disturbance regime and fluctuations in resource availability. Finally, the importance of residence time is illustrated by comparing archaeophytic and neophytic weeds of agricultural fields: the former are common in old crops introduced with the beginning of agriculture but poorly represented in relatively recently introduced crops, where neophytes are most numerous. These patterns can by explained by the history of plant invasions in Central Europe.

PREDICTIVE, SPATIALLY EXPLICIT MODELLING OF BLACKBERRY DISPERSAL

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A predictive model for the dispersal of weedy Blackberry *Rubus fruticosis* agg. is developed using a novel modelling methodology; one that is designed to capture the multiscale interactions that represent the dispersal mechanisms associated with both frugivore mutualisms and human-induced disturbances. Existing methods of capturing the multiple modes of dispersal for environmental weeds rely on the 'mixture of curves' that model seed dispersal as a one-dimensional model in a homogeneous environment. In this new approach, a variety of GIS data sources are combined in a hierarchy, creating a model that is spatially explicit, captures the fragmentation/mosaic environment and models dispersal mechanisms at their individual operational scales.

The crux of the modelling formalism is the method of abstraction from fine resolutions (short distance dispersal, for example) to coarse resolutions involving long distance dispersal (LDD) as well as the GIS data on which the practical models rely. Figure 1 is an example of how the modelling method is used to segment a landscape using a variety of data inputs. Different modes of dispersal `use' the created structure during a simulation to discover the most likely dispersal patterns. The result of a simulation is a landscape-scale prediction on the future distribution of R. fruticosis agg. given the current location of disparate populations.

The key features of the model presented here over existing models are the explicit modelling of short distance dispersal mechanisms and LDD and the segmentation of the environment into heterogeneous regions of space. The new approach is superior where existing models miss nuances such as: seed rain density (via seed-eating birds) at remnant vegetation boundaries and corridor movement for other fauna.

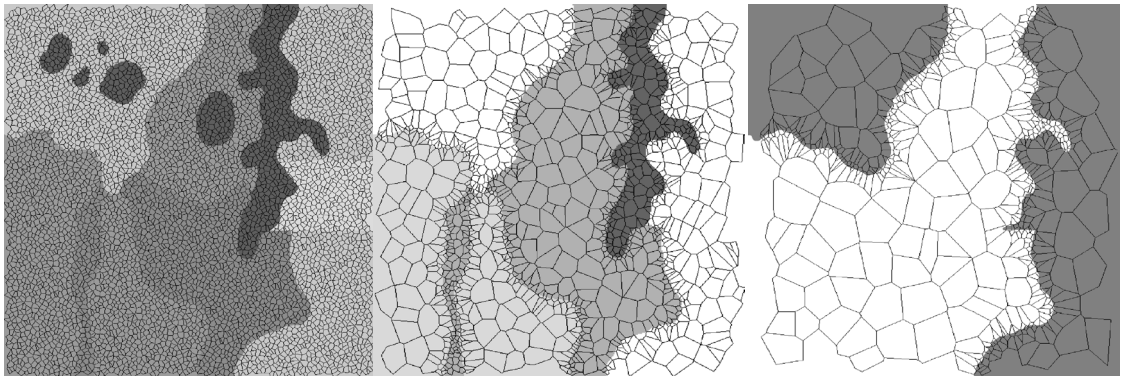

Figure 1: An example landscape is represented with three types of input data and then associated with a single structure that models the landscape using progressively larger cells. Each cell on the right comprises one or more cell in the centre, which in turn comprises one or more cell on the left. The underlying data might represent any combination of satellite imagery, vegetation surveys, or fauna population maps.

PREDICTIVE SPREAD MODELS FOR LIPPIA (PHYLA CANESCENS) IN AUSTRALIA

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Lippia (*Phyla canescens*) is a prostrate perennial, originating from the Flooding Pampa of South America. This plant exploits extreme events such as flooding and disturbance to colonise riparian habitats in Australia, where it is now considered a severe environmental and agronomic weed, currently invading high production agricultural areas in the Murray-Darling Basin. Climate change and new water agreements will alter the water available for distribution in the Murray-Darling Basin, potentially influencing the future extent of available habitat for this weed. Conservation practitioners require spatially-explicit guidance to clarify uncertainty regarding the future distribution of Lippia prior to adapting or formulating management interventions. The extent of potential prediction inaccuracies is explored using bioclimatic envelope models (BEMs). Results indicate that predictions derived from BEMs for future distributions of riparian weeds are weak in landscapes where water is transported over long distances into low rainfall areas. An alternative modelling approach is outlined, using reaction-diffusion equations to simulate spread within a spatially-realistic environment. This modelling approach provides a generic framework for describing the spread of riparian weed species and can be adapted to fit the physiological characteristics and life-history traits of a variety of different weed species.

MODELLING THE POTENTIAL FUTURE DISTRIBUTION IN AUSTRALIA OF GROUNDSEL BUSH, AN INVASIVE WEED (BACCHARIS HALIMIFOLIA)

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Groundsel bush (*Baccharis halimifolia* L. Asteraceae) is an introduced perennial shrub which has been a pest in Queensland and New South Wales for over 50 years. At present its range is thought to extend coastally from Bundaberg in Queensland, south to Kempsey in New South Wales. Using parameters based on its known native distribution in North America we used CLIMEX (a climate matching program), to model its potential distribution. Based on this model, it appears to have the potential to spread further south in New South Wales and into Victoria. Additionally, it is important to understand the impact climate change may have on invasive species such as groundsel bush. Using the predictions given by the Intergovernmental Panel on Climate Change (IPCC), climate change scenarios were modelled by altering temperature and rainfall levels, producing a variety of distributions. Predictions such as these are useful for alerting management authorities as to the potential impact this weed may have, given optimum conditions for establishment and growth.

A BROAD FRAMEWORK FOR REVIEWING WEED IDEAS, POLICY AND ACTION AT A NATIONAL SCALE

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Science plays an important role in the development of public policy in many fields, ranging from health and pharmaceuticals to energy and transport. The management of invasive plants is another, both in primary production and in environmental protection. This paper creates a simple framework to review (a) the realm of ideas, and (b) the realm of action, that together accounts for the generation of public policy in weed management and the responses in key sectors of the economy.

In the realm of ideas, input from science into weed policy is accompanied by input from business interests (such as land holders or plant traders), and from conservation interests (such as park managers and community groups). The level of public awareness, often reflected in the amount of media attention, is also a key factor in focussing the minds of policy makers. In particular, a perception at the political level that the public cares about an issue, or doesn't care, is critical to whether an issue is even placed on the agenda for policy attention. The Australian government's slow response to the climate change issue is a well known example of perception lag.

In the realm of action, the paper reviews each of the major avenues through which ideas and policy translate into action in Australia. As in other countries, these include government processes and programs at national, provincial and local level, and the action of landholders, plant traders and community groups. It also includes weed education and skill building in weed management, plus efforts to lift public awareness. Success in education and awareness building can feed back as a fresh influence on policy development.

Australia is widely seen as an international leader in some aspects of weed science and policy. As well as presenting a generic framework that could be applied to other countries, this paper uses examples from the Australian context that are especially important there in the flow of ideas, the formulation of weed policy, the delivery of information and the nature of weed action.

THE VALUE AND FUTURE OF NATIONAL WEED ICON SPECIES IN AUSTRALIA

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A component of the National Weed Strategy was to address weed problems of national significance, which evolved into the Weeds of National Significance program supported by all governments in Australia. This program has generated many benefits to the nation by providing a national focus and profile for species which has attracted funding and support from governments at all levels, natural resource management regions, industry, environmental sector and land managers. The success of the program is due to the use of a robust and easily understood, simple, objective and clearly defensible methodology for ranking species followed by systematic implementation of nationally agreed strategies for each of the 20 selected species. It has also been supported by sound communication, clear decision processes, commitment from key stakeholders at all levels of government, industry and community backed by a supportive network of dedicated coordinators.

The Weeds of National Significance program has been in operation for seven years and each weed species is scheduled for evaluation, but significant achievements have resulted from the work to date with examples available for aquatic weeds and bitou bush/boneseed which show how national cooperation has made the management of these weed more effective than if left to individual jurisdictions to implement in their own right.

The systemic and overarching benefits to the nation which can be attributed to the operation of the Weeds of National Significance programme are summarised below:

• Clear understanding of what drives the species invasion backed by a national plan to manage the species;
• National mapping of the species and a clearer understanding of species predicted and actual distribution;
• Improved understanding of the national distribution and implementation of containment lines for many species;
• The development of best practice management information;
• Strengthened networks at the landholder, local, state and commonwealth levels;
• Exchange and sharing of resources both human and technology based;
• Increased landholder ownership of pest management issues;
• Greater understanding of weeds by senior management and elected representatives enabling them to make more informed decisions;
• Closer liaison between community, government and research providers with stakeholders being more involved and having ownership of research programs;
• Increased communication specifically targeted to community needs with landholders exchanging information and offering solutions to each other.
• Increased resources from states, local government and community.

Some aspects of this paper have been presented at Australian Weeds Conferences as the project has progressed. This paper focuses on on-ground and over arching achievements of the WONS program that have not been published previously.

WEED PROOFING AUSTRALIA: A WAY FORWARD ON INVASIVE GARDEN PLANTS

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The garden plant industry has already been identified by the Weeds CRC, the CSIRO, the Victorian Department of Primary Industries and WWF Australia as Australia's dominant weed spread pathway. However, Australia's weed defence system is not currently geared to address this critical pathway. This paper outlines a strategic response to this challenge. It proposes a 10-point plan for policy changes necessary to address the invasive garden plant issue.

The critical issues that the proposed policy package addresses include:

• Thousands of high risk garden plants that are yet to naturalise and become widespread can be legally sold through the Australian garden plant industry;

• There is very low consumer awareness about the issue of invasive garden plants and role that consumers play in their spread;

• The garden plant industry is uncertain about the weed status of garden plants. The garden industry is a national market, while weed control is carried out by eight separate jurisdictions each with different laws and lists of prohibited weeds. Furthermore weeds are prohibited in different ways and are usually only prohibited in certain regions. The result is a confusing array of lists that retailers have to navigate through.

• The current situation discourages members of the Garden Plant Industry to take the lead on the issue of invasive plants due to commercial competition. By voluntarily removing invasive species from trade, less proactive competitors can offer a wider range of products to consumers.

• The Garden Plant Industry is a heterogeneous grouping of traders that are fragmented and dispersed. They include internet and mail order distributors, discount department store chains, informal market stalls as well as reputable retail nurseries. Controlling the sale of invasive plants through such an industry poses a significant regulatory challenge.

• The national regulatory framework and the weed lists that it generates is poorly harmonized and not well-geared to enable the garden plant invasion pathway to be controlled.

WWF's 10 point plan is designed to target different stages and audiences along the invasion pathway from propagation to escape of high risk invasive garden plants.

The implementation of the 10 point plan should result in: the national phase out of the supply and trade of high risk invasive plants in the garden plant industry; increased product demand for low risk garden plants; communities being mobilised to remove these plants from their gardens and to search and destroy new infestations of escaped invasive garden plants.

HERDING FERAL CATS 'COORDINATING INVASIVE SPECIES MANAGEMENT ACTIVITIES AMONG VARIOUS AGENCIES IN THE EVERGLADES ECOSYSTEM'

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The Everglades is one of the most renowned wetlands on earth. The Everglades is a World Heritage Site and an International Biosphere reserve due in part to its incredible biological diversity. Yet the Everglades is in serious trouble. Decades of human exploitation, urban encroachment and invasive species expansion have the Everglades poised on biological collapse. The Comprehensive Everglades Restoration Plan initiated in 2000 provides a framework and guide to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. The restoration effort covers over 4.6 million hectares, is anticipated to cost over $10 billion dollars and is the largest ecosystem restoration project in the world.

Although the primary focus of the restoration effort is to improve hydrologic conditions, it was quickly realized that in order for the restoration effort to succeed invasive plants needed to be addressed. One of the greatest challenges in managing invasive plants in the Everglades is bringing together many different agencies with different mandates and priorities.

The purpose of this talk is to describe the history and process that we have gone through to develop a cooperative approach to invasive species management in the Everglades. As a result of these efforts we have begun to see effective control of invasive plant species such as Melaleuca (*Melaleuca quiquenervia*) and Australian pine (*Casuarina equisetifolia*), native to Australia.

CONSERVING BIODIVERSITY BY ABATING THE THREAT OF ALIEN PLANTS: TURNING THEORY INTO REALITY

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The recognition that alien plants are a major cause of biodiversity loss has not led to a greater understanding of which species are at risk, or the development of on-ground conservation management strategies. To turn the theory of biodiversity loss due to alien plant invasions into an on-ground management reality, an 11-step process was developed using the alien shrub Chrysanthemoides monilifera (L.) Norl. Several new processes were needed to achieve these 11 steps, for example, the Weed Impacts to Native Species assessment tool was developed to assess the biodiversity at risk. This led to a significant increase in the number of the native plant species known to be at risk (from six to 160+). Sites were then assessed based on the alien plant and the biodiversity at risk, which led to 169 priority sites for control. Coordinated implementation and monitoring are crucial steps to ensure that all the stakeholders (government and community) are undertaking control in a manner that ensures conservation outcomes are achieved and reported. While this process is gaining wide acceptance in Australia, it requires considerable resources and commitment both in the planning and implementation phases (ie all 11 steps). Irrespective, the benefits to date have outweighed the costs, resulting from a better understanding of impacts, longer term commitment to restoring sites, wide community support and significant new funds. These 11 steps could be applied to abate other threats to biodiversity.

INCORPORATING THE COST OF IMPACT INTO OPTIMAL MANAGEMENT STRATEGIES FOR INVASIVE SPECIES: THE VALUE OF KNOWING THE IMPACT CURVES

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The impact of some invasive species will not decline proportionately with their density when managed, for example a seed contaminant will continue to have a large impact until the density is reduced to a very low level. The level of optimal management effort depends on the relationship between the population density of the invader and the cost of impact caused by the invasive population. In management studies this relationship is often assumed to be linear; however, we have little empirical knowledge of this relationship and it could plausibly take several different non-linear forms. We examine how the optimal management effort level varies based on four functional forms of the cost of impact. The optimal management effort minimizes a total cost which is a sum of the cost of impact and an economic cost of management effort. If we apply an inaccurate cost of impact curve, the invested management effort is smaller or larger than the optimal level based on an accurate cost of impact curve. We calculated the increase of the total costs due to this over- or under-investment in management which indicates the value of information of the cost of impact curve. The value increases with the time scope of management and it also depends on what kind of inaccurate cost of impact curve is applied. Knowing the correct form of the cost of impact curve will enable managers to better prioritize species for control and make more efficient budget allocation decisions.

LANDSCAPE SCALE DETECTION OF WOODY WEEDS BY REMOTE SENSING – MAPPING INVASIVE AFRICAN OLIVE (OLEA EUROPAEA SSP CUSPIDATA) IN SOUTH-WEST SYDNEY, AUSTRALIA

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Analysis of remotely sensed data such as satellite imagery is widely used as a tool to monitor changes in vegetation cover and condition. The mapping of invasive species by remote sensing has been dominated by the detection of weeds in rangeland and agricultural environments. Detection and mapping of woody weeds by remote sensing is an emerging field, which frequently relies on distinct seasonal foliage contrast for the target weed and the use of imagery collected from aircraft. In this study, analysis of Landsat Thematic Mapper satellite imagery was used to detect dense infestations of the woody weed African Olive (*Olea europaea* ssp *cuspidata*), at a large landscape scale using its unique spectral signature.

African Olive, is an evergreen dense crowned tree introduced into cultivation in Australia in the mid-19th century. It has become highly invasive in the Cumberland Plain region of south-west Sydney, and now threatens the long term viability of endangered ecological communities. Major centres of African Olive infestation were identified on public and private landholdings with a 94% user's accuracy. Further GIS analysis across the 721 sq km study area revealed the extent of impact on native vegetation, and the steep slope preference for African Olive establishment. This study demonstrates the effectiveness of mapping suitable weed species using remote sensing techniques, particularly in complex landscapes with a high proportion of private ownership.

NON-TARGET EFFECTS OF WEED BIOLOGICAL CONTROL AGENTS IN AUSTRALIA

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All pest management options have associated risks. Biological control can be a cost effective, permanent, and relatively safe method of control. However, the introduction of a novel organism into an ecosystem inevitably involves a degree of uncertainty regarding potential impacts on target and non-target species. The risk to non-target species is determined largely from host testing of potential agents; a vital component of weed biological control for more than 80 years. During this time there have been many advances in our understanding of host selection and improvements in testing methods. There has also been growing concern regarding the non-target effects of weed biocontrol agents. Due largely to a lack of post release monitoring, there is presently little evidence to either confirm or refute this unease.

We compiled a database of weed biological control agents released in Australia and investigated the relationship between host testing procedures and realised non-target effects. Three case studies of known or suspected non-target effects were also examined: the attack of *Neptunia major* by *Neurostrota gunniella* (an agent against *Mimosa pigra*); the impact of *Aconophora compressa* on *Lantana camara* and *Citharexylum spinosum*; the attack of native *Rumex* spp. *Pyropteron doryliformis*. Results of these studies are discussed.

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BIOLOGICAL CONTROL OF SOLANUM VIARUM (SOLANACEAE) IN THE USA: CURRENT STATUS AND PERSPECTIVES

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Solanum viarum (Solanaceae) is a perennial prickly bush, native to South America that has been spreading throughout southeastern United States since it was found in Florida in 1988. This non-native plant has invaded at least 400,000 hectares of grasslands, agricultural crops, and conservation areas in at least seven states. The rapid spread in the United States can be partially attributed to the large seed production per plant, effective seed dispersal by cattle and wildlife that feed on fruits, and introduction of the plant to the new area without its natural enemies (herbivorous and pathogens) that keep weed's population in low numbers in the area of origin. Management practices for *S. viarum* are mostly based on herbicides/ mowing which only provide a temporary solution and are relatively expensive. A biological control project was started in 1997 by the University of Florida in collaboration with Brazilian and Argentinean researchers. The first biocontrol agent approved for field release in 2003 was the leaf beetle *Gratiana boliviana* (Chrysomelidae). Currently, more than 120,000 beetles have been released in Florida, Georgia, Alabama, South Carolina, and Texas. Evaluation of the feeding effects of the beetles on *S. viarum* plants and changes in the number of beetles on the plants have been made since 2003 in at least 5 of the release sites. The beetles got established in almost all the release sites. Beetle dispersal is a function of plant availability. Defoliation by *G. boliviana* in preventing fruit formation and decreasing population number of *S. viarum.*

CLASSICAL BIOLOGICAL CONTROL OF INVASIVE AQUATIC PLANTS, CABOMBA AND ALLIGATOR WEED

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Invasive aquatic plants have diverse social, economic and environmental impacts and associated high costs of control. Alligator weed (*Alternanthera philoxeroides*) and cabomba (*Cabomba caroliniana*) are two introduced invasive aquatic plants that are serious pests in Australia and around the world. These plants are difficult to control because standard chemical and physical control methods are not effective, or in some cases, may exacerbate the problem. The only sustainable long-term solution is biological control. Biological control of alligator weed has been effective in controlling large floating mats in aquatic systems. We are seeking additional biological control agents for terrestrial and cooler areas. Several promising agents, a beetle (*Disonycha argentinensis*) and a thrips (*Amynothrips andersoni*), were not host specific and are therefore not safe for release in Australia. We are currently testing a tip-galling fly (*Clinodiplosis alternantherae*) and continue to study the ecology of the weed to improve management strategies. We have identified three potential biological control agents for cabomba. These include a stem boring weevil (*Hydrotimetes natans*) and two pyralid moths (*Parapoynx* spp and an unknown genus). We will begin testing the weevil for host specificity in mid-2007. We also continue to conduct ecological research on cabomba to create better management strategies and to predict effectiveness of biological control agents.

IS MANAGEMENT EFFECTIVE? THE RESULTS OF AN ADAPTIVE EXPERIMENTAL MANAGEMENT PROGRAM TO DETERMINE BEST PRACTICE CHEMICAL CONTROL ON CYTISUS SCOPARIUS AND IMPACTS ON NATIVE VEGETATION

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Management of invasive plant species is often done in the absence of appropriate evaluation to determine the effectiveness on the target species/community or the off-target damage to other species.

Adaptive experimental management, however, considers management actions as experimental treatments and employs approaches such as replication and control. This allows alternative management strategies to be compared simultaneously. Parks Victoria has used this approach in one of its largest pest control programs.

English Broom (*Cytisus scoparius*) has been a high priority weed for control in the Alpine National Park for over fifteen years, but managers have little evidence of the outcomes of extensive weed control efforts. Following the bushfires in 2003, which burnt extensive stands of C.scoparius in the Alpine National Park, Parks Victoria established a series of one hectare trial plots to address the effectiveness, efficiency and environmental outcomes of best-practice chemical control strategies.

The effects of three best-practice herbicides (360 g L-1glyphosate, 300g,L-1 triclopyr with 100 g L-1 picloram, 600g L-1 triclopyr) applied during Autumn or Spring on one-hectare plots were compared with non-treatment plots at each of three sites. After 3 years results indicate substantial differences in rates of damage to C.scoparius stands, however, no herbicide resulted in a 100% kill rate. Herbicide type and timing of application were important factors. There were significant changes to native vegetation across all sites after 3 years, in both treated and control plots. Herbaceous species were the most susceptible growth-form to increasing C.scoparius and herbicide application, with decreasing cover and richness across all treatments and control plots. Grass cover decreased across all treatments and control plots except where 300 g L-1 triclopyr with 100 g L-1 picloram was used, here cover increased. Mortality of canopy trees was greater across all treated plots in comparison to control plots, hence suggesting direct impacts from herbicide application. The implications for management and future management directions as a result of these findings will be discussed.

REDUCING HERBICIDE RATES IN TEMPERATE CENTRAL NORTH ISLAND FORESTS OF NEW ZEALAND

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Reducing chemical inputs when establishing new plantations, is becoming an increasingly important concern for all forestry companies seeking FSC certification. The application of lower herbicide rates reduces costs and has perceived environmental benefits. A trial was established in the central North Island of New Zealand to investigate the response of weeds to reduced herbicide rates, in a typical forestry release operation, on five invasive weeds. Two herbicide mixtures were applied to *Cytisus scoparius* (Broom), *Ulex europaeus* (Gorse), *Cortaderia selloana* (Pampas), *Holcus lanatus* (Yorkshire Fogg) and *Buddleja davidii* (Buddleia) at 100%, 75%, 50%, 25% and 0% (control) of the recommended operational applied rates. Weed seedlings were treated when they were 4, 8 and 12 months old respectively. When evaluated one year after treatment, the weed height reduction and mortality, expressed as a percentage of control values, increased as the herbicide rate increased. Similarly weed height reduction and mortality, as a percentage of the control values, increased as weed age and size at time of treatment application declined. Herbicide mixture 1, containing mainly clopyrlid, was clearly more effective against the target weeds species than mixture 2 containing mainly terbuthylazine and hexazinone. Mortality and height reduction results for both herbicide mixtures, indicate that rates cannot be reduced significantly from the recommended rates currently in operational use.

CONTROL OF THE TUBEROUS WEEDS ANREDERA CORDIFOLIA AND TROPAEOLUM PENTAPHYLLUM

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Anredera cordifolia (Ten.) Steenis (Madeira vine) and *Tropaeolum pentaphyllum* Lam. (Ladies legs) are both twining, smothering, perennial vines with large storage roots which support annual regrowth of foliage in cold climates but with foliage present year round in warmer areas. The presence of the storage roots makes these weeds difficult to control as they readily regrow after the top growth is removed. Herbicides with an ability to translocate within a plant after application to the foliage offer the best opportunity to kill underground parts of the plant. For the experiments reported here, *Anredera cordifolia* was grown from aerial tubers for several months in 150 mm diameter plastic pots prior to treatment while the *Tropaeolum pentaphyllum* was grown from underground tubers in a similar way. Both species were trained up stakes to avoid entanglement prior to treatment. We evaluated several herbicidal control methods and investigated regrowth potential from the tuber during 12 months post-treatment. *Anredera cordifolia* was well controlled by foliar applications of triclopyr and glyphosate plus Pulse, at rates of 0.5% and higher for both herbicides. Also effective were picloram gel applied to the cut stem and soil injections of imazapyr. Glyphosate painted neat onto leaves and imazapyr as a foliar spray were slightly less effective. *Tropaeolum pentaphyllum* was well controlled with foliar applied triclopyr at rates of 1.0% or higher. Complete brownoff occurred within 3 weeks and the tubers decayed within 3 months after treatment. Glyphosate and metsulfuron-methyl were slower acting and tuber decay ranged from 0 – 50% only. Picloram gel applied to cut stems gave intermediate results.

WEED RECRUITMENT FOLLOWING LANDSCAPE-SCALE DISTURBANCE TO PRIMARY RAIN FOREST

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Severe tropical cyclone 'Larry' crossed the coast of north Queensland on 20th March 2006, with very destructive winds over a radius of 40-50 km and destructive winds extending to 120 km. We conducted fifty 0.1 ha surveys between November 2006 – February 2007 in the rain forest across the damage zone and inland along the cyclone track looking for invasive plant species. Surveys were distributed across the landscape with respect to the amount of damage the forest had received, the location of the site in relation to other disturbances such as roads, power lines and former forestry operations, and the amount of native regeneration. We found that a limited suite of weed species had the potential to invade disturbed rain forest, and that this declined with the level of disturbance. Proximity to an artificial disturbance increased the likelihood of weed presence and abundance. Wind-dispersed species were more abundant and more invasive than bird-dispersed species, and were more likely to have attained a reproductive stage within their first growing season. Advanced native regeneration occasionally grows sufficiently densely to exclude weeds, but weeds typically germinate and grow faster and reach reproductive maturity earlier than the native species with similar regeneration requirements. We discuss the implications of our findings for the management of native vegetation, and for the potential impact of weeds under the predicted increased cyclone intensities resulting from climate change.

ECOLOGICAL ROLE AND IMPACT OF INVASIVE SPECIES IN RAINFOREST HABITATS FOLLOWING CYCLONE LARRY

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In tropical forests, natural disturbance creates opportunities for species to claim previously utilised space and resources and is considered an important mechanism in the maintenance of native plant diversity. However, ecologists have long recognised that disturbance also promotes exotic plant invasions. Cyclones cause extensive defoliation, loss of major branches and multiple treefalls resulting in a significantly more open canopy and increased light and heat levels in the understorey. The widespread and massive disturbance caused by cyclones provides ideal conditions for rapid recruitment and spread of exotic species. The ecological roles of exotic species in rainforest habitats following such a severe disturbance are very poorly understood.

Category 5 Cyclone Larry crossed the North Queensland coast in March 2006 causing massive destruction to rainforest habitats from Tully to Cairns and west to the Atherton Tablelands. We established 11 plots in an area extensively damaged by this cyclone near El Arish in North Queensland. On each plot 9 2*2m quadrats were established with three quadrats per plot in each of the following treatments; (1) complete debris removal down to the soil layer, (2) removal of coarse woody debris only, and (3) uncleared. We have monitored recruitment, growth and mortality of all native and non-native species in the 99 quadrats every three months since the cyclone. Here we present the recruitment dynamics of exotic species across the study area in relation to the level of disturbance, the type of quadrat treatment, and the composition and density of the native recruiting flora. Our results suggest that invasive species will mostly comprise a transient component of the flora in the early stages of the recovery process, however, some species may go on to have longer-term effects on the successional trajectory of the rainforest and future forest composition and structure. We discuss these results in the context of potential management responses to major disturbances in the tropics.

EFFECTS OF NON-NATIVE SLUGS ON INVASIVE AND NATIVE PLANT ESTABLISHMENT IN FORESTS: EVIDENCE FROM THE HAWAIIAN ISLANDS

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Non-native slugs from around the world have become established on many Pacific Islands. Slugs are often recognized as important garden pests and predators of seedlings, but little is known about how introduced slugs are affecting plant establishment in natural areas. Hawaii has no native slugs, but over a dozen slug species are now established. We reviewed Rare Plant Recovery Plans produced by the U.S. Fish and Wildlife Service and found that introduced slugs were mentioned as potential threats to 67 rare plant species in natural areas, based on anecdotal observations by field biologists. We then initiated an experimental field study to assess the impact of slug herbivory on the growth and survival of two endangered plant species (*Cyanea superba*, and *Schidea obovata*) and two invasive plant species (*Clidemia hirta* and *Psidium cattleianum*). In mesic forest on the Island of Oahu, we tracked the fate of outplanted seedlings in replicated enclosures on the forest floor, with and without slug control. Slugs significantly impacted seedling survival of both endangered plant species, decreasing their survival by 51%, on average. Slugs did not significantly affect seedling survival of the two invasive plant species. Non-native slugs may facilitate the success of some invasive plant species by reducing competition with more palatable, native plant competitors. Slug control measures are relatively inexpensive and could facilitate restoration of native plant communities on Pacific Islands.

SOUTH AFRICAN WORKING FOR WATER ALIEN CLEARING OF BUGWEED (SOLANUM MAURITIANUM): REINVASION THROUGH SEED DISPERSAL, SEED BANKS AND RESPROUTING

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Solanum mauritianum is a major weed in the eastern higher rainfall regions of southern Africa. A field assessment of the Working for Water Program's (WFW) clearing of bugweed along the Sabie River, through grassland and savanna reaches, was undertaken in 1996/7 and 2005. WfW started clearing alien plants within 30 m of the banks of rivers in 1995, hence the study provides both an early and later assessment of WfW's effectiveness. Sampling was undertaken in 40, 0.1 ha plots, established in (a) high (>50% alien (all species) aerial cover) versus low (<50%) invasion intensity areas, (b) WfW-cleared versus uncleared areas, and (c) savanna versus grassland reaches, in a factorial design (5 plots per treatment combination). Even with clearing, bugweed densities (plants >1 m in height) increased, both in 1996/7 and 2005 (by which time all plots had been cleared at least once). Seed production occurs on plants of >1.65 m tall, and progressively increases to >20 000 seeds plant-1 annum-1 for the tallest plants (about 7 m tall). The fruits (berries) are consumed by birds, which may disperse seeds considerable distances. In situ seed banks were assessed in 1996/7 within the litter, 0-2 and 2-4 cm soil depths. Even though seed bank densities were highly variable, means across the 8 treatment combinations (biome, invasion intensity, cleared versus uncleared) were high (47-554 seeds/m2). Hence the invasion potential remains severe despite clearing. Seed densities were higher in savanna than grassland ($P<0.0001$), and also in high- compared to the low-invasion intensity sites ($P=0.0046$). There were no significant effects of clearing per se, or any interactions. Seed persistence, as indicated by half life, increased with depth of burial and was higher under tree canopy shade than intercanopy ('open') in the field. Seed half life did not vary greatly, and with 2 exceptions from 14 comparisons (field and greenhouse), was in the range of 8.5-11.5 months. Secondary seed dormancy can be induced under field conditions and so some seeds may persist for several years. A high percentage of plants resprouted after clearing, particular in savanna (41+19%) relative to grassland (31+19%). For both savanna and grassland, cutting lower on the stem results in higher mortality, while cutting higher allows resprouting recovery. However, variation in stem diameter at cut height did not appear to have an effect on survival. Reinvasion within the more open and higher light at the soil surface post-clearing environment is thus through a combination of recovery of adults by resprouting and the establishment of dense cohorts of seedlings. Hence WfW clearing of bugweed is not being effectively achieved. Improved clearing by cutting lower down on the stem should greatly reduce the proportion of plants resprouting. However, seedling emergence is likely to be a problem for several years, especially given the high seed bank densities and longevities. More thorough and frequent follow-ups will be essential to maintain the improved situation after clearing.

MANAGEMENT OF THE INVASION OF RUBUS SPECIES WITHIN SOUTH WESTERN AUSTRALIA

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Rubus anglocandicans (Rosaceae) is the most widespread taxon within the *R. fruticosus* aggregate that is identified as a Weed of National Significance in Australia. In the south west of Western Australia it is more widespread than the other two naturalised blackberry species, *R. ulmifolius* and *R. laudatus*. Blackberry plants often form impenetrable spiny thickets along waterways and adjacent bush land areas. The unwelcoming nature of these thickets has resulted in limited information of the actual impact of any of the species upon the native biodiversity.

We have established a baseline for future long term studies that aim to monitor changes in the structure and function of blackberry-invaded ecosystems after several new strains of the biological control agent, the rust, *Phragmidium violaceum*, are established. This rust originates from Europe. *Rubus anglocandicans* is highly susceptible, *R. ulmifolius* is susceptible and *R. laudatus*, an American species, is resistant to attack by the rust. Trials investigating the interaction of *P. violaceum* with herbicides have also been included so as to widen the management options.

We surveyed fairly pristine sites located on the edge of an invading front of *R. anglocandicans* and compared the species richness and abundance of the native plant species on either side of this front. During 2005 and 2006, 8 sites in the Manjimup area and 2 near Albany were selected where blackberry plants occupied on average 59% of the available space within the infested areas. All sites are in areas where there have been no releases of the new rust strains.

There were 46% fewer short, native plants species and these were 79% less abundant within the blackberry infestations than they were within the adjacent blackberry-free areas (5.4 ± SE of 2.09 versus 10.0 ± 1.95 species). A 20% reduction in the invertebrate fauna was also associated with the *R. anglocandicans* invasion of pristine areas.

Studies to examine ecosystem function in this system are being planned. Soil nutrients were not statistically different between the infested and pristine areas. Decomposition rates are however expected to be much faster under blackberry plants which may also have potential impacts upon the adjoining aquatic ecosystems.

Although the American blackberry is completely resistant to the new rust strains that are currently being released, we have recently discovered high densities of an eriophyiid mite on some *R. laudatus* populations located in Perth. This mite can totally prevent the ripening of the blackberry fruit, thus reducing their attractiveness to fruitivores and consequently the invasive potential of the plant. Further studies are required to determine the extent of the current eriophyiid mite populations and any impact these mites are having on seed quality. Potentially this mite could be used as a management tool to prevent populations of *R. laudatus* expanding into areas where the *P. violaceum* rust is impacting upon existing populations of *R. ulmifolius* or *R. anglocandicans*.

Information on the distribution and ecology of these blackberry species has been incorporated into a State management plan for control of these weeds (see http://www.ento.csiro.au/weeds/blackberry/blackberryWA.html).

PRACTICAL APPROACHES TO THE MANAGEMENT OF FALLOPIA JAPONICA IN THE UK

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Fallopia japonica (Houtt) Ronse Decraene continues to cause problems in the built environment. This can be particularly costly where development is planned, as control of the plant prior to work commencing is often required.

As this plant has the potential to damage structures, pavings and services, treatment is necessary to avoid future problems. A practical approach to treatment allows the development to go ahead on schedule and for costs to be minimised. The recently published Environment Agency Code of Practice gives guidance to developers but many require additional assistance in the various stages of treatment from initial identification through to final 'sign off'. Practical management requires each site to be assessed independently as many factors contribute to decisions regarding effective control for example development timescale, building footprint, previous treatment methods and site conditions. Examples of poor planning which can contribute to escalating costs are: inappropriate use of chemical treatments, late identification of the plant and lack of management plans. With an effective management plan, proper training can be given to site operatives, treatment can be employed effectively and the site can be handed over to the client on schedule and on budget.

THE ROLE OF LONG-DISTANCE AND RANDOM DISPERSAL IN POPULATION DYNAMICS OF HERACLEUM MANTEGAZZIANUM AT A LANDSCAPE SCALE

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Long-distance dispersal and random events in seed transport and establishment are important processes that significantly affect the dynamics of species at both small and large scales. Especially in the case of invasive species they play the key role in shaping the patterns of colonizations, spread and metapopulation dynamics. However, real data on long-distance dispersal are very scarce because it is difficult to determine the shape of dispersal curves and amount of randomly dispersed seeds. The aim of this study is to estimate the role of long-distance dispersed seed in the population dynamics of an invasive species *Heracleum mantegazzianum* (Apiaceae), native to Asia, at a landscape scale. To assess the role of randomly dispersed seed in the dynamics of *Heracleum mantegazzianum*, we combined knowledge about its (i) small-scale dynamics (stage-based matrix models), local dispersal and (ii) large-scale dynamics taken from the longitudinal series of aerial photographs covering 50 years of invasion in Slavkovský les, Czech Republic. The imposing appearance of the studied species with large inflorescences makes it possible to identify individual flowering plants or their populations on aerial photos. Population dynamics of the species in the same area that was covered by aerial photographs has been monitored since 2002 to 2006. Matrix models were extended by using the dispersal function allowing to simulate the population development on a spatial dimension. The simulations were run on a grid where the quality of individual cells and their suitability to invasion by *H. mantegazzianum* were classified on the basis of the aerial photos. Real data on the distribution of *H. mantegazzianum* in the landscape were used to compare the observed and estimated distribution and colonization rate. To determine the proportion of randomly dispersed seed, a set of realizations starting in the year of first occurrence of the species at the locality was run with parameter combinations covering 0 to 20.0% of seed dispersed at random. Preliminary results show a consistent pattern of the population dynamics, where the maximum fit of simulated runs with real species distribution inferred from aerial photos was achieved when the proportion of randomly dispersed seeds varied between 2.0 to 3.0% of the total amount of seed produced.

RECONSTRUCTING INVASION OF TALL HERACLEUM SPECIES IN EUROPE AT DIFFERENT GEOGRAPHICAL SCALES USING AFLP MOLECULAR MARKERS

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Tall species of *Heracleum* were introduced into Europe from south-west Asia and are now widespread in many countries. *Heracleum mantegazzianum* Sommier et Levier (giant hogweed) has long been recognized as a prominent example of an invasive alien with a wide distribution, significant impact and remarkable dynamics of spread at both national and European scales. However, it has only recently been confirmed that there are two more species of the genus invading Europe: *H. sosnowskyi* Manden. and *H. persicum* Desf. ex Fischer. *Heracleum mantegazzianum* and *H. persicum* were introduced as garden ornamentals in the nineteenth century, whereas *H. sosnowskyi* was used as a crop after the Second World War.

The aim of our study was to reconstruct and characterize the history of invasion of these three species of tall hogweeds into Europe and to understand the mechanisms of their spread at different geographical scales. This is possible through the study of genetic structure, and inter- and intra-population variability of samples collected from both invaded and native ranges using amplified fragment length polymorphism (AFLP) markers.

We employed a biogeographical approach and studied populations at three geographical scales: (i) continental – we analysed samples from sixteen European countries covering most of the species' secondary distribution range in this continent; (ii) regional – we sampled at least twenty populations in regions of three countries with contrasting climates (Czech Republic, Great Britain and Switzerland); and (iii) local – we analysed samples from one river system in Great Britain. Differences in population structure and possible invasion scenarios will be discussed in the presentation.

CLIMATE CHANGE AND ALIEN PLANT INVASIONS: PREDICTING FUTURE IMPACTS TO BIODIVERSITY

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Changes to the Earth's biosphere pose a major threat to the conservation of native biodiversity worldwide. The decline of biodiversity can be largely attributed to the anthropogenic processes of habitat destruction, accelerated introduction of alien species, and increased carbon emissions leading to global warming. However, the interaction of these processes is likely to pose a greater threat than each in isolation. This research assesses the synergism between predicted changes in global climate and the distribution of some of Australia's worst environmental weeds. Several bioclimatic modeling approaches and emission scenarios were used to project species distributions and the output statistically evaluated (ROC and κ statistics) to determine the model most appropriate for making future projections. The output of these modeling exercises was coupled to a geographic information system (Arc View 9.1) to overlay soil types and protected areas. Alien species exhibited three patterns of future range (i) expansions, (ii) contractions, and (iii) stability. Using these results predictions were then made about the possible future impacts on biodiversity. For example, many of those alien plant species that exhibited range contractions, became concentrated at high elevations in the alpine regions of Australia, and represent a potential further threat to alpine species already considered at risk form the direct impacts of warming on snow cover . The results provide a framework for assessing the combined impacts of global warming and pest species on biodiversity and identify those species and regions where proactive management of pests is most needed.

CLIMATE CHANGE AND PLANT INVASIONS: MECHANISMS VERSUS MODELS

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A frequent assertion is that climate change will exacerbate the environmental problems arising from invasive plant species. The premise is that within a particular region climate change may: a) increase its suitability to new introductions; b) facilitate the spread of established aliens; and c) increase the vulnerability of ecosystems to invasion. Much of the evidence for these future trends arises from the outputs of bioclimatic models that use current climate associations to predict the future distributions of taxa. Nevertheless, the impact of climate must be viewed across the entire process of invasion including probabilities of introduction, likelihood of establishment, rates of spread and likely outcome of competition with native species. This approach is followed for the alien flora in the United Kingdom and integrates predicted horticultural trends, bioclimatic associations, demographic responses to climate variables and impact scenarios for selected ecosystems. The results illustrate that climate is but one factor shaping the composition and distribution of alien plants in the UK and that while certain species may benefit from climate change others are likely to be less responsive or even decline. Plant responses will also be shaped by propagule pressure and residence time. Mechanistic studies highlight the importance of climate variability as well as the non-linear relationships between climate variables and plant performance. Ecosystems that appear the most robust under climate change scenarios are often already impacted heavily by alien species. The results emphasise the danger in oversimplifying climate change impacts on aliens species and highlight useful avenues for further research.

USING THE WEED SEED WIZARD TO UNDERSTAND AND MANAGE THE WEED SEEDBANK

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Are you waging war with weeds? You may think that you are, but your worst enemy is often the bank of long-lived seeds lying hidden beneath the soil. It may seem that no matter how many weeds are killed, there are always more seeds ready to spring to life. To win the war against weeds often requires a long-term campaign to deal with this persistent seed bank.

The "Weed Seed Wizard" is a simulation model being developed to help co-ordinate management of weed seed within the seedbank. The model uses records of management actions and weather, and simulation of important aspects of seed and plant biology, to track and predict the number, ages, soil depth, dormancy levels, viability and germination of seeds in the soil and thus the amount of weeds appearing each year. Two versions of the model are being created: a relatively simple and user-friendly version for providing decision and management support via the web; and a 'research' version, incorporating more detailed representations of soil, seeds and biological processes, for integrating current understanding of the underlying seedbank dynamics and exploring these dynamics in more detail. In this paper, we explain the structure of the model and show how it can simulate the effect of various management decisions on weed germination, weed density, and the long-term sustainability of the natural system. We also show how the seed dormancy characteristics, germination requirements and competitiveness of different weed species or populations can strongly affect the dynamics of the system, and thus the choice of an appropriate management strategy.

UNDERSTANDING TARGET WEED POPULATION DYNAMICS CAN IMPROVE OUR ABILITY TO SELECT EFFECTIVE AGENTS AGAINST WEEDS

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Understanding the population dynamics of a weed and the role of environmental factors in influencing these dynamics can help prioritize insect and pathogen guilds based on their likely efficacy in controlling target weeds. In order to be effective, an agent needs to inflict sufficient damage, on appropriate organs or lifestages, and do so in a timely manner. Modeling the population dynamics of a weed can indicate the likelihood of agents from different guilds being able to inflict these desirable damage patterns under the range of environmental conditions that are likely to be encountered in the introduced range. The most desirable agents are those that, when released from their own natural enemies, would act upon the plant population in the manner that most dramatically reduces the problems caused by the weed – characteristics that will vary from weed to weed. The characteristics of the most desirable agents can then be used to influence the suite of agents that are specifically targeted for searching, and to help prioritize them for importation and host-specificity testing. If agent establishment follows the lottery model, then prioritizing agents that, should they establish, are most likely to be effective should improve our overall success rate in controlling weeds, as well as reducing the number of agents released and their concomitant costs and risks of non-target effects.

HABITAT HETEROGENEITY OR AFRICAN MONOCULTURE? MODELLING THE RISKS ASSOCIATED WITH PARA GRASS INVASION IN A TROPICAL WETLAND IN NORTHERN AUSTRALIA.

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Plant invasions are recognized as a key threatening process worldwide. Despite its isolation Australia contains almost as many exotic plants as natives and many have gone on to become invasive. In tropical northern Australia, African grasses, introduced as pasture species, feature prominently in lists of environmental weeds. In this study we documented the impact that an invasive, exotic pasture species, *Urochloa mutica* para grass, is having on the wetlands of the Mary River, Northern Australia. Prior to this study, our understanding the extent of para grass invasion, the impact on wetland biota and the factors controlling the invasion process were poorly understood. The limited evidence available prior to the study suggested that para grass may have been transforming areas of tropical wetlands from a complex spatial and temporal mosaic into a monoculture. We used spatial technologies (GIS & remote sensing) and field surveys of wetland flora to examine habitat association para grass distribution and a number of landscape variables (e.g. inundation duration, depth, soils, vegetation). The habitat suitability models derived were used to create simple, spatially explicit models of para grass spread. These models allowed us to identify wetland habitats at high risk of para grass invasion; some of these threatened habitats were of key biodiversity conservation significance. The information derived from these models enabled us to identify and prioritise habitat conservation and weed management priorities in the Mary River wetlands, recognised nationally as having high biodiversity conservation significance. The analytical approach developed also addresses a key element in weed risk assessment – potential distribution modelling – acknowledged as a knowledge gap in weed risk management across Australia.

COMBINING RESEARCH ON THE MECHANISMS OF WEED INVASION AND AUTOGENIC WEED RESISTANCE

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Building weed-resistant plant communities must take into account the various mechanisms used by weeds to invade. Single-species plantings have been particularly effective to stem the spread of invasive annual grasses. However, the current threat of invasive forb species in the western U.S. necessitates identifying species mixtures that effectively resist invasion by both annual grasses and broad-leafed invasive forb species. Thus, two primary lines of research are needed if remediation of degraded ecosystems are to be weed resistant: 1) identify the mechanisms used by individual weed species to invade ecosystems and 2) identify the best plant materials that counterbalance invasive weed mechanisms. My talk highlights a research program focused on these two primary lines of research. Emphasis is given to the differential traits and mechanisms used by invasive weeds and promising integrated weed management techniques to promote autogenic weed resistance of ecosystems. I highlight a recently completed study evaluating the effectiveness of single- and multi-species plantings of grasses, forbs, and shrubs to resist invasion of the annual grass (Bromus tectorum L.) and the invasive forb (Isatis tinctoria L.). Seeds of both invasive species were introduced into plots in autumn 2004 and 2005, and seedling density was quantified in the following two summers. B. tectorum invasion was lowest in plots containing grass species. Conversely, I. tinctoria invasion was lowest in the four-species forb mix and highest in the single-species forb plot. Disturbance consistently increased invasive species density. Significant positive relationships were found between weed invasion and aboveground light and soil nitrate within plots. The grass-forb-shrub mix presented the greatest barrier to invasion possibly through the inclusion of species that acquired resources similarly to weeds.

INVASION DYNAMICS AND MANAGEMENT OF THE INVASIVE TREE CASUARINA EQUISETIFOLIA IN THE ATOLL OF MORUROA (FRENCH POLYNESIA), A FORMER NUCLEAR TEST SITE IN THE SOUTH PACIFIC

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Human disturbances are recognized as a major triggering factor for invasion of native habitats by pioneer or early successional species. The coral atoll of Moruroa (21°50'S lat., 138°55'W long.) located in the Tuamotu archipelago (French Polynesia, South Pacific), a site of extensive nuclear testing by France and of massive settlement (more than 2,500 people on a 3 sq. km land surface) between 1966 and 1996, provides a striking example of extreme disturbance in an island ecosystem.

Ironwood tree *Casuarina equisetifolia* (Casuarinaceae), a salt-resistant, drought-tolerant and nitrogen fixing tree, first introduced to the atoll in 1966 as an ornamental and a shade tree, appeared invasive in 1994 and is now a major concern for the French Army, especially for the maintenance of the road, the airstrip and the radiological monitoring installations. Recent field-surveys conducted in 2005 and 2007 reveal that more than half of the atoll is now covered by dense monospecific stands of C. equisetifolia (ca. 150 ha). Ironwood density in six 100 sq.m quadrats ranges between 90 (trees up to 12 cm in dbh) and 290 stems/sq.m (75% of the trees less than 4 cm in dbh). Larger trees (up to 20 m tall and more than 30 cm in dbh) found along the main road might be those originally planted in the 1960's and 70's. The main cause of massive ironwood invasion is probably a combination of the complete destruction of the native vegetation and soil sterilization during the atmospheric tests between 1966 and 1975 followed by severe anthropogenic disturbances caused by the demolition and cleanup of all the infrastructures and equipments in 1996. Ironwood is known as an aggressive invader in open or disturbed areas and poor soils, e.g. in human-modified coastal habitats in the Everglades in Florida, in phosphate-mined areas on the raised atoll of Nauru, or on young lava flows in La Réunion Island. Different control methods (chemical treatments with glyphosate applied on cut stumps and frilled trunks, fire, sea-water inundation) are being tested in collaboration with the French Army. A rehabilitation project of the atoll by planting native plants in the treated areas was recommended.

THE MANAGEMENT OF INTRODUCED WILDING CONIFERS IN NEW ZEALAND

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The natural regeneration of introduced conifers, or wilding spread, is causing concern in many parts of New Zealand, particularly in the dry eastern hill and high country of the South Island. The Department of Conservation, the largest New Zealand land manager, currently spends around NZ$14 m annually on weed eradication, of which about 25% is spent on controlling wildings. The major species involved are Lodgepole or contorta pine (*Pinus contorta*), Scots pine (*P. sylvestris*), Corsican pine (*P. nigra*), dwarf mountain pine (*P. mugo*), radiata pine (*P. radiata*), ponderosa pine (*P. ponderosa*), Maritime pine (*P. pinaster)*, European larch (*Larix decidua*) and Douglas-fir (*Pseudotsuga menziesii*). Most control is unintentional, in the form of browse by wild and domestic animals. Deliberate control is mainly via physical means, by hand pulling of small seedlings and stem cutting using hand tools, chainsaws and scrubcutters. Where wildings are dense and accessible, machinery (bulldozers, diggers, tractor-driven mulchers) have been cost-effectively employed. Chemicals applied by foliar application have been effective when sprayed from the ground, but much less so when aerially applied. Stem poisoning is often used (and successful) for scattered larger trees, especially those growing amongst native shrubland where felling creates light wells and promotes new wilding recruitment. Fire is not favoured, due to consent and logistical requirements, plus loss of non-target species. Removal case studies and costs are used as examples of operational control in practice.

THE IMPACT OF AILANTHUS ALTISSIMA ON THE FLORISTIC DIVERSITY AND NEW PROTOCOL OF ERADICATION

Eric Motard

The Tree of Heaven, *Ailanthus altissima* (Mill.) Swingle is an exotic invading plant originated from China. Its allelopathic ability has been proved by ex situ experiments. The aim of our study was to explore its in situ impact on the floristic diversity of forest stands. For that purpose, we compared floristic inventories performed around trees of different species, in sites invaded or not by *Ailanthus altissima*, in a forest near Paris: the Fontainebleau forest (Seine-et-Marne, France).

The results showed that the neighbourhoods of ailanthus harboured significantly less species and lower rate of indigenous species in comparison to other tree species.

In the same way, a negative correlation was obtained between the number of ailanthus suckers growing in the forest stands and their floristic diversity.

This study showed how destructive is the *Ailanthus altissima* on the biodiversity of natural areas and how urgent it is to take the best actions to eradicate this species from the more sensitive sites.

And besides we are currently developing a new protocol of eradication, easy to use in forests, presenting a minimal risk for the ecosystem. We are testing the efficiency of infusion of a very specific active substance in the *Ailanthus* trunk, in order to kill at the same time the seed-bearers and their suckers around.

PSIDIUM CATTLEIANUM: ECOLOGY & IMPACTS OF AN INVASIVE TROPICAL TREE

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Psidium cattleianum Sabine (strawberry guava) is a small tree introduced to Hawaii in 1825 from Brazil and considered one of the state's most disruptive alien weeds. On all the major Hawaiian islands as well as on many other tropical islands in the Pacific and Indian Oceans, nearly monotypic stands of this species infest thousands of hectares of mesic and wet forest. It is a serious threat to native forest ecosystems due to its ability to invade even relatively undisturbed wet forests and form thickets up to 10 m high with dense mats of feeder roots. On Hawaii Island, *P. cattleianum* infestation impedes *Acacia koa* silviculture and, because it is a wild host of economically important fruit flies, limits crops grown by Hawaii farmers. We report on studies of the ecology and economics of strawberry guava on Hawaii Island. In lowland wet forest dominated by *Metrosideros polymorpha* (900 m asl), demographic studies document high rates of population growth through both seedling and sprout recruitment contributing to high local stem densities (>15,000 stems/ha). Density and diversity of native species are inversely correlated with *P. cattleianum* basal area. *P. cattleianum* seed banks are ephemeral (< 6 mo), however, with most seed depletion due to rapid germination and seed predation by rodents. The lack of a persistent seed bank suggests that coupling biological control with chemical and mechanical treatments may be able to reduce impacts in target

WEDNESDAY
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2007 UPDATE ON DEVELOPMENT OF A NATIONAL EARLY DETECTION AND RAPID RESPONSE SYSTEM FOR INVASIVE PLANTS IN THE UNITED STATES OF AMERICA

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To minimize the establishment and spread of new non-native invasive plants in the United States, a cooperative interagency effort is being made to develop a National Early Detection and Rapid Response System (EDRR) for Invasive Plants. To achieve this goal, a coordinated framework of new and established public and private partner groups is being organized at the local, state, regional, and national levels to: detect and report suspected new plants to appropriate officials (agency field personnel and trained volunteers); identify and voucher submitted specimens (designated botanists); verify reported new plant records as correctly identified and potentially invasive taxa (state interagency weed teams and FICMNEW); archive new records in designated regional and national plant databases [e.g., the Invasive Plant Atlas of New England (IPANE), and the USDA Plants Database]; rapidly assess confirmed new records (federal and state weed scientists); and rapidly respond to confirmed new invaders (impacted land owners/managers, cooperative weed management areas, and task forces). In 2003, Phase One of the project, a Conceptual Design Plan for the proposed system, was developed and published. In Phase Two of the project, the USGS and IPC are cooperating with a number of state and regional groups to develop and field test the components of the system. Work is also proceeding to develop an online EDRR Information System, a training program for volunteers, and a rapid assessment process. Once implemented nationwide, the system will provide an important second line of defense against invasive plants, and will complement federal efforts to prevent new introductions of potential foreign invaders at U.S. ports of entry. With both exclusion and EDRR systems in place, the nation will be better able to defend against future economic and environmental losses due to 'plants out of place'.

TACKLING CONTENTIOUS INVASIVE SPECIES

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Some naturalised plants are both highly valued and highly invasive. This is the case with a number of perennial grasses that were deliberately introduced to Australia as pasture species. Examples from northern Australia include hymenachne (*Hymenachne amplexicaulis*), para grass (*Urochloa mutica*), gamba grass (*Andropogon gayanus*) and buffel grass (*Cenchrus ciliaris*). The latter is the most widely cultivated pasture species in arid and semi-arid northern Australia and highly regarded by many pastoralists. In many situations it greatly increases pasture productivity for cattle. However, it is also widely regarded as having negative environmental impacts through competition with native species and changes to ecosystem function.

There are major technical challenges to managing the impacts of aggressively invasive alien species that are widespread and abundant. It is difficult to devise cost-effective management techniques for them. However, in the case of contentious species, there is also the need to resolve conflicting interests. This must involve not simply devising management techniques but overcoming socio-economic barriers.

We argue that solutions to problems involving contentious species, like buffel grass, require a comprehensive assessment of the economic, environmental and social costs and benefits of the species. Assessment should be made across organisational scales. The perspectives of people operating at the level of the individual enterprise or management unit will be important because they are the ones who will be most directly confronted by attempts to change management practices and so maximise the overall benefit:cost ratio. Perspectives at industry, institutional and regional scales are also important because they will be affected by the ways in which managers of enterprises and other management units deal with the problem locally and because of their roles in formulating and implementing policy.

Perspectives on buffel grass are extremely diverse and it is not a simple scenario in which the species is “good” for pastoralism and “bad” for the environment. Furthermore, economic, environmental and social costs and benefits and perspectives on the species appear to vary geographically across its extensive range in Australian rangelands. Therefore, priorities are to (i) document the environmental, social and economic costs and benefits of buffel grass and its management in representative regions of northern Australia; (ii) capture the perceptions, attitudes and values of organisational and individual stake-holders, including their views on appropriate costs and benefits, objectives, strategies and management methods; and (iii) identify the potential for change to maximise overall benefit:cost ratios, including economic, environmental and social considerations. We believe such an approach will facilitate progress toward more co-operative action at all levels to gain some of the benefits of using this species but minimise its deleterious impacts.

MUTUALISMS – KEY DRIVERS OF INVASIONS….. KEY CASUALTIES OF INVASIONS

David M. Richardson, Anna Traveset

Symbiotic relationships between plants and other organisms are hugely important mediators of invasion success for introduced plants. Seed dispersal and pollination by animal agents and relationships between plants and micro organisms in the soil often determines whether a species will invade, and/or the extent to which it will spread in a new environment. Recent research has established a framework for understanding the roles of mutualisms in invasions, and there has been an explosion of research in this area. Biological invasions also have a profound effect on naturally occurring mutualisms in many ecosystems. Some such impacts are widely known, but the mechanisms that produce such impacts are poorly understood. Many types of invasive species have huge potential to alter evolutionary trajectories by causing many types of changes to prevailing mutualisms. This introduces a new layer of complexity to programmes aiming to reduce or mitigate the effects of biological invasions. These findings have important implications outside the field of invasion ecology, for understanding the importance of mutualistic interactions in population dynamics. This paper reviews developments and challenges in these areas.

REGIONAL DIFFERENCES IN HABITAT INVASIBILITY – A CASE STUDY FROM DENMARK

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Habitat invasibility has been studied for many alien plant species in all major biomes, and key factors favouring plant invasion have been identified. However, the relative importance of these factors may change depending on regional differences in climate and land use. Here we present a case study based on 2343 sites along a 300 km long W–E transect across Denmark.

The field investigations were carried out as part of environmental impact assessments for planned motorways and related projects. Comprehensive lists of all vascular plant species were collected in natural forests, plantations, fens, bogs, heathlands, meadows, dunes, rivers and lakes. Presence-absence data of 17 invasive alien species were related to species diversity, habitat size and habitat isolation, distance to transport corridors, land use at a landscape scale and climate.

The resulting multivariate models were compared for four regions along the transect. In SW Denmark dry habitats were found to be more invasible than other habitat types. Contrasting the forests of central Denmark were the most invaded habitats in this region. In all regions wetlands were relatively less invaded as regards the number of invasive species. In W Denmark invasive species with tolerance to nutrient-poor acidic soil types prevailed, and generally the highest number of invasive species was recorded in urban areas. The most abundant invasive plants species in Denmark was Rosa rugosa. The results are discussed with respect to priorities for control of invasive plants.

HOW MANY WEEDS ARE THERE?

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Before publication of the landmark A Geographical Atlas of World Weeds in 1979 (Holm et al.), no one had any real idea how many weeds there were in the world. Indeed the Atlas provided us with the first real census of the worlds weed flora documenting 6,391 species names including synonyms.

The release Randall's A Global Compendium of Weeds in 2002 considerably increased this number documenting 20,672 weedy taxa including 2,526 synonyms from just under 300 references. However the work in compiling these names has continued unabated and the database that underlies the original publication now contains 29,259 weedy taxa, including 4,803 synonyms, from 902 references. The database contains 144,962 individually referenced weed records and comprises the largest dataset of weed related information in the world.

While this is a significant increase in numbers it does represent a slow down in the discovery of new weeds over the last five years. The Compendium documented nearly 21,000 names in six years from less than 300 references, while an increase of nearly 9,000 names from an extra 600 references over a similar time frame does indicate a drop in the discovery rate. By far the vast majority of weed references added to the database, post compendium, were for species already documented by early 2002.

Of the 29,259 weedy taxa, the most referenced species is Sorghum halepense (L.) Pers. which has 197 weed references. The weediest 1%, based on the number of weed references, comprises 293 species with 57 or more references, while the weediest 10% comprises 2,926 species with 11 or more references. At the other end of the spectrum, those with just one weed record, or 14,194, species, comprises 48.5% of the database. That's a lot of plants that seem to have little or no real significance as weeds.

The top five weedy families in the Compendium database hold no real surprises and are probably more a reflection of the size of, and variation within, these families rather than any inherent tendency to weediness on their part.

Table 1. The top five weedy Families - February 2007

Family	Weedy Genera	Weedy species	Weed Records
Asteraceae	546	3575	18305
Poaceae	382	3136	19792
Leguminosae - Papilionaceae	193	1770	8869
Brassicaceae	137	858	5801
Apiaceae	120	492	2510

Discovery will continue of course but most "new" weeds are unlikely to be serious or significant players on the global stage.

References

Holm, L.G., Pancho, J.V., Herberger, J.P. and Plucknett, D.L. (1979). A Geographical Atlas of World Weeds. John Wiley and Sons NewYork, USA.

Randall, R.P. (2002) A Global Compendium of Weeds. R.G. and F.J. Richardson, Melbourne.

HOW ARE WEEDS SPREADING WITHIN AUSTRALIA?

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There has been considerable effort to elucidate the means by which weeds and potential weeds enter Australia and to assess the risks associated with importation of plants, but no comprehensive studies have been undertaken to ascertain the way that weeds spread once present within Australia or to assess the relative threats or risks (likelihood and potential magnitude) of different sources and pathways due to species, quantity of propagules, distance, and sensitivity of the invaded environment. For example, while many environmental and agricultural weeds were ornamentals that 'jumped the garden fence', the means by which they jump the fence and then move from one area to another is not well understood. We presume we know but this has not been documented. Most recently naturalised taxa are still only locally distributed, and so it is critical to identify the primary pathways for the spread of these, as well as more widespread weeds, so as to be able to prevent movement to un-infested areas. In this project the following research questions are being addressed. How do weed propagules spread within Australia? Which sources and pathways account for the majority of weed ingress? Which sources and pathways currently pose the greatest risks? In what ways are the risks changing with changing environmental conditions and local trade and other patterns of movement? How can current and emerging risks be managed? On what potential sources and pathways do we have insufficient information to identify their importance or to design management strategies? Two approaches are being taken to answer these questions - analysis of past and existing research through collation and review of the scientific and other literature, and a survey of scientific experts with expert group risk analysis. The results of the literature review only are reported here.

OPTIMISING SURVEILLANCE FOR INVASIVE PLANTS USING AN INTEGRATED LANDSCAPE MODELLING TOOL

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Consider the scenario of a newly detected weed incursion that has been targeted for eradication. It becomes necessary to implement a surveillance strategy to identify extent and monitor possible spread of the incursion. Current surveillance strategies are ad hoc, involving intensive survey in the vicinity of the known infestation, with sporadic efforts at greater distance. Surveillance efforts are invariably expensive and resource limited, so efforts that maximise the chance of detection are preferred.

A novel approach to this problem is to simulate the various dispersal and life-history mechanisms that influence incursion spread and establishment, and concentrate surveillance efforts in areas most susceptible to invasion. The approach may improve efficiency, reduce resource wastage, and improve the success of management actions such as eradication.

The approach is comprised of two components: development of an integrated landscape modelling tool for predicting areas susceptible to invasion, and the development of surveillance strategies that maximise chances of detection. A GIS based decision support tool has been developed for simulating a variety of dispersal syndromes and life histories, and for optimising surveillance. Elements of the decision support tool will be described, and application to case study data demonstrated. It is intended that the tool be disseminated amongst weed managers to guide surveillance efforts.

THE VICTORIAN WEED ALERT PROGRAM

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The Victorian Government has developed a Weed Alert program to prevent the introduction of serious new weeds to Victoria and eradicate the most important incursions that have naturalised. The program is based on a comprehensive early warning, surveillance and rapid response approach.

The introduction of new weeds from overseas and other states is an increasing threat with globalisation, technology and climate change. The Weed Alert program recently determined species that pose the highest threat to the State's important assets and values should they be introduced. Understanding the capacity of each species to naturalise in Victoria and their impact should this occur is a fundamental early warning tool of the program.

Weed Alert focuses its surveillance on two important weed categories, Victorian Alert Weeds and State Prohibited Weeds. Victorian Alert Weeds have not been declared and are believed to be either not be in Victoria to-date or here in low numbers. From the 40,000 potential weeds worldwide, these are the priority 410 thought to pose the highest threat. By contrast State Prohibited Weeds are declared under the Catchment and Land Protection Act (1994). The government has a legislative responsibility to treat these species for eradication wherever they occur.

Weed Alert's rapid response measures are described in an updated Weed Alert Rapid Response plan. The Weed Alert program is now fully operational and provides an example for national and international government agencies.

This paper will provide an overview of Weed Alert's early warning, surveillance and rapid response measures and discuss some of the challenges experienced.

DETERMINING VICTORIAN ALERT WEEDS

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Victorian Alert Weeds (VAW) are potential weeds of the future that may pose a serious threat to Victoria's agricultural and natural assets or affect human health. Some of these weeds are thought to have already naturalised in small numbers, although still eradicable from the State, while others have not yet reached Victoria but could present a major threat if they were to arrive.

The process of defining VAW consists of a number of steps. The Weed Alert team trawls for candidates in literature, followed by a rapid prioritisation process to determine the weeds' history, recorded distribution and potential threat. The weed is then placed in a threat matrix to gauge its priority. Species that are not deemed to be a priority are discarded. The list is then arranged according to priority and submitted for a detailed Weed Risk Assessment.

Weed Risk Assessments comprise of assessing the invasiveness, distribution and impacts of each species in an attempt to objectively determine their importance through a numerical ranking.

The Weed Risk Assessment team then submits a report to the Weed Alert panel. The panel continually adds and deletes species as new information becomes available on a weed's biology, ecology, invasibility and threat – a weed may move up or down the priorities based on this information. The Weed Alert panel uses the Weed Risk Assessments results to rank each species for an appropriate response.

Further research will be undertaken to investigate groups of weeds that are problematic, for example, families or genera. The limitations of the process will be discussed.

MAJOR GOALS FOR AN INTERNATIONAL EARLY DETECTION AND RAPID RESPONSE (EDRR) WORKING GROUP UNDER THE IUCN INVASIVE SPECIES SPECIALIST GROUP.

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In order to help promote early detection and rapid response (EDRR) as the preferred management strategy for addressing new and emerging invasive alien species - around the world – an International EDRR Working Group is being established under the IUCN Invasive Species Specialist Group (ISSG). Initially, the ISSG EDRR Working Group, which will be comprised of EDRR specialists from different regions of the world, will focus on a number of high priority goals. These will include development of interagency invasive species partnerships at the local, state/provincial, regional, national, and international levels; state/provincial and national EDRR systems for early detection, reporting, identification, rapid assessment, and rapid response to new incursions of invasive species; a Global Invasive Species EDRR Listserve for posting invasive species alerts; a Global E-Commerce Monitoring System (for tracking internet sales and trading of IAS), as well as a new biological protection ethic on the use and global spread of exotic species.

MORPHOLOGIC AND VEGETATION CHANGES ASSOCIATED WITH AMMOPHILA ARENARIA INVASION & ERADICATION, DOUGHBOY BAY, STEWART ISLAND

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The program to eradicate *Ammophila arenaria* (marram grass) from the three active dune systems of Doughboy Bay, Rakiura National Park, Stewart Island (southern New Zealand), is thought to be the largest restoration project of its kind. The present paper examines changes in the morphology and vegetation of the coastal dunes following Ammophila invasion (1950-1999) and eradication and dune restoration (1999-2006).

Ammophila invasion of the southern dunes occurred rapidly, during a phase of post-storm barrier progradation. Ammophila subsequently established a dense, uniform vegetation cover in conjunction with the formation of a series of type one foredune ridges, as the barrier prograded (1958-2000). The parabolic dunes that were characteristic of the pre-Ammophila barrier are still evident. A remnant, moribund population of the indigenous primary sand binder, *Desmoschoenus spiralis* (pikao), occurs along the back of the barrier, but very few specimens occurred within the Ammophila zone prior to commencement of the restoration programme. Ammophila colonisation also forced the southern dunes to expand northwards, by colonizing the northern margins of the southern dune. This area was almost certainly too exposed for Desmoschoenus prior to the arrival of Ammophila.

The Department of Conservation commenced the restoration programme in 1999. Initial applications of herbicide (Gallant®NF) by helicopter resulted in approximately 70 percent necrosis of leaf material in year 1. Significant re-growth occurred in year 2, particularly along the foredune. Helicopter operations in year 2, and ground operations in years 3 and 4 (using an all-terrain vehicle), have virtually eliminated Ammophila, although the re-establishment of plants from seed is still occurring (five years after the last flowers were produced).

The overall morphology of the southern barrier has not changed rapidly following Ammophila necrosis. Sedimentation has been retarded by in-situ marram rhizome, which is resilient to decay and abrasion. The foredune-ridge topography associated with Ammophila is slowly decaying, as minor blowouts and shadow dunes develop. These shadow dunes have formed around Desmoschoenus planted in 2001, 2002 and 2003, other species and patches of marram rhizome. The northern third of the barrier, which is experiencing high rates of sedimentation, is eroding rapidly. In general, the barrier is returning to its pre-Ammophila morphology and vegetation cover.

The diversity and cover of indigenous and exotic plants have been monitored annually since 1998 using permanent quadrats and transects. Prior to the commencement of the restoration programme species diversity within the Ammophila zone was high. Many of these species, however, are not usually associated with active dune systems in southern New Zealand. Ammophila stabilized the substrate, which allowed the establishment of a range of opportunistic exotic and indigenous species. Ammophila necrosis has resulted in higher rates of sedimentation and burial, particularly since 2002. This has favoured the reestablishment of specialist dune species as overall species diversity has declined.

REPLACING TAMARIX CHINENSIS (SALTCEDAR) COMMUNITIES WITH DESIRED RIPARIAN HABITAT ALONG THE RIO GRANDE AND PECOS RIVERS IN SOUTHWESTEN UNITED STATES

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Tamarix chinensis (saltcedar) was introduced into the United States in the late 1800's as an ornamental and conservation tree. With time it replaced native riparian trees leaving near monotypic stands along an estimated 600,000 ha of western North America waterways. In New Mexico and west Texas, the Rio Grande and Pecos are the largest river basins that flow through hot, dry, semi-arid landscapes to the Gulf of Mexico. Large scale ecosystem restoration programs initiated in 1987 on the Rio Grande and in 1996 on the Pecos have focused on replacement of saltcedar communities with desired riparian habitat. Woodland, shrub, meadow and marsh communities are sought as replacement habitats and their establishment is primarily dictated by hydrologic and soil driven processes. Literature indicates riparian communities as highly dynamic and subject to localized environmental conditions that influence their development. During an initial management phase utilizing state-of-the-art aerial application of herbicide, fire and mechanical treatments nearly 60-70% of saltcedar on the Pecos and about 25% on the Rio Grande has been removed. Restoration work following saltcedar control is now actively being undertaken by several governmental entities and private interests. Progress on these projects was surveyed in 2006 and 2007 and this paper reviews a wide array of adaptive strategies being employed to minimize saltcedar and other invasive plants from reestablishing in recovered areas.

ESTABLISHING MONITORING PROTOCOLS TO ASSESS THE RECOVERY OF NATIVE SPECIES FOLLOWING WIDESPREAD ALIEN PLANT CONTROL

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Invasive alien plants are acknowledged as a major threat to biodiversity, but few native species have been definitively identified as being at risk. As a result, management strategies do not adequately target the recovery of such species, or undertake effective monitoring to assess their recovery after control. For example, an informal survey of over 50 alien plant control practitioners revealed that few had monitoring programs that could report on the known species at risk, nor were the results in a format that enabled a ready comparison between programs. Underlying this problem was that many control and monitoring programs did not have clearly defined objectives, which in turn led to the premature abandonment of many monitoring programs.

To address these problems, monitoring protocols were developed as part of a statewide plan to limit the impacts of the alien plant Chrysanthemoides monilifera (DC.) T. Norl. on native biota in New South Wales, Australia. This plan encompasses 350 sites managed by different stakeholders across multiple land-tenures. The same monitoring protocol could not be implemented at every site because of differences in the occurrence of priority native species, their population density, and the resources and skills of site managers. A monitoring system was therefore required that could address these problems. The guidelines developed contain 3 tiers of complexity, with techniques ranging from simple qualitative assessments to robust research studies, with site managers adopting the tier most suitable to their desired outcomes. Using these protocols, monitoring is being undertaken at over 50 sites. The benefit of this approach is that it allows the results from each site to be centrally compiled and analysed across all sites. This approach is now being adopted for other major alien plants threatening biodiversity in Australia.

WOADY YALOAK RIVER COMMUNITY PROJECT - A CASE STUDY IN THE DEVELOPMENT OF SUCCESSFUL PARTNERSHIPS IN THE DELIVERY OF COMMUNITY EDUCATION IN WEED CONTROL

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The development of effective partnerships between the community led Gorse Task Force (GTF), Department of Primary Industries (DPI) , Department of Sustainability and Environment (DSE), Corangamite Catchment Management Authority (CCMA), Golden Plains Shire (GPS) , Woady Yaloak Catchment Project (WYCP) and local landcare groups have provided the opportunity for private landholders to actively participate in an on ground weed control project. These stakeholders have worked collaboratively to influence landholders to implement integrated weed control programs on their private property through the provision of education, funding incentives and compliance activities.

The Woady Yaloak project area was originally established in 2003 in consultation with the GTF, CCMA, DPI and WYCP. The community and the CCMA identified the Woady Yaloak River catchment as an area of rising concern due to the spread of woody weeds and the low level of private landholder commitment to pest plant control.

Over the past four years a GTF funded facilitator employed by DPI has provided private landholders with one on one extension. This model of community education which incorporated a 50% cost share for on ground works has focused on building the capacity of all land managers to simultaneously control pest plant infestations and re-establish native vegetation along a 30km continuous frontage of the Woady Yaloak River. 95% of landholders within the project area have voluntarily undertaken long term gorse control, and through the provision of DPI legislative compliance support all landholders are acting to prevent the spread of noxious woody weeds.

This paper highlights the achievements of the project, it illustrates how an effective community education program, with the support of DPI compliance can significantly increased the communities' capacity to understand and implement integrated weed control.

COLLABORATIVE APPROACHES TO INVASIVE PLANT MANAGEMENT: THE INVASIVE PLANT COUNCIL OF BRITISH COLUMBIA, CANADA

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The Invasive Plant Council of British Columbia (IPCBC), is proof that collaborative approaches to invasive plant management are highly effective and efficient. With a mandate to facilitate province-wide coordination for invasive plant management, this non-government organization works by consensus to influence change. All members— individuals, organizations, agencies and businesses— have committed to increased cooperation as signatories to the Council's Memorandum of Support. Through this increased collaboration, natural resource managers and community volunteers undertake more effective and efficient on-the-ground operational work.

A key strength of the IPCBC is its inclusive membership representing all perspectives involved in invasive plant management in British Columbia (BC). The Board includes directors from all four orders of Canadian government (federal, provincial, local and first nation), regional committees, resource sector (forestry, mining, agriculture, horticulture), non-profits (conservation and wildlife, recreation and tourism), and private sector (utilities, transportation).

The IPCBC complements the work of key partners and collaborators, most notably the network of regional invasive plant committees. Over 20 committees bring together local practitioners to build consensus on key local invasive plants and management approaches. Each committee is uniquely designed to deliver tasks ranging from public education, field trips to performing on the ground management. Along with the IPCBC, all work together on shared needs such as media information, public communication, key research and sound technical knowledge.

Invasive Plant Council of BC provides a successful case study to examine fundamental steps and key components for building successful collaboration for invasive plant management across multiple governance jurisdictions.

AUSTRALIAN PARTHENIUM WEED RESEARCH AIDS MANAGEMENT OF THIS WEED IN THE AGRO-ECOSYSTEMS OF ETHIOPIA AND PAKISTAN

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Parthenium weed (*Parthenium hysterophorus* L.) has been present in Australia for about 50 years, in which time it has spread from isolated infestations to establish core populations in central Queensland with scattered and isolated plants occurring south into New South Wales and north-west into the Northern Territory. Its main effect is upon livestock production, but it is also causing health concerns in regional communities. To help coordinate actions on its management, a National Weeds Program has created a Parthenium Weed Management Group (PWMG) and under this group has formed a Parthenium Weed Research Group (PWRG). Funding coming from this national program and other sources has supported the PWRG group to undertake a collaborative and technology exchange research program in the areas of biology, ecology and management, while the PWMG has focused on community awareness and the production of various extension and management packages. PWRG studies have been undertaken in two main areas: 1) biology and ecology and 2) management. Research in the area of biology and ecology has included studies on the evaluation of competitive plants to displace parthenium weed, the use of process-based simulation models to monitor and predict future spread and abundance under present and future climate conditions, the effect of the weed on human health and the ecology of its seed-bank. Management research has centred on the development of biological control approaches using plant-feeding insects and pathogens The effectiveness of biological control is also being monitored through long term studies on seed bank size and dynamics, and fire as another potential management tool, is being evaluated. In addition to this important research, an effort has also been made to spread the most important findings and management outcomes to the wider community through an extension and education program driven by the PWMG. These developments within Australia in parthenium weed management are now being applied to countries such as Ethiopia and Pakistan where their weed managers are preparing for the rapid spread of this weed from already established, widely dispersed populations.

SUPPORTING COMMUNITY LED WEED PROGRAMS WITH COMPLIANCE

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Demand from the community for action on weeds is high. The community weed model employed by groups in Victoria such as the Victorian Serrated Tussock Working Party and Gorse Task Force, has allowed key stakeholders to pool resources and knowledge and work cooperatively and strategically toward controlling weeds. This collaborative approach has proved very effective in encouraging the majority of landowners to participate in weed management. The community have identified that all land owners must participate for projects to be effective. From this comes an expectation that government will provide compliance support to ensure the small percentage of land owners that refuse to meet their obligations for weed control, do not jeopardise the success of these projects. Carrying out compliance projects on a variety of established weeds, in a range of environments across the state and involving key stakeholders such as community groups, presents a number of challenges. This paper looks at the challenges and discusses the use of a mobile compliance approach as an efficient means to support communities tackling weed problems. The approach, utilising a team of specialist compliance staff, has been piloted across Victoria over the last 3 years and has proved to be an effective tool in assisting community groups that are actively working toward control of established weeds.

CONTROLLING LANTANA – THE IMPORTANCE OF INTEGRATED CONTROL

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Lantana is recognised as a Weed of National Significance because it threatens primary production, biodiversity and recreational activities in some of the richest regions of Australia. Efforts to control lantana have had a mixed response, despite the significant number of options available. The variables that influence the effectiveness of lantana control efforts need to be analysed to improve current practices, increase the integration of available options and ensure adequate follow up and competitive species suppress its return.

Climate, season and different phenotype may vary some lantana control efforts, but practices undertaken by land managers are more likely to contribute to the variation of outcomes. Seasonal mis-timing, limited access to infestations, high density and inadequate follow up or insufficient planning are likely to lead to greater mixed results by land managers. An integration of controls is likely to improve the ad hoc approach by many landholders and is desirable to achieving better success in control efforts.

To identify best management practices, a series of trials has been funded by the Australian Government through the Natural Heritage Trust and Defeating the Weeds Menace programs. A methodology to undertake these trials was developed with researchers, local government officers, state agencies, and land managers to determine the trials' methodology using adaptive management principles. Twelve trials sites have now been set-up from far north Queensland to southern New South Wales to measure how various control sequences will provide a range of efficacy and cost-effectiveness, dependent on the local situation.

This paper identifies some of the outcomes achieved to date and highlight the best alternatives that can be used by land managers in similar situations to improve their desired outcomes. The improved information will ultimately influence control of lantana by limiting efforts likely to fail and the resulting waste of resources that ensues.

MANAGEMENT OF JAPANESE AND GIANT KNOTWEED IN AUSTRALIA; AN EXAMPLE OF SUCCESSFUL INTERVENTION AT AN EARLY STAGE OF INVASION

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Nationally and at state level Australia is progressively adopting a biosecurity approach to protecting agriculture, environment, the economy and human health. Victoria is in the process of developing a fully integrated biosecurity system. Principles of this approach include risk-management, prevention, early detection and clearly defined roles, responsibilities and accountabilities. Prevention and early intervention are identified in the Australian Weeds Strategy as the most cost-effective techniques that can be deployed against weeds. Here we use two *Fallopia* species to provide an example of these techniques being applied successfully across public and private land in Victoria and Tasmania .

The tall rhizomatous perennials Japanese knotweed (*Fallopia japonica*) and giant knotweed *(F. sachalinensis)* have both naturalised in many countries outside their native range, after introduction as ornamental or fodder plants. Japanese knotweed in particular is considered an extremely troublesome weed with substantial effects on infrastructure, flooding and riverbank stability, amenity values and biodiversity. Several introductions of these species to Australia have occurred over at least 100 years, but they are rare in gardens and naturalised only on a small scale. An analysis of potential distribution shows that large areas in the southern states of Australia are suitable for establishment of these weeds. A large scale problem may have been avoided so far simply because human activities or flooding did not happen to spread the weeds from the small number of sites where they became abundant.

Australian awareness of the potential threat from these two *Fallopia* species has increased recently and they have been declared as noxious weeds under legislation in three states. Information is now available online and in printed form to encourage early identification and reporting of new occurrences. No further trade in these species is thought to be occurring. The known infestations are small, reasonably accessible and removal of them using excavation and herbicides is being led by state governments, with the aim of eradication. Current progress towards eradication is good and requires only a small a fraction of the resources expended in other countries to control widespread infestations.

PONDED PASTURE SPECIES IN NORTHERN AUSTRALIA: THE COMPLEXITIES OF CONTROL AND MANAGEMENT

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Ponded pasture systems were developed for the benefit of grazing industries, especially beef and dairy cattle in areas of northern Australia, where nutritional problems for cattle occur in the dry season. The successful development and continued use of ponded pasture systems is due to the introduction of palatable grasses, which are highly productive and capable of growing at greater water depths than native pasture species. Three introduced grass species were approved and widely used for ponded pasture systems; these include - Olive Hymenachne (*Hymenachne amplexicaulis*), Para Grass (*Brachiaria mutica*) and to a lesser extent Aleman grass (*Echinochloa polystachya*). These grasses are now regarded as invasive weeds in natural freshwater systems and other waterways such as cane drains in Queensland and Northern Territory.

The issue of controlling introduced pasture grasses is complex due to land tenure, economic, historical and legislative factors which vary between each species. Para grass is a widespread serious weed of shallow wetlands. It has a long history of cultivation and has invaded extensively into significant wetland areas, including iconic areas for conservation such as Kakadu National Park. Para grass is not a declared weed species on either a state or national level, hence any legislative control is determined by local councils. However, it is considered an 'environmental weed' in Queensland, which restricts planting in sensitive wetlands. Active cultivation of para grass is now also illegal. In contrast, Olive Hymenachne and Aleman grass can grow in deeper water than para grass and are actively invading surrounding wetlands and waterways. They were officially approved for pastures by DPI in 1988, although they were introduced and encouraged for planting since the 1970's. Eleven years later (1999) Hymenachne was declared a 'Weed of National Significance' (WONS), implying that it was one of Australia's 20 worst weeds. It is now prohibited for import into Australia and declared a class 2 pest weed in Queensland and Northern Territory. This means that landholders must make a reasonable attempt to keep their land free of H. amplexicaulis. Aleman grass is classified as a potential environmental weed; it cannot be planted in sensitive wetlands and can no longer be cultivated. However, there is no state or national legislation forcing removal or control.

The rapid spread of these introduced ponded pasture species and perceived benefits has made control of these weeds difficult. Landholders are reluctant to spend resources controlling or removing these species, even if required, as they were previously encouraged to cultivate them. Weed officers are also reluctant to enforce landholders to remove or control ponded pasture species (even if legislated) for the same reasons. Therefore, control of waterways surrounding infested private land is difficult to achieve, both from a socio-economic viewpoint but also from a biological viewpoint. Significant resources are required to access remote sites, and ongoing control is needed, hence some weed managers and landholders view this as futile particularly when sites are continually reinfested from other uncontrolled areas. Therefore overall control effort is negligible, and these species continue to spread, threatening water storage areas, significant wetlands and cane production. We discuss the difficulties of controlling ponded pasture species on public and private land, and identify steps to resolve these issues. Similar issues face land managers in the attempt to control other introduced pasture species in Northern Australia.

INVASIVE ALIEN PLANT CLEARING BY "WORKING FOR WATER" ALONG THE SABIE RIVER IN THE KRUGER NATIONAL PARK, SOUTH AFRICA.

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Invasive alien plants (IAP) negatively impact scarce water resources in Southern Africa and are also thought to be one of the most significant threats to biodiversity. In 1995 the Department of Water Affairs and Forestry launched the "Working for Water" programme which aimed to primarily secure water resources through the large-scale clearing of invasive alien plants while simultaneously addressing poverty alleviation. The programme was introduced into the 2 000 000 ha, Kruger National Park (KNP) in 1997 and has since become a major component of invasive plant management in the reserve. However, very little post-clearance monitoring has taken place. The aim of this study was to investigate the response of alien and indigenous vegetation to clearing of IAPs in riparian zones, and to understand the factors responsible for varying levels of post clearance recovery. Vegetation composition and structure as well as associated environmental variables were sampled at 12 sites along the Sabie River within and adjacent to the KNP. Relative alien density varied from 4- 97% between sites and was strongly negatively correlated with both total plant diversity (H': $r^2 = 0.7181$, $p=0.0005$) and evenness of distribution (Simpson's evenness: $r^2=0.6828$, $p=0.0009$). Surprisingly, an increase in the number of follow-up treatments, showed a similar increase in the relative alien density ($r^2=0.5820$, $p=0.0039$), even though sites with the highest number of treatments were not necessarily initially the most invaded ($r^2=0.0089$, $p=0.7704$). This suggests that clearing may also act as a disturbance in the system. The protocols for each of the clearing treatments are currently being assessed in order to reduce negative effects of these integral clearing practices in the future.

THE ROLE OF FRUIT TRAITS OF BIRD-DISPERSED PLANTS IN INVASIVENESS AND WEED RISK ASSESSMENT

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Birds play a major role in the dispersal of seeds of many fleshy-fruited invasive plants. The fruits that birds choose to consume are influenced by fruit traits, such as aspects of fruit morphology, phenology and pulp nutrients. However, little is known of how the traits of invasive plant fruits contribute to invasiveness or frugivore diversity, and how an understanding of these relationships could be used to improve invasive plant management. This study explored relationships between fruit traits, plant invasiveness and frugivore diversity for an assemblage of bird-dispersed invasive species in south-east Queensland, Australia. Both plant invasiveness and frugivore richness were negatively correlated to fruit width, and all highly invasive species had quite similar fruit morphology (smaller fruits, seeds of intermediate size and few (<10) seeds). Lower pulp water was the only pulp nutrient trait associated with invasiveness. There were strong positive relationships between the diversity of bird frugivores and plant invasiveness, and in the diversity of bird frugivores in the study region and another part of their alien range. These results suggest that fruit size and frugivore diversity could play an important role in predicting invasiveness and be used to improve weed risk assessment processes for bird-dispersed plants.

MELASTOME DISPERSAL AND RECRUITMENT IN TROPICAL RAINFORESTS

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The invasion of the Wet Tropics rainforests by several Melastomataceae species (*Miconia calvescens, M. nervosa, M. racemosa* and *Clidemia hirta*) poses a major threat to native plant communities. These invasive species can dramatically changed large tracts of rainforest habitats. Both *C. hirta* and *M. calvescens* are noxious weeds on Hawaii and other islands where *M. calvescens* may form extensive monospecific stands. All four species are considered to have some degree of shade tolerance while growing rapidly in high light environments. All are fleshy fruited, produce large seed crops, and are potentially widely distributed by birds and bats. The four species are listed as Class 1 weeds (the highest priority category) in Queensland and are subject to eradication. While *Miconia nervosa, M. racemosa* and *Clidemia hirta* each currently constitute single site infestations, *Miconia calvescens* has been recorded at ~20 locations in north Queensland.

During a recent intensive melastome eradication program, spatial and size data was collected on nearly 5000 *Miconia* spp. and *Clidemia* sp. individuals (all subsequently eradicated) across three locations. We apply dispersal simulation models developed from extensive field observations of vertebrate frugivores that disperse similar small-seeded berry native species to the melastome infestations. Our goal was to assess how well the current spatial and stage structure is predicted by dispersal models and to compare a species with multiple site invasions to species which are currently contained to single site infestations. By comparing invasive species patterns of movement across the landscape, we increase our understanding of factors affecting spread and recruitment which better enables us to prioritize and effectively manage existing populations.

REPRODUCTIVE BIOLOGY OF INVASIVE ASCLEPIADS IN SOUTH-EAST QUEENSLAND

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Plant reproductive biology has critical roles in facilitating weed invasions and determining rates of spread. However, research to date has not provided conclusive reproductive characteristics that can be consistently associated with invasive alien plant species. Characteristics that invasive alien plants are hypothesized to have include: (1) a pollination system that is suitable for generalist pollinators; (2) a self-compatible mating system, and (3) high levels of seed production. Our study examines the reproductive biology of three invasive alien plant species of the subfamily Asclepiadoideae. The motivation for selecting Asclepiads as the species of interest is that the flowers are morphologically complex and are therefore thought to be unsuitable for generalist pollinators. Additionally, numerous studies of Asclepiads in their native ranges have observed high levels of self-incompatibility and low levels of fruit-set. Nevertheless, the study species appear to have established effective pollinator mutualisms in their invaded range in Australia, thereby defying the theoretical predictions. Specifically, our study investigates: (1) how ecologically specialized these species are in their pollination requirements; (2) whether mating systems are skewed towards uniparental reproduction, and (3) whether reproductive output is limited by pollinators. The results of the study will be discussed in terms of whether reproductive traits can be incorporated into screening protocols to predict and rank potential invasive impacts of alien plant species.

SEED LONGEVITY OF BELLYACHE BUSH (JATROPHA GOSSYPIIFOLIA L.) IN NORTH QUEENSLAND

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Understanding the seed ecology of bellyache bush (Jatropha gossypiifolia L.) is critical for effective management of infestations after the implementation of control measures. This paper presents preliminary results from a field experiment currently being undertaken to determine the potential longevity of bellyache bush soil seed banks. Both intact (unscarified) and ant-discarded (scarified) seeds have been buried at six depths [0 cm (without mulch), 0 cm (with mulch), 5, 10, 20 and 40 cm] and exposed to either nil (rainfall-excluded) or natural rainfall conditions. Initial seed viability was determined at 0 months (control) and subsequently for exhumed seeds at 3, 6, 12, 24, 36, and 48 months.

Bellyache bush seed viability was initially very high (100%) but declined at varying rates thereafter depending on seed type and the burial depth and site conditions imposed. Viability of intact seeds (across all depths) expired after 36 months in the natural rainfall site whereas viable seeds were still present after 48 months in the rainfall excluded site. Ant-discarded seeds, on the other hand, were still viable after 48 months' burial in both the natural rainfall and rainfall-excluded sites. Nil viability was first recorded at 12 months for intact seeds that were buried at 5 -10 cm and exposed to natural rainfall conditions. Seeds located on the surface generally persisted for longer than if buried at depth. The implications of these findings for seed bank management are discussed.

PLANT INVASION OF AN URBAN LANDSCAPE ON THE TEMPE CAMPUS OF ARIZONA STATE UNIVERSITY

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Urban landscapes can often be utilized to infer the invasive nature of horticultural species. Often the point of introduction may be an urban area with a species escaping the anthropogenic area into adjacent natural areas. The Tempe campus of Arizona State University was surveyed for invasive species growing in the campus landscaping scheme. This site was chosen because has landscaping representative of the urban areas of the desert southwestern USA, and a history of horticultural plantings dating to 1885. This campus has also been designated as an arboretum. Invasive species were identified, the number present recorded and the site of occupancy marked by global positioning (GPS) equipment. The most common invasive species was Bermuda grass (*Cynodon dactylon*) and the most common invasive woody plant was found to be African sumac (*Rhus lancea*). The GPS data was placed in a geographic information system to display the distribution of the invasive species across the campus by plant density.

WHAT DETERMINES PLANT SPECIES INVASIVENESS?A CASE-STUDY USING AMANI BOTANIC GARDEN, EAST USAMBARA MOUNTAINS, TANZANIA

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The lack of experimental studies that test for biological traits that confer plant invasiveness whilst controlling for confounding variables represents a barrier to progress in understanding plant invasions and how they can be managed. Comparisons of invasion success and failure among species are often not possible, as failed introduction and naturalisation events are rarely recorded. In many cases, time since introduction and introduction effort are unknown and thus cannot be assessed in analyses. Amani Botanic Garden (ABG) in the East Usambara Mountains of Tanzania is a rare exception, as detailed records of past plantings have been made, as well as subsequent surveys of plant condition and survival. ABG was first established in 1902 as a series of trial plantations, containing over 600 mainly woody species of potential commercial use. A third of the species are still present in their original plantations, and 82 are showing signs of reproduction, naturalisation and/or spread into other plantation areas and surrounding forest. Combining information from historical records and exhaustive present-day surveys has allowed the introduced ABG flora to be used as a system for testing determinants of invasion success across a wide range of plant taxa. Initial results suggest that probability of escape from planted areas may be explained by introduction effort and biogeographic origin. Work is underway to understand the importance of such factors in determining invasion success, in relation to plant traits. Research findings will contribute to invasive species risk assessment and management.

RECONSTRUCTION AND MECHANISMS OF THE INVASION OF A DIVERSE AFRICAN SAVANNA GAME RESERVE BY THE ALIEN PLANT CHROMOLAENA ODORATA

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The invasion of Hluhluwe Game Reserve, a mesic savanna in KwaZulu-Natal, South Africa, by the alien plant *Chromolaena odorata* was well documented from an early stage of the invasion process, something that is lacking with many studies on alien plant invasion. Analyses of the historical distribution at various stages of the invasion process allowed us to identify some of the factors that allowed invasion to occur, enabling us to determine which theories of alien plant invasion played a role in the invasion process. Initially, invasion was positively correlated with some vegetation types and negatively with others indicating that habitat conditions initially played an important role. As the invasion progressed this correlation changed, indicating that species characteristics of the invading plant were playing a more dominant role in the invasion process.

POTENTIAL INVASIVITY OF ALIEN SPECIES INTRODUCED AS BIOENERGY CROPS IN ITALY: CULTIVATION CRITERIA TO REDUCE RISK OF WEED PROLIFERATION

Roberto Crosti

One of the main energy policy targets of the European Union is to increase renewable energy sources by 2010 in order to meet sustainability goals, in particular the reduction of greenhouse gas emissions agreed under the Kyoto Protocol. Various legislative actions have been undertaken in order to facilitate this target, for example, the recent Biomass Action Plan has already described various actions that will be taken to encourage the use of all kinds of plant biomass for renewable energy production. In Italy, the current Government policy looks at the promotion of the use of crops and of short rotation forestry as a source of energy. Concern, however, is growing on the potential harm that new extended and intensive cultivation could produce on the territory. This research presents the results of a study of the Department of Environmental Protection of the Italian Environment Agency (APAT) which, at present, is investigating whether there is a risk of alien species, once introduced in widespread and intensive cultivation for biomass production, becoming invasive and altering the structure of the vegetation remnant in agroecosystems, thereby reducing the associated biodiversity. Studying the autoecology of the crop species, investigating the invasibility elsewhere and developing Risk Assessment systems are management tools that will help understand the potential harm of alien species used for biomass and develop cultivation criteria to avoid the risk of new biological invasions in Italy.

APPLYING DISPERSAL DATA FROM NATURAL SYSTEMS TO THE MANAGEMENT OF RAINFOREST INVASIONS

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Rainforest community dynamics are characterised by high species diversity, and spatially and temporally infrequent recruitment opportunities. In addition, they are strongly influenced by vertebrate dispersal providing seeds to access these opportunities. These traits provide a very different context for plant invasions to those most often considered, and our understanding of how this influences the pattern and process of invasion and the suitability of management response is slim. Due to the structure and complexity of rainforest environments, individuals are often widely spaced and difficult to detect from further than a couple of metres. As such, there exists both opportunity and need to use a predictive model of the pattern and rate of invasive spread in rainforest to explore how management effort can be most effectively distributed in space and time.

We use an empirically derived model of dispersal kernels to predict the invasive spread of a woody species in Australia's tropical rainforests. *Miconia calvescens* has caused dramatic environmental and economic damage in its invasive range in the Pacific. It is now spreading into intact rainforest from a number of introduction sites in Queensland's Wet Tropics. The model is an individual based simulation based on dispersal data that is derived from ecological studies of fruit removal and dispersal and life history data derived from greenhouse and field data. We use it to predict spatial patterns and rates of invasion, while simulating different spatial and temporal patterns of management investment to identify effective strategies for distributing management effort.

PATTERNS OF ALIEN PLANT INVASION IN THE KRUGER NATIONAL PARK, SOUTH AFRICA: PERSPECTIVES FROM MULTIPLE SPATIAL SCALES

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Biological invasions are among the most pressing issues facing conservation managers. In an effort to provide strategic direction to management interventions, much emphasis is placed on collecting spatial data, but often with little understanding of how the data is to be used. We used a unique data set from the Kruger National Park (KNP), South Africa, to assess the implications of spatial scale in developing an understanding of the distribution of invasive alien plants. Using 28,000 alien plant records collected over the entire area of the KNP (2 million ha), we assessed the impact of patterns of alien plant distribution at nine spatial scales, ranging from point data to presence/absence data at the resolution of quarter-degree cells. The influence of scale in evaluating alien plant distribution is underestimated, as visually evaluating maps at different spatial scales substantially alters the perceived patterns of invasion and would subsequently impact management planning. Scaling up from smaller to larger grid cells always distorts the abundance and distribution patterns. Scattered, patchy distribution patterns appear continuous, suggesting that the entire area is invaded. Data at a point-scale and up to a resolution of 500 m cells appear useful for relating species to environmental features. Data at a resolution coarser than 1X1 km cells loses too much detail to be particularly useful for determining environmental correlates as the habitats and local scale details are aggregated. Interestingly, data at the quarter-degree scale provides a highly distorted image of the real pattern of invasion, even when considered across an area of 2 million ha.

MONITORING AND EVALUATION TOOLS FOR LARGE SCALE WEED MANAGEMENT PROJECTS

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The biodiversity of Brisbane is unmatched by any other capital city in Australia, however, that biodiversity is under significant pressure from development demands, associated fragmentation and weed invasion in remaining natural areas. Wipe Out Weeds! was developed to address serious invasive plant threats to Brisbane's biodiversity and landscape amenity.

The Wipe Out Weeds! (WOW) program is a citywide, holistic weed management program that has been in implementation since 2003. Regular monitoring and evaluations of each of the major outcomes of the program have been key components from the commencement of implementation.

The major outcomes of the WOW program are:

- Prevent and protect (Prevention and early detection and eradication)
- Contain and Maintain (Control impacts and maintain ongoing reduction of infestations in priority areas)
- Aware and Assist (Awareness and Incentives/assistance for residents)

These outcomes are delivered through a number of discrete projects within the program:

- WOW Priority Projects
- WOW Events
- Weeds Awareness (Fact sheets, displays & presentations)
- Green Choice Nursery Pilot
- Wildlife Conservation Partners Assistance Trial
- Internal and regional collaborations

The outcomes of the annual evaluations have been critical in building successful business cases that has seen funding for proactive weed management by Brisbane City Council increase 500% in the last three years. Evaluation outcomes have also heavily guided the development of further projects within the program and ensured that additional funds are placed in areas that are now known to be delivering outcomes consistently and within required standards.

Appropriate monitoring and evaluation tools were considered and/or developed in the inception stages of the Wipe Out Weeds program and this is considered critical in ensuring the clear line of sight required by on-ground staff and project managers between project implementation and outcome evaluation.

The paper describes standards and targets set and direct and indirect tools used to measure outcomes. It also explains why and how they are implemented within the citywide context of the Brisbane City Council Wipe Out Weeds program.

DISTRIBUTION AND ABUNDANCE OF THE GRASSES IMPERATA CYLINDRICA (SPEARGRASS), ANDROPOGON GAYANUS (GAMBA GRASS) AND PENNISETUM SP IN CENTRAL AFRICAN SAVANNAHS.

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In west and central Africa, there are strongly defined savannah forest boundaries. Researchers and early explorers who observed forest patches with tall trees in the savannah or in bushland have assumed that these indicated the past presence of a more extensive closed canopy forest of which they are mere relicts. Much recent work challenges this discourse, and suggests instead that these savannahs areas are stable and rather that they are being slowly colonised by the forest.

In central Cameroon, three of the most abundant Poaceae in these savannahs are *Imperata cylindrica, Andropogon gayanus* and *Pennisetum* spp. *I. cylindrica* is considered one of the tropic's worst invasives, although its origin is disputed and may be native to Africa. While the latter two are native, they are considered serious threats to native tropical savannahs in northern Australia.

To understand the ecology of these species, vegetation was sampled in savannah areas in central Cameroon, near the forest edge and in the centre of the savannah. Fifty-two plots were established, each 100m2, and emergent shrubs were mapped. Within each plot, understorey vegetation was sampled in three 0.75 m * 0.75 m area. Densities and biomass per species were calculated. After cutting the vegetation, soil was sampled to 50 cm depth and bulk density measurements were made from 0 – 20 cm depth in 5 cm increments.

Pennisetum sp. had the highest biomass contribution, comprising 30% of the understorey biomass across plots. *Andropogon gayanus* comprised 17% of the biomass, and *I. cylindrica* 5%, although densities of *I. cylindrica* were the highest. Distributions of the species with respect to proximity to the forest edge and soil properties are discussed.

PROBLEMS OF ALIEN WEED INVASIONS IN SOUTHERN AFRICA: THE SWAZILAND SITUATION

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Invasive weed species pose a great menace in Southern Africa. In Swaziland, over 300 alien weed species have become a major threat in agriculture. Among these are such noxious weeds as *Chromolaena odorata* [(L.) M.R. King and H.E. Robins.], *Lantana camara* (L.), *Solanum mauritianum* (L.), *Psidium guajava* (L.) and *Parthenium* spp. *Chromolaena odorata* (known as 'Sandanezwe' or 'Wandile' in the local language, siSwati) is the most problematic of these invasive weeds. It is rapidly spreading throughout the country, is usually inedible by livestock, and has led to closures of commercial, and government-owned cattle ranches, among others. Game reserves that are the backbone of the tourist industry in Swaziland, have reported similar invasions with *Chromolaena odorata* and *Parthenium* species. The beneficial and detrimental aspects of these alien weeds are elucidated in the text. Ongoing attempts to control alien, invasive weed species in Swaziland include detailed mapping of infestation zones throughout the country, and manual control by slashing and controlled burning. Research into various control methods are currently being undertaken. Grazing trials using special goat breeds from South Africa, are being investigated. The role of current research is stressed, and compared with research efforts in neighbouring countries within the South African Development Community. Sustained and coordinated efforts of all stakeholders, including individuals, village communities, corporate bodies, government, commercial farmers, small-scale farmers, and pesticide companies, are being solicited as possible solutions that will efficiently bring invasive weeds under control in Swaziland.

EVALUATING THREATS TO CONSERVATION POSED BY ALIEN PLANTS ON SOIL-GROWING BRYOPHYTE AND LICHEN COMMUNITIES IN COASTAL SAND DUNES BY QUANTILE REGRESSION

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Sand dunes are dynamic and fragile ecosystems threatened in the whole area of the Mediterranean basin. Current threats to dune systems and dune vegetation include the catastrophic damage caused by urban development and the more insidious cumulative damage caused by fragmentation, over-stabilisation, afforestation with exotic species, uncontrolled recreational uses, nutrient deposition, wild fires. Generally speaking trampling degrades or destroys the vegetation and results in deterioration that promotes wind erosion. Since 1930s, many coastal areas have been subject to reforestation with exotic trees (*Acacia* sp. pl., *Eucalyptus* sp. pl., *Pinus* sp. pl.) and sand dunes have been stabilized also thanks to the plantation of *Carpobrotus* species [*C. acinaciformis* (L.) L. Bolus, *C. edulis* (L.) N.E. Br. in Phillips], succulent chamaephytes, with a prostrate and trailing habit, originating from Southern Africa. Furthermore, *Carpobrotus* plants have been largely planted in gardens, slopes and roadsides, throughout the coastal. The two species and their hybrids have then been largely naturalized and becoming invasive. These taxa are causing one of the most severe threats within plant communities occurring in coastal continental and island habitats in the Mediterranean basin and in Mediterranean-like regions in the world. Afforestation of dunes with exotic species has had a major effect on large areas of dune landscape. Some sites hold large conifer plantations which have the effect of suppressing the dune vegetation communities and lowering the water table. The significance of epigeous lichens as indicators of man-made disturbance in the Mediterranean area as well as the impact of exotics on cryptogamic vegetation has been very poorly investigated so far. The main aim of this work is the evaluation of the threats to conservation posed by alien plants and man-made disturbance to bryophyte and lichen communities growing on sand dunes in the island of Sardinia (Italy) in order to outline recovery action priorities.

Relationships between abundance and species richness of bryophyte and lichen communities vs. abundance of alien species has been assessed by means of quantile regression, a statistical technique intended to estimate, and conduct inference about, conditional quantile functions. Just as classical linear regression methods based on minimizing sums of squared residuals enable one to estimate models for conditional mean functions, quantile regression methods offer a mechanism for estimating models for the conditional median function, and the full range of other conditional quantile functions. From this study focussed on Sardinian coastal area, it clearly emerges that epigeous bryophytes and lichens in particularly, fade in sites subject to invasion of *Carpobrotus* spp., in too densely unmanaged plantations with exotic trees (*Acacia saligna, Acacia mearnsii, Eucalyptus camaldulensis, Pinus pinea, Pinus halepensis*) and in presence of man-made disturbance such as trampling, vehicle tracking and soil eutrophication.

SPECIES TRAITS AS DETERMINANTS OF INVASION SUCCESS: GLOBAL ANALYSIS USING SOURCE SPECIES POOL AND SOME METHODOLOGICAL INSIGHTS

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To explore the role of species traits in determining invasion success, we used a source pool of species native to Central Europe and analysed how frequently they occur as invaders in other parts of the world. Number of biological traits and characteristics describing their distribution in the native range were used to explain their occurrence as aliens elsewhere on the globe. Two measures of occurrence were employed: (i) number of records in the database of the Global Compendium of Weeds, reflecting the ability to become introduced; and (ii) proportional number of records where the species was considered a "weed", reflecting the ability to become invasive. The introduction success can be explained to a large extent by distributional variables alone (size of the native range in particular). Biological traits do not have a direct effect on the probability that a species is introduced, but they do affect the probability of it becoming invasive, which is determined by both biological and distributional traits. The study also provided important methodological insight into analyses of the role of traits in plant invasions. Compared to general linear models, regression trees appeared to be a preferable analytical tool for these analyses, because they have a similar explanatory power but, although their structure was equivalent to that of general linear models, they needed much less number of significant predictors to reach similar conclusions. Their further advantages are invariance to monotonic transformations of predictor variables, ability to deal with highly nonlinear relationships and high order interactions, and most importantly, the possibility to handle missing values, which are common in analyses of large set of invasive species. A disadvantage of regression trees is that they do not allow for phylogenetic corrections. However, detailed phylogenetic analyses of the data by variance partitioning methods show that the parts of variation strictly due to phylogeny are very small, and appear predominantly only among species within genera. The little importance of variation strictly due to phylogeny thus enables efficient predictions by regression trees without taking phylogenetic effects and constraints into account. This is so because the large and important part of phylogeny, related to phylogenetically structured variation of ecological traits, remains imbedded in the regression tree analyses, without including phylogeny as separate explanatory variables.

SNEAKER WEEDS: SLOW-CREEPING SLEEPER WEEDS

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Many authors have stressed the need to act early to counter new species of invasive weeds before their populations grow, spread and become unmanageable. The difficulty comes in knowing which of the many plant species that naturalise are at risk of becoming weedy in the future. Very often we don't even try to do anything with them until after they have started to 'move' and expand their population and distribution. We've been looking though the back records of some of New Zealand's potential problem weeds and find that some of them seem to have been slowly spreading, although this has often been on roadsides and in waste places – places where people don't worry about them so much. Some of these species have become major weed problems overseas. As these weeds slowly become more widespread here, there is a steadily increasing danger that they will find a time and place that suits their rapid spread into hitherto untapped habitats. This danger is enhanced by the threatened effects of climate change, which, in New Zealand, is likely to mean more frequent and longer-lasting droughts in the east and more rain and greater flood damage in the west. Both scenarios, by potentially opening up new and different habitats, increase the chances of some of these sneaker weeds being able to thrive and become serious problems in previously unavailable habitats. This danger applies to both agricultural and environmental weeds.

EVOLUTIONARY GENETICS OF INVASIVE ARTICHOKE THISTLE IN CALIFORNIA

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Cynara cardunculus var. *sylvestris* or artichoke thistle is a serious noxious weed invading thousands of acres of mainly grasslands in California, Australia and South America. California's artichoke thistle populations exhibit varying degrees of morphological intermediacy between artichoke thistle growing in its native Mediterranean habitat, and the two cultivated varieties: var. scolymus, or globe artichoke, and var. altilis, or cardoon. Despite a range of morphotypes and apparent variation in invasiveness among them, self-sustaining populations of *Cynara cardunculus* in California are almost exclusively identified as the weedy form, var. sylvestris. The morphological differences observed between populations in California may be the result of multiple origins of introduction, hybridization between varieties, ferality of cultivars, or a combination of these circumstances. Morphological differences may explain variation in aggression and spread among populations. Seeds were collected from fourteen populations in California across a wide range of habitats in the summer of 2005, and from sixteen potential progenitor populations in Spain and Italy in August 2006. Seeds were germinated in a greenhouse and transplanted into three common gardens representing inland and coastal environments in Riverside and Irvine California. Tissue was harvested for microsatellite analysis for the purpose of determining specific taxonomic variety and country of origin. Although circumstantial evidence points to Italian origins, seedling morphology of California's artichoke thistle more closely resembles that of the cultivars or of southern Spain. Multiple introductions and gene flow between closely related taxa may have provided adequate genetic variability for invasiveness to develop across a range of habitats in California.

DOES LOCAL GENETIC ADAPTATION TO FROST IN THE INVASIVE RANGE FACILITATE THE SPREAD OF BUDDLEJA DAVIDII FRANCH?

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Coldness or frost usually reduces plant fitness, depending on time, intensity and duration. In consequence, frost acts as a distribution barrier. This climatic limitation of distributional ranges and its overcoming by genetic adaptation is of particular importance for plant invasions.

The Butterfly Bush, *Buddleja davidii*, is an invasive shrub native to China. In 1890, it was introduced to Europe for ornamental reasons, and has been subject to artificial selection by breeders. The first spread started after World War II, facilitated by large number of open sites in urban areas. Both in native and invasive range, the species occurs on disturbed sites like roadsides and along railways but also on stream and river banks, but it is also expanding into semi-natural sites. Thus, *B. davidii* can be found on several plant watch lists not only in Europe but also in the USA, Hawaii, Australia and New Zealand.

Within this new distributional range, the species apparently has a wide ecological amplitude in terms of climatic conditions. Concerning distribution maps the species seems to prefer oceanic or mediterranean climate. Nevertheless, small populations can also be found in sub-continental regions of Germany and Austria. Since plants generally have the ability for rapid evolutionary adjustments to novel environments, we expected that *B. davidii* populations have adapted to the new climatic conditions. Rapid evolutionary change might be one explanation for the success of invasive species in general, and could be an important mechanism for the ongoing spread of *B. davidii*. Therefore, we asked whether its eastward spread is limited by frost sensitivity, and whether frost hardiness is increasing with longitude among populations indicating evolutionary adaptations to climate. In order to quantify population x environment interactions, we carried out a common garden experiment with offspring from 20 invasive *B. davidii* populations sampled across Western and Central Europe, and tested leaves for their frost resistance using the electrolyte leakage method.

We found indeed that the populations differed significantly in frost resistance (population x frost interaction, $F_{4,19}=1.4$, $p<0.05$) indicating genetic variation for this trait in *B. davidii*. However, we did not find any relationship between frost hardiness and geographic location or climatic variables of the populations' home site. Hence, we conclude that even though populations differ in frost resistance, they are not genetically adapted to climatic conditions of their home site within the invasive range. This lack of local adaptation might be due to insufficient time, founder effects or genetic bottlenecks during the invasion process.

THE ROLE OF RESISTANCE AND TOLERANCE AS INVASION MECHANISMS : A TALE OF THREE ALIEN SENECIOS

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Escape from natural enemies is an accepted mechanism allowing some alien invasive species (IAS) to invade and flourishing in novel environments, particularly with high environmental suitability and where close relatives and associated adapted natural enemies are rare. Higher natural enemy impacts on natives provide the invader with a competitive advantage. Successful invasions also occur where there are close relatives of the invader, which might appear to throw a general importance of "enemy release" into question. Plants, however, have two non-mutually exclusive defence mechanisms against natural enemies; resistance – damage reduction, and tolerance – the ability to compensate for the damage. Closely related plant competitors can therefore play out a game of strategic defence limit impacts of natural enemies. Successful plant species are also likely to have strategies that will help them invade new environments. In this study we explored the defensive strategies of three globally invasive Senecio species; *S. jacobaea, S. inaequidens* and *S. madagasgariensis* and found that both resistance and tolerance were associated with defence against a relatively generalist natural enemy amongst these species; *Aphis jacobaeae*. This system is used to discuss the role of resistance and tolerance defence mechanisms in plant invasion success through enemy release.

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THURSDAY
SEPTEMBER 20

CAN VOLUNTARY CODES OF CONDUCT PREVENT PLANT INVASIONS?

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Many plant invasions arise from intentional introductions of species, often for horticultural use. Governments enact laws and policies to deal with the introduction, movement, and control of a large number of species, but not all species are covered by these regulations and not all governments have adequate laws. Voluntary Codes of Conduct, or Best Management Practices, for various enterprises within the larger field of horticulture are one method for addressing these gaps. A workshop held in St. Louis, Missouri, USA, in 2001 developed Codes of Conduct for nurseries, public gardens, landscape architects, the gardening public, and government. Efforts since the workshop have brought together diverse groups of people working to implement the Codes of Conduct in many parts of the United States. In particular, coordinated projects are going on in two western states, Washington (Washington Invasive Species Coalition - WISC) and California (California Horticultural Invasives Prevention - Cal-HIP). In both states stakeholders have used the Codes to begin stimulating dialogues that may prevent spread of some species. Both projects will be analyzed for their strengths and weaknesses, providing advice to others interested in using the Codes to engage stakeholders in collaborative partnerships. While it may be too early to determine if species introduction and spread has been deterred, both projects have found the Codes useful in determining issues and concerns of the many stakeholders and in gaining trust and respect among former adversaries.

IMPACT EVALUATION OF THE TACKLING WEEDS ON PRIVATE LAND INITITIATIVE ON THE GARDEN INDUSTRY IN VICTORIA

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The Tackling Weeds on Private Land (TWoPL) initiative focussed on developing effective partnerships with, and building capacity of key stakeholders whose actions directly impact on or influence the management of weeds on private land. An adoption model was used by the project both to develop engagement strategies and to measure the impact and effectiveness of these strategies over the life of the project. The model is based on stakeholders progressing along a continuum of 'awareness' and 'acceptance' to 'action'. Both quantitative and qualitative methods were used to analyse changes over time of 5 different stakeholder groups; Catchment Management Authorities, Municipal Councils, Linear Reserve Managers (road and rail), the Garden industry and the Fodder industry in terms of their levels of awareness and adoption of weed management practices. Data was collected and analysed at the beginning (to provide a baseline), middle and end of the project.

This paper describes the results for one of the 5 stakeholders - the garden industry, incorporating retail and wholesale nurseries and landscapers in Victoria. It measures and describes the impact that the TWoPL initiative has had on 4 key areas of weed management responsibility:

- Not selling or promoting declared weed species
- Preventing the spread of weeds resulting from their business operations
- Reporting new plant (potential weed) species
- Working with other organisations/ bodies (such as other members of the garden ` industry, state and local government agencies) in a coordinated approach to weed management.

WE ARE NOT THE ENEMY– RECENT INITIATIVES ON INVASIVE PLANTS BY THE NURSERY & GARDEN INDUSTRY

Chin R

The Nursery and Garden Industry is turning greener – is that possible? For many many years the Nursery industry has been the target of people, organisations and governments that are looking for somebody to blame about environmental weeds. Yes we have been guilty in the past and yes there may be some amongst the industry that still do the wrong thing – but they are the minority. As an industry we are working hard to reduce the impact of environmental weeds on Australia's built and natural environments. We are not the enemy any more.

There are a number of ways we are going about this. Firstly we are currently involved in supporting a number of government projects on a federal, state and local basis promoting weed awareness, removal and 'safe' planting – either working directly or indirectly. We also sit on the National Weeds Advisory Group which reports to the minister. Recently we have embarked on a major project, a national 'Grow Me Instead' program that will see a separate publication in every state and a national education program. The Nursery & Garden Industry Australia has appointed a national environmental officer and has recently seconded a Nursery Industry Development Officer (that's me) to work on national weed projects. Finally we have also recently published a position paper on invasive plants and introduced a national labeling guideline that covers both invasive and poisonous plants. As an industry we are working hard, we are working with you. Winning the 'War on Weeds' is a big job. We can only hope to succeed if we work smart and together.

EMPOWERING GARDENERS TO MAKE INFORMED CHOICES WHEN BUYING GARDEN PLANTS

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Recent research from the Weeds CRC has calculated that about 3,735 plant species imported into Australia for cultivation as garden plants are referenced weeds yet to naturalise in the environment here. A significant number of this wave of potential future weeds present a risk to industry and the environment here but can still be legally traded in Australia. Consumers have no easy way of knowing whether a plant that they are buying is a potential invasive plant and how to prevent it from becoming one. This paper outlines on the role of a labeling standard and scheme in reducing the weed spread risk associated with the sale of invasive plants.

Currently, plant labels generally omit information about a plant's invasiveness or responsible management techniques.

The United Kingdom's peak horticultural industry body has already adopted a national plant retail labeling code and a specific labeling code for hazardous plants. The UK experience has shown that transition costs to a new national labeling standard are minimal when generous phase-in times are allowed.

This paper proposes a labeling scheme for Australia that that is regionally flexible (a plant may be high-risk in one State and low-risk in another); mandatory (to create a level playing field in a fragmented and dispersed industry); and provides a range of benefits for the nursery industry at minimal cost and disturbance. The labeling scheme would also work in tandem with the nursery industry's existing "Grow Me Instead" campaign which suggests non-invasive alternatives to popular invasive species in trade. The scheme would also remove a potential future civil liability risk for the industry.

Support for a national labeling scheme for invasive plants has been expressed from leading representatives of the horticultural industry, consumers and scientists along with WWF Australia. Industry leaders are already taking measures to better inform consumers: Diggers, a national mail-order retailer with around 10,000 members, have already introduced new labeling codes for their seeds that indicate regionally-specific invasiveness. These pro-active moves are to be commended but highlight the need for a national standard to ensure consistent information is presented to consumers and gardeners to prevent confusion.

SUSTAINABLE GARDENING AUSTRALIA

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Sustainable Gardening Australia (SGA) has been developing programs for gardeners since 2002. SGA's goal is to have every Australian home gardener adopt and apply sustainable gardening practices that are appropriate to their local area.

The methodology we use to achieve this goal is to work in close collaboration with high profile garden centres who who share our vision of gardening being one in a more environmentally compatible manner. For garden centres to be certified as a Sustainable Garden Centres (SGC) they must undertake specific training to ensure their staff are able to give informed and knowledgable advice on sustainble gardening techniques. Plus SGC's themselves undertake to operate as resource efficient as possible thus setting an example.

The five key portfoio's of SGA's focus are :

1. Water
2. Environmental Weeds.
3. Wildlife gardening (thru promotion of indigenous plants)
4. Chemicals (advocating use of chemicals with low environmental impact)
5. Resource re-use and re-cycling

Currently there are 18 Certified SGC's located throughout Vic and WA, with a further 45 garden centres at various stages along the certification pathway. SGA has just commenced operations in Sth Aust and is due to commence in Tasmania later in 2007.

MANAGING LUDWIGIA PERUVIANA (L.) HARA AND LUDWIGIA LONGIFOLIA (DC) HARA INFESTATIONS IN NSW: PROGRESS AND PROSPECTS

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Ludwigia peruviana (Primrose Willow) and *Ludwigia longifolia* (Long-Leaf Willow Primrose), both South American natives, have become significant aquatic weeds in eastern Australia, posing considerable threats to Australia's Wetlands of National Significance. Until recently, both species were considered relatively minor weeds. However, their potential to become major threats to aquatic habitats is now evident, and this needs wider recognition, so that infestations detected early can be managed.

Since its first recording in Botany Wetlands in Sydney in 1971, *L. peruviana* has spread widely from the initial infestation. The magnitude of entrenched infestations in Botany Wetlands, and the rate at which spread occurred indicates how a new 'immigrant' could rapidly become an 'invader'. Spread of *L. longifolia* has been less spectacular, but this invader too poses similar problems to wetlands and aquatic habitat management.

Two case studies are presented, which demonstrate the success and limitations of implementing integrated weed management, to contain the invaders. Whilst prevention of new infestations has priority, containment, eradication and reduction of infestations are necessary. Containment, as well as local eradication of *L. peruviana* in Botany Wetlands has been achieved by combining early detection, herbicides, mechanical and manual control, aided by water management and controlled burning. However, its spread in the Sydney region has continued. Success in containing the spread of *L. longifolia* has also been limited.

Longer-term strategies for management are revegetation of previously weed-infested areas with native species, development of bio-control agents and increased education and awareness. Developing closer cooperation between multiple stakeholders and effective evaluation of implemented actions are also essential steps for success.

ALLIGATOR WEED CONTROL IN THE WAIKATO REGION, NEW ZEALAND

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Alligator weed (*Alternanthera philoxeroides*) is an aquatic and terrestrial weed, often described as one of the world's worst weeds. Discovered in northern parts of New Zealand in the early 1900's it is believed to have been accidentally introduced via ship ballast water. Alligator weed is extremely invasive and threatens the Waikato region's lakes, rivers, wetlands, and the highly valuable agricultural land on which the region's economy relies. Classified as an eradication plant pest under the Waikato Regional Pest Management Strategy (RPMS), Environment Waikato's (EW) is responsible for its control. First discovered in 1990 in the delta area of the Waikato River, New Zealand's longest river, control of alligator weed has been problematic from the start. The aggressive nature of the weed, restrictions on herbicide use in aquatic situations, and spread of the weed via fishing equipment, agricultural activity and contractors equipment, and urban subdivision activity, has resulted in numerous infestations throughout the region. Currently there are over 30 alligator weed infestations on over 100 properties in the Waikato region across a broad range of habitats and land-use types, including: rivers, streams, wetlands, farming and cropping land, residential lawns and gardens, a sand quarry, an organic recycling centre, and a landfill. Infestations range in size from a few square metres, to 200 hectares. A comprehensive, intensive and ambitious control programme has been developed by EW in response to the rapid spread of alligator weed. A range of strategies have been employed including: resource consents allowing the use of the herbicide metsulfuron-methyl in aquatic situations, restrictions placed on activities in infested areas, intensive herbicide control programmes, herbicide trials, control monitoring programmes, and public awareness campaigns. Significant reductions in density infestations have been acheived, however, ongoing intensive control is required to maintain the gains, and controlling the spread of alligator weed via human activity remains challenging.

DISTRIBUTION AND EARLY DETECTION OF THE FRESHWATER INVADER DIDYMOSPHENIA GEMINATA (DIDYMO) IN NEW ZEALAND

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Didymosphenia geminata (didymo) was discovered in a single river in Southland, New Zealand, in October 2004. This was the first validated record of this microscopic invasive alga in the Southern Hemisphere. Predicting the likely distribution of the micro-organism within New Zealand and detecting it at an early stage of invading a new site were critical to Biosecurity New Zealand's incursion response. Unlike many of the invasive species we encounter, basic information was lacking for didymo. The environmental characteristics favourable to didymo establishment were identified and then used to categorise New Zealand rivers according to the level of risk of establishment. This information was used to identify potential hot spots and to target those high risk rivers in the scheduled national survey programme.

Sampling techniques were available for periphyton but the development of procedures specific to didymo were desirable to increase sampling efficiency and minimise the risk of false negatives. A comparison of the costs and effectiveness associated with all sampling methods tested showed that filtering samples from the water column was the most efficient method for detecting didymo at low densities. Microscopic analysis is an effective method of sample analysis. More recently a unique genetic fingerprinting tool has been developed for didymo as well as specific field collection and preservation techniques, thus allowing detection earlier than with previous techniques.

We will report on two years of research and the operational tools used by Biosecurity New Zealand to determine the distribution of this unwanted organism, so that we can better target public awareness measures and determine impacts while investigating containment and control measures.

A PROACTIVE MANAGEMENT APPROACH TO AQUATIC WEED CONTROL IN NEW ZEALAND

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Many New Zealand water bodies are already highly impacted by a range of alien invasive plants, but there are areas still free of most of the worst weed species and effective preventative management is still attainable. The isolated nature of this country makes accidental importation outside of the aquarium/pond trade very unlikely. Many problem species do not reproduce sexually or are poorly dispersed between water bodies so natural (non-human) vectors are limited. The majority of aquatic weed introductions are human mediated. Catchments are essentially islands in a sea of land and can be managed accordingly.

Risk management of aquatic weeds include pre-border, border and post-border steps. These include:

• Identify potential weeds not known to be present in New Zealand, giving those assessed to pose a threat to our water bodies "Unwanted Organism" status

• Intercept plant importations at the border (e.g. soft x-rays) and post entry quarantine measures

• Identify weed threats present in New Zealand but not yet, or sparingly naturalised and ban from propagation, sale and distribution (e.g. National Pest Plant Accord)

• Regional and national assessment of low incidence/high impact naturalised species ,with eradication programmes

• Identify and rank weed-free sites/regions, predicted impacts of weed species, nearest weed sources and high probability vector pathways

• Manage weed sources and vectors and instigate targeted surveillance programs in unimpacted high value water bodies with effective incursion response should an incursion be detected.

This talk will be illustrated with examples of each of these steps.

A NATIONAL FRAMEWORK FOR EARLY DETECTION, RAPID ASSESSMENT, AND RAPID RESPONSE TO INVASIVE SPECIES

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Effective early detection, rapid assessment, and rapid response (EDRR) to invasive species is critical to halting their establishment and spread. To better understand and coordinate EDRR efforts within the United States, the National Biological Information Infrastructure (NBII), United States Geological Survey, Departments of Interior, Agriculture, Commerce, and Defense, and the National Invasive Species Council, collaborated on the development of an EDRR Framework. A seven-component National Framework for Early Detection, Rapid Assessment, and Rapid Response to Invasive Species was developed and in 2006 the NBII launched a draft web site <http://edrr.nbii.gov> to facilitate visualization of the framework. Metadata records that are compliant with the Dublin Core Metadata Standard and which incorporate standardized vocabularly terms from the NBII Thesaurus were created for EDRR elements (e.g. organizations, tools, checklists, identification guides). These metadata records were then grouped and displayed under the seven EDRR component areas on the web site. Researchers, educators, students, and members of the general public can now search this catalog of EDRR resources online to learn more about the EDRR concept and to learn more about EDRR efforts occurring in their local communities. Future enhancements to the site include incorporation of an online key-styled decision support tree that will lead users to the framework component or element that they need, based on their answers to questions about their EDRR-related needs. In addition to providing increased exposure and education on the concept of EDRR, this framework has also allowed identification and prioritization of gaps in need of future cross-agency funding.

EARLY DETECTION: A GOOD IDEA SO NOW WHAT? FOUR MODELS FROM HAWAII.

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With an estimated 20-50 new species becoming established in Hawaii every year an effective system of prevention and early detection must be developed. The island-based Invasive Species Committees (ISCs) have proven to be an effective mechanism for rapid response to, and control of, incipient pest species. Each ISC has a voluntary board and chair along with a paid coordinator and staff to implement on-the-ground work. As these teams were developing, the voluntary board and participating committee members suggested targets for control. Many of the suggested targets were fairly widespread and potentially already having impacts. As more information has become available on the variables influencing the success of eradication efforts it is clear that management strategies should emphasize detecting incipient populations at very low levels to increase the probability of island-wide eradication. Island-wide early detection projects for terrestrial plants have been developed for the islands of Hawaii, Maui, Molokai, Oahu and Kauai. On Maui, two highly trained parataxonomists developed a list of about 100 target species and drove all public roads. As a result, 8 species were prioritized for eradication. Additional roadside surveys are taking place under contract on the Island of Hawaii, by Bishop Museum staff on Oahu and planned surveys on Kauai utilize the expertise of the local staff of the National Tropical Botanical Garden. The advantages and disadvantages of each of the four roadside survey strategies as well as the model for deciding which of the newly detected incipient plant species to target for eradication are discussed.

WEED SPOTTERS ASSIST DETECTION OF NEW INCURSIONS

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To be able to eradicate serious new weed incursions, they first have to be found.

The chances of incidental detection of serious weed threats is increased by the more sets of informed eyes present in the field.

In Victoria, the Department of Primary Industries (DPI) and Department of Sustainability and Environment encourage agency staff and volunteers to register as Weed Spotters.

Weed Spotters watch for and report serious new weed threats and have an important role in detecting declared State Prohibited Weeds and potential weeds of the future - Victorian Alert Weeds.

Registered Weed Spotters may be asked to collect specimens and field information about the weed they have found. These are delivered to their local DPI Weed Alert Contact Officer (WACO) who forwards the specimen to the National Herbarium of Victoria (Herbarium) for formal identification.

Weed Spotters are offered training in weed identification and specimen collection. They receive a kit including the Weed Spotter handbook and Weed Spotter weedeck, and a newsletter.

Strategic recruitment of new Weed Spotters is being carried out across the State and focuses on particular introductory pathways for serious new weed threats.

The DPI Weed Spotter Coordinator works with the WACOs across the State to coordinate training and other activities, strategic recruitment, training material and publications for Weed Spotters.

WACOs conduct training for local Weed Spotters and filter the reports and specimens received before forwarding the specimens to the Herbarium. Feedback to the Weed Spotters is important to maintain and encourage their participation.

The activities of Weed Spotters, the surveillance for, and response to serious weed incursions are managed by the DPI Weed Alert program and are outlined in the Weed Alert plan Victoria.

The Victorian Weed Spotter program has provided a model that is being applied to Queensland and will then be considered for national application.

INTEGRATION OF FORMAL WEED ERADICATION PROGRAMS WITH LOCAL WEED MANAGEMENT AREAS FOR EARLY DETECTION AND RAPID RESPONSE OF INVASIVE WEEDS

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California is occupied by over 1400 species of naturalized non-native plants. Of these, at least 200 have been identified as invasive and/or noxious. Over the past 100 years the state has had a very successful weed eradication program. Over 13 weed species have been permanently eradicated and 14 others are near eradication status. This program has traditionally been carried out by the state and many county agriculture departments. With serious budget reductions over the past 20 years this program has diminished inspite of growing introductions of invasive plant species. California has also undergone a demographic shift from agricultural economy to urban environmentalist majority.

California has responded by forming a set of 52 Weed Management Areas (WMAs) which cover the entire state and serve as local weed control councils which pull together all interested partners both public and private. These WMAs greatly enhance the previously existing state program. They focus on: 1) local weed prioritization, 2) strategic planning based on GIS weed location maps, 3) education and outreach programs, 4) demonstrations plots for Integrated Weed Management methodologies, 5) regionally-based grant writing, cooperative control projects. The groups rely heavily on non-technical volunteers known affectionately as "weed warriors". This program has attracted $5 million dollars from our state legislature and the US Congress recent authorized $90 million for WMAs across the nation. This talk will emphasize what factors have lead to the most effective groups in California.

COMPARISON OF THE LEAF TRAIT RELATIONSHIPS OF INVASIVE SPECIES IN THEIR NATIVE AND INVADED RANGES: A LEAF CARBON STRATEGY APPROACH

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Plants in invasive populations differ in abundance and at times physically to plants of the same species in their native range. This project sought to determine if release from herbivory in the new range results in re-allocation of resources from defense to faster growth, seen as leaf trait differences between the original and new ranges. Herbivory levels and leaf trait data related to carbon capture and allocation were collected for 15 invasive species. Species were chosen that have a limited natural range in southwestern South Africa, southeastern and southwestern Australia or the North Island of New Zealand and have established invasive populations in at least one of the other areas. Herbivory levels were significantly lower and leaves larger in the new invasive range of most species. In general, leaf trait relationships (trait regression gradients) did not differ between original and new ranges, suggesting that the fundamental leaf carbon strategy has been maintained. However, invasive populations had greater trait values indicating higher leaf carbon capture ability associated with increased allocation to growth.

EXOTIC GRASS ALTERS NITROGEN DYNAMICS IN THE TROPICAL SAVANNA IN NORTHERN AUSTRALIA

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Invasive exotic grasses may alter ecosystem processes by changing the resources pools of an ecosystem, or the rates of flux between these pools. *Andropogon gayanus* Kunth. (Gamba grass), is a tall (~ 4 m) perennial African grass which is invading ecosystems in the tropical savannas of northern Australia. *A. gayanus* is a highly productive grass, producing up to 31 t ha-1 of biomass. This invasion could have significant impacts on nitrogen (N) cycling in the northern savannas. We investigated the impact of *A. gayanus* on two key N pools (plant and soil) and one key N flux (N loss during fire). We hypothesised that the higher biomass production of *A. gayanus* would result in higher plant N pools, and furthermore that this would result in a decrease in soil N due to increased N uptake from the soil. We also hypothesised that the higher *A. gayanus* plant N pools would result in a higher N loss during fire. N pools and fluxes were measured at five sites at Wildman Reserve, which borders Kakadu National Park (~250km south east of Darwin). We found that, compared with sites dominated by native grasses, sites invaded by gamba grass had (1) five times higher above ground plant N pools; (2) reduced soil total N pools by up to six times; (3) reduced mineralisation by 20%; and (4) increased N loss during fire by 113%. These results suggest that *A. gayanus* has significantly altered savanna N dynamics and represents a serious threat to the savannas of northern Australia.

INVASION BY ASPARAGUS ASPARAGOIDES PROVIDES A POSITIVE FEEDBACK BY ALTERING SOIL NUTRIENT PROPERTIES

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In Australia many native plants have adapted to soils with low nutrients. Because of this low fertility, many plant communities are thought to be protected from invasion by alien plants. However, *A. asparagoides,* native to southern Africa, has the potential to invade undisturbed communities with low fertility in south-west Australia. *A. asparagoides* has displaced many native woody shrubs and trees and as such there has been a gradual shift in nutrient pools from plant biomass to the soil. Soils where *A. asparagoides* has invaded are more fertile then adjacent *A. asparagoides* free areas. Once an invasion has occurred into communities with the poorer soils, *A. asparagoides* plants are then in a position to provide a positive feedback by increasing the rate of nutrient cycling. *A. asparagoides* foliage contains higher phosphorus and nitrogen concentrations compared to the native species in their new environment. Being a geophyte, at the end of spring aboveground growth ceases and its foliage senesces. This littferfall retains the high nutrient content, which is then rapidly leached away as *A. asparagoides*' foliage quickly decomposes. *A. asparagoides* also has the capacity to trap and intercept these nutrients through its root architecture being a tuberous root mat found only in the top 20cm of the soil. These changes to the soil fertility will need to be taken into account when attempting to restore areas invaded by *A. asparagoides* in south-west Australia, as soil nutrient enrichment in Australia has already been shown to favour other alien species.

INVASION OF EHRHARTA CALYCINA AND PELARGONIUM CAPITATUM IN BANKSIA WOODLAND IS ASSOCIATED WITH DIFFERENT CHANGES TO ECOLOGICAL PROCESSES

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Global change in biodiversity is occurring at an unprecedented rate with invasion of natural plant communities being recognized as a key threatening process. The Mediterranean South West of Western Australia is listed within the world's 25 biodiversity hot spots. Fire is important for the persistence and stability of plant communities in these ecosystems. Aerial photographs and Geographic Information Systems were used to determine the fire history (1963-2000) in a 450 hectare urban Banksia woodland Reserve. Links were established between the frequency of disturbance and the invasion of the South African hemicryptophyte *Ehrharta calycina* (PCe) and chaemaephyte *Pelargonium capitatum* (PCp). Ecological studies of soil seed bank, vegetation, nutrient composition of the leaves and soil of native and invasive species show significant differences between areas in good condition (GC) and weed-invaded areas (GC vs. PCe and PCp), and also between the individual invasive species (PCe vs. PCp). A significantly smaller soil seedbank of invasive species occurs in GC than in PCe sites, with the invasive soil seedbank being less in PCp than PCe and GC sites. A lower diversity of introduced species occurs in the vegetation at the PCp sites than PCe sites, although this diversity is greater at both these sites than at GC sites. Soil pH, EC, S and N were significantly higher at sites invaded by *Pelargonium capitatum* than sites invaded by *Ehrharta calycina* and sites in GC. Significantly higher concentrations of total and available P were found at PCe and PCp than GC sites. A greater understanding of the impacts of disturbance on ecosystem processes and the communities' response to differing invasive species enables us to make more informed decisions when attempting to restore ecological function to invaded communities.

POSTERS

DOES HIGH PHOTOSYNTHETIC CAPACITY CONTRIBUTE TO THE INVASION SUCCESS OF BERBERIS DARWINII IN NEW ZEALAND?

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Plants with high rates of photosynthesis generally have high rates of biomass accumulation and growth, so this trait can be associated with invasion success. We hypothesized that high photosynthetic capacity might be contributing to the invasion success of the environmental weed *Berberis darwinii* (Darwin's barberry) in New Zealand. We measured photosynthesis of *Berberis darwinii* and four New Zealand native species (*Coprosma grandifolia, Melicytus ramiflorus, Pseudopanax arboreus*, and *Shefflera digitata*) growing in secondary broadleaf forest. Measurements were made on ten plants per species, half from sunny sites and half from shady sites. At sunny sites, *Berberis darwinii* had an average maximum photosynthetic rate almost double that of the native species. Sun-grown plants of *Berberis darwinii* had higher rates of photosynthesis than native species across most photosynthetic photon flux densities. However, all species had lower rates of photosynthesis in shade-grown leaves compared to sun-grown leaves. The invasion success of *Berberis darwinii* may be partially explained by its ability to photosynthesise at higher rates than native species, and hence gain a rapid height and biomass advantage. Management efforts should focus on *Berberis darwinii* plants in sunny sites, since they will grow faster—and produce fruit earlier—than plants in the shade.

WEED MANAGEMENT PRACTICE CHANGE BY VICTORIAN LINEAR RESERVE MANAGERS

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Linear reserves such as rail and road reserves are transit corridors which provide a pathway for weed spread potentially impacting on thousands of landholders in Victoria. Linear reserves are often repository's of high value remnant flora and fauna communities which are highly susceptible to exotic weed invasions. As land managers, organisations that manage linear reserves have legislative responsibilities to prevent the growth and spread of weeds and protect flora and fauna.

Developing partnerships and collaboration is an efficient and effective approach to weed management. Over the last three years the Victorian Government's Tackling Weeds on Private Land (TWoPL) initiative has engaged with Linear Reserve Managers at a state-wide level to build partnerships and organisational capacity, promote innovation and establish a strategic approach for improved weed management. This has supported private land weed management investment and assisted in building the capacity of all land mangers to tackle weeds over the longer term.

To achieve practice change within an organisation for improved weed management, requires effective stakeholder analysis and engagement strategies targeted at different levels within the organisation. The TWoPL initiative used a three stage process to effect this change. Information delivery, consultation and active participation methods were used to move the organisations through awareness to acceptance into action to fulfil their weed management roles and responsibilities.

The result of this approach has seen partnerships developed between four Victorian Rail industry organisations to produce vegetation management guidelines for rail corridors, and various projects on weed mapping, weed hygiene, staff training and weed management trials by VicRoads and Municipal Councils.

This poster will share learning's of the TWoPL initiative which can assist future practice change programs which aim to reduce the economic and environmental impacts of weeds on linear reserves.

WEED MANAGEMENT PRACTICE CHANGE WITHIN THE VICTORIAN FODDER INDUSTRY

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The Victorian fodder industry is a key stakeholder in the challenge to minimise the spread of weeds. The movement of fodder to assist farmers recover from drought and wildfire can see a heightened risk for weed spread within this industry. The adoption of good weed management practices across the fodder industry can potentially have significant economic and environmental benefits to the community.

The activities of various industries and agencies have a significant influence on how weeds impact on private land. This is often a barrier to wider adoption of community weed management. The Victorian Tackling Weeds on Private Land initiative has sought to influence a range of stakeholders including the fodder industry to change practices to adopting a strategic approach to weed management. The Victorian Department of Primary Industries engagement approach with the fodder industry has been to promote partnerships, innovation and build industry capacity to better manage weeds into the future.

This poster demonstrates how through stakeholder analysis, including network mapping and attitude benchmarking an engagement plan can be developed and implemented to successfully achieve practice change within the fodder industry.

The Australian Fodder Industry Association (AFIA) and the Australian Agricultural Contractors Association (AACA) have worked collaboratively with the Department of Primary Industries on several projects to assist with minimising weed spread across the industry. These projects include development of an industry Code of Practice to minimise weed spread and a hay bale tagging device (AFIA), formal training of association members in weed hygiene procedures (AACA) and targeted distribution of weed spread risk information at times of wildfire and drought.

Collaboration and partnerships between government, community and industry are essential to the success of weed management programs. The Tackling Weeds on Private Land initiative seeks to share project learning's on how engagement with industries such as the fodder industry can be done successfully.

EFFECTIVENESS OF 2,2-DPA IN CONTROLLING BABIANA, IXIA AND ALLIUM IN NATIVE BUSHLAND

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Herbicide efficacy field trials on *Babiana angustifolia, Ixia maculata* and *Allium triquetrum* using Propon (740g/kg 2,2-DPA) at 5 and 10 kg/ha with 3.5ml/L Agral, as a surfactant, showed significant control of target species. Babiana and Ixia treatments showed indication of stress within two weeks of herbicide application.

Twelve months after herbicide application there had been no emergence of Babiana at either concentration. With incomplete wetting and shadowing of plants at time of herbicide application Ixia trials showed a 96% reduction in cover using the lower rate of herbicide and 99% reduction with the higher rate. Although Allium showed no signs of stress post treatment there was a 94% reduction in cover using 5kg/ha and a 97% reduction at 10kg/ha.

Initial seedling resistance trials using Kings Park bushland species (20species representing 16 genera from 7 families) indicated Propon at 5 and 10 kg/ha + Pulse at 2ml/L produced severe leaf and shoot damage at both rates to all species. Initially 5 kg was less damaging but still caused leaf drop on every species tested with the exception of *Anigozanthos manglesii*. However, all species (except *Ozothamnus cordatus* as insufficient material was available) at 5 kg/ha recovered, at 10 kg/ha *Ozothamnus cordatus, Calothamnus quadrifidus, Melaleuca huegelii* and *Grevillea crithmifolia* were killed.

CHILEAN NEEDLE GRASS (NASSELLA NEESIANA) REGIONAL BEST PRACTICE MANAGEMENT

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Chilean needle grass (*Nassella neesiana* (Trin. & Rupr.) Barkworth, CNG) has perennial characteristics that allow it to persist in pasture and out compete with more desirable species. Once reproductive, CNG produces numerous unpalatable flower stalks and little leaf material, reducing stock rate and grazing utilisation. This paper describes an experiment that commenced in 2003, comparing set stocking to strategic grazing of a CNG dominated pasture with treatments of chemical control, fertility and pasture rehabilitation to attempt to reduce the dominance of CNG in different climatic regions.

Set stock grazing led to a shift in pasture composition to annual species with broadleaf weeds. Flupropanate application (1.5l/ha 745g a.i./l) decreased the basal cover of CNG at all sites although the residual effect varied between the sites. Off target damage by flupropanate was normally restricted to the season post spraying although grazing management effected the recovery of desirable perennial species. Set stock grazing of flupropanate plots, as opposed to strategic or lockup plots, shifted the pasture composition to annual grasses and broadleaf weeds with large areas of bare ground. In flupropanate plots that had large areas of bare ground (typically set stock plots), the residual effect of the herbicide was less apparent as CNG basal cover increased within two seasons of treatment application.

Glyphosate was able to kill mature CNG plants and enable resowing of perennial pastures, where seasonal conditions were favourable for pasture establishment. CNG was able to re-invade resown plots within the experimental period due to low pasture competition, and no residual herbicide activity.

The use of glyphosate at 'selective rates' led to increased bare ground and reduced pasture competition leading to more broadleaf weeds at Glen Innes.

Spraytopping at Glen Innes had minimal effect on desirable perennial species whilst reducing CNG basal cover, CNG standing panicle seed, and CNG panicle seed viability.

Timing of strategic grazing during the reproductive period was critical to reducing panicle seed maturation. Sheep stocked equivalent to 300DSE/ha tended not to graze CNG stems once the panicle seed had emerged.

RESULTS OF ACCELERATED EFFORTS FOR MANAGEMENT OF MICONIA CALVESCENS ON MAUI, HAWAII: 2003-2006

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Effort to eliminate the invasive tree *Miconia calvescens* from the Hawaiian island of Maui has in many ways provided a prototype for grassroots statewide efforts to address invasive species issues in Hawaii – involving an inter-agency, partnership approach to capacity-building for assembling a knowledge base, public education, fundraising, strategic planning, and implementation of control. From the discovery of *miconia* in a Maui botanical garden in 1988, awareness and resources have slowly but steadily increased, with federal, state, county, and private entities working in concert. The threat of *miconia* to biodiversity and watersheds in Hawaii has become widely recognized because of its demonstrated (in Tahiti) ability to establish monotypic stands in low- to high-elevation rainforest habitat, to create a barren forest understory with characteristics conducive to reduced infiltration and erosion, and to contribute to instability of steep slopes through its shallow root system. Spot application of herbicides using helicopters as a platform for treating individual *miconia* trees has been used to supplement on-the-ground effort since 1995, with the goal of attaining and maintaining a condition of no fruiting trees. Yet each fruiting tree can annually produce millions of bird-dispersed seeds, providing potential for explosive spread and population growth. By 2001, it became apparent that the scope of the control program was inadequate. During 2003-2006, Haleakala National Park provided leadership and vastly increased resources for *miconia* control on Maui, recognizing the threat of this invasive tree to the park's rainforests of Kipahulu Valley, arguably the most biologically diverse and intact rain forest in the U.S. An area of 14,000 hectares was brought under annual reconnaissance. The number of mature trees detected and killed annually area-wide was reduced from 7,710 in 2003 to 465 in 2006, demonstrating overall programmatic progress toward the goal of zero fruiting trees. But as of early 2007, the ability of the national park to contribute major funding to the effort has been sharply reduced, and partners are scrambling for compensatory funding from other sources in order to maintain momentum.

EFFECTS OF INVASIVE INDIGENOUS AND NON-INDIGENOUS PLANT SPECIES ON FOREST ECOSYSTEM PROCESSES: LESSONS FROM BRITISH COLUMBIA, CANADA

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Displacement of native vegetation and suppression of commercially valuable tree species by exotic and indigenous invasive plants, respectively is a major problem in coastal forest ecosystems in British Columbia (BC). Research trials involving various control methods including manual and mechanical cutting, chemical herbicide, mulching uprooting and bioherbicide have been carried out to manage Scotch Broom, Gorse, Spurge Laurel and English Ivy on federal lands, municipal lands, parks and private lands. Our results have been shown various level of success depending on the target invasive plant, as well as, an integrated management approach might be more successful and sound. Indigenous forest weeds, are serious problem endemic to conifer regenerating sites following harvesting in coastal forests of BC. The most effective and economical way for suppression of indigenous forest weeds is by manual cutting and chemical herbicides. However, herbicide persistence in the environment, have created extreme pressure to develop friendly methods of controlling weeds. Biological control through the use of indigenous pathogenic fungi (mycoherbicides) is an additional tool for management weedy vegetation. To date, we have successfully developed and registered the first biocontrol agent Chondrostereum purpureum as "Chontrol™ Paste" for management of weedy tree species. Ongoing research and development of other bioherbicides for management of forest weeds are salmonberry and salal. Treatments of salmonberry and salal with formulated products of Phoma spp. caused severe damage to these weeds, respectively. The use of the foliar pathogen Valdensinia heterodoxa for control of salal is showing promise in areas where variable retention silviculture are implemented.

INVASIVE SPECIES INFORMATION MANAGEMENT AND EXCHANGE IN THE AMERICAS: I3N

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In the Western Hemisphere, few countries have collected and organized their information on invasive alien species (IAS), and technological barriers often prevent or inhibit access to it, even for local users. Informatics tools for collecting and organizing IAS information can help countries to better manage biological invasions. To overcome this problem, the Invasives Information Network (I3N) of the Inter-American Biodiversity Information Network (IABIN) created a distributed network of IAS databases. I3N is composed of in-country information providers working to implement common standards for IAS information exchange. Each data provider controls its information, though information is documented and posted in a standard format. The public can search the records for free from a single Web page. Software tools to assist with cataloguing and distributed searching were developed by the National Biological Information Infrastructure (NBII, USA), Instituto Horus (Brazil), and Universidad Nacional del Sur (Argentina). Invasive alien species profiles or fact sheets and occurrence information can be collected using the I3N Database for Invasive Alien Species Template, served on the Internet using the I3N Web Template, and exchanged in the globally recognized Extensible Markup Language (XML). The I3N facilitates cooperation among countries and provides education and training on the importance of IAS information exchange and the use of I3N tools. Interest in the I3N concept and tools continues has spread beyond the Americas. Representatives in Africa and Asia are now seeking to collaborate with the I3N and learn how to implement similar networks in their own countries.

EVALUATION OF HERBICIDES FOR CONTROL OF TAENIATHERUM CAPUT-MEDUSAE AND BROMUS TECTORUM IN CENTRAL OREGON RANGELAND, USA

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Medusahead (*Taeniatherum caput-medusae*) and downy brome (*Bromus tectorum*) are serious annual grassy weeds in rangeland areas of the western United States. Research plots were established north of Madras, Oregon during the fall of 2003 to evaluate chlorsulfuron plus sulfometuron at three rates compared to imazapic. These plots were evaluated for control of medusahead and downy brome and for stunting of intermediate wheatgrass (*Thinopyrum intermedium)* during the spring of 2004 through 2006. Additional plots were established during the fall of 2005 to evaluate sulfosulfuron alone or in combination with glyphosate applied in October or November, during the spring of 2006 to evaluate propoxycarbazone applied in the March or November of 2006, and in the fall of 2006 plots to compare a November application of chlorsulfuron plus sulfometuron, imazapic, rimsulfuron and imazapic plus glyphosate. Results from the first set of plots indicate near 100 percent control of medusahead and downy brome at all three rates of chlorsulfuron plus sulfometuron. This compares to 74 to 81 percent control with imazapic. Stunting of the intermediate wheatgrass was observed during the spring following application of chlorsulfuron plus sulfometuron, but not in subsequent years. An increase in the growth of intermediate wheatgrass was observed the spring following application of imazapic compared to untreated plots, presumably due to reduced competition from the medusahead and downy brome.

EFFECT OF HERBICIDE ROUND-UP® (GLYPHOSATE) ON THE INVASIVE GRASS, CYMBOPOGON NARDUS (FRANCH.) STAPF (TUSSOCKY GUINEA GRASS) AND RESPONSE OF NATIVE PLANTS IN KIKATSI SUBCOUNTY, KIRUHUURA DISTRICT, WESTERN UGANDA

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The grass, *Cymbopogon nardus* (Franch.) Stapf (Tussocky Guinea grass) is one of the most prevalent invasive plants in the pastoral lands of the Ankole region in western Uganda. This study investigated the effects of spot sprayed herbicide Round-up® (glyphosate) on *C. nardus* and the response of the plant communities that had been smothered by the *C. nardus* before the application of the herbicide.

There was spot application of Round-up® in demarcated complete stands of *C. nardus* located in five villages in March 2006, after burning in January 2006. Control plots were also established in Kikaatsi and Bukonja villages. In March 2007, all plant species occurring in 1 x 1 m plots established in both treated and control plots were enumerated. A total of 120 plots were established during the survey. Data were analyzed using MVSP, SPSS and CANOCO software.

A total of 137 species belonging to 96 genera and 27 families were recorded in both the control plots and glyphosate treated stands. Herbicide treatment decreased the *C. nardus* density with increased density of other species in the treated plots. These results indicate that glyphosate significantly reduces *C. nardus* and encourages indigenous species to re-establish. Future research and management perspectives are also given.

STRATEGIC ALIEN PLANT MANAGEMENT: DELIVERING BIODIVERSITY CONSERVATION THROUGH LANTANA CAMARA CONTROL

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Determining the impacts invasive alien plants have on biodiversity is a critical step for conservation, especially for widespread alien species which are unlikely to be eradicated. As these species have invaded large areas encompassing many diverse ecological communities, it is essential to identify the biodiversity and invaded sites at risk and then prioritise or rank them based on the level of impact. This two step process (ie selecting species and then sites most under threat) can be used to maximise the conservation outcomes by ensuring control is undertaken at sites where the biodiversity benefit will be the greatest. This paper reports on a national project in Australia, using this two step process to assess the impacts of an alien plant species and deliver on-ground conservation outcomes.

Lantana camara L. is a Weed of National Significance in Australia, with infestations spanning most eastern states. A recent study showed that approximately 10% of all the listed rare and threatened species were at risk from the invasion of *L. camara* just within one state, New South Wales. However, in order to understand the full extent of the impact of *L. camara* on biodiversity, across all species (not just the listed rare and threatened species), the Weed Impacts to Native Species assessment process was used. The distributions of the identified native species at risk and specific site information are now being collected and analysed to determine priority sites for control. Site selection involves assessing individual sites for the level of impact (ie from *L. camara*), the condition of the site (being other threats present and the condition of the population of threatened species present) and the ability to achieve control.

As *L. camara* infestations have been present at some sites for several decades, details of new associations are also being assessed. For example, many native animals, particularly birds, now utilise this alien plant as *L. camara* has replaced the native shrub layer. This information is also critical to ensure conservation outcomes, by ensuring that these native species are not adversely affected during control. To further ensure that conservation outcomes are achieved, information on the other alien plant species present is also being collected. This information will ensure alien plant-substitution does not occur following *L. camara* control. The native biodiversity, which was most at risk from *L. camara*, would then also be protected from any new alien plant threats.

This strategic approach will ensure that the management of alien plants, that do have a significant impact to biodiversity, will deliver conservation outcomes. Given that the widespread assumption that control alone will lead to biodiversity benefits is being rejected by a growing number of studies, new management strategies such as the one detailed here are desperately needed if we are to save native species from the threat from alien plant invasions.

HABITAT PREFERENCE OF INVASIVE SPECIES IN HUNGARY: DATA FROM THE WHOLE COUNTRY SURVEY

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In Hungary between 2002 and 2005 satellite image supported, hexagon grid based, actual field vegetation mapping (abbreviated as MÉTA, which stands for GIS Database of the Actual Vegetation of Hungary) was accomplished that collected data on plant invasion. We used two different spatial resolutions: the hexagon of 35 ha size, and the quadrant of the basic basic quadrate of the Central-European Flora Survey (3500 ha, subsequently mentioned as quadrant). Hungary is covered with 2834 quadrants and 267 813 hexagons.

The area of each (semi)natural vegetation type estimated in each hexagon. In the filedwork 87 vegetation types were distinguished, but during the analysis they were merged into main habitat types: euhydrophyte hahitats, marshes, rich fens and Molinia meadows, eu- and mesotrophic wet meadows, collin and montane hay meadows, halophytic habitats, open sandy grasslands, open rocky grasslands, dry and semi-dry closed grasslands, riverine shrublands and woodlands, mesic deciduous woodlands, steppe woodlands, rocky woodlands, open Quercus pubescens woodlands, dry and closed Quercus woodlands.

On the quadrant scale we recorded the existence and potential negative effect of 15 important plant species or groups: *Acer negundo, Ailanthus altissima, Amorpha fruticosa, Asclepias syriaca, Aster* spp., *Celtis occidentalis, Echinocystis lobata, Elaeagnus angustifolia, Fraxinus pennsylvanica, Phytolacca americana, Prunus serotina, Fallopia* x *bohemica, Solidago* spp., *Robinia pseudo-acacia, Vitis* spp. (excluding the native *V. sylvestris*).

Proportion of areas of main habitat types (see above) endangered by each species was calculated and used to show importance and habitat preference of the studied invasive species.

ALIEN PLANTS OF MARGINAL HABITATS IN TRADITIONAL AGRICULTURAL LANDSCAPE OF SW POLAND

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In agricultural landscapes of Central Europe alien plants are usually linked to arable fields. The available data show that the archeophytes are a prevailing group and neophytes are less numerous. However, in agricultural areas a key role in biodiversity conserving play the marginal habitats of different structure - ditches, field roads, margins and other boundaries, with various amount of shrubs and trees. In these habitats the occurrence of archeophytes is not common but an increase of neophytes, including invasive species, can be observed. In 2004-2006 I studied the occurrence of anthropophytes in typical, rather traditional farmland of SW Poland. Data in 1319 vegetation plots were collected in crosswise transects marked out in 70 independent field margins, randomly selected in an area of about 1000 km2. Data were collected also on crop fields adjoining the transects. The naturalized alien species amounted to c. 15% of nearly 500 vascular plants recorded. Most of them were archeophytes noted almost exclusively in crop fields, but only occasionally in field margins. The opposite distribution pattern was observed in neophytes. In the latter group distinct habitat preferences could be observed (e.g. *Juncus tenusis* to field roads, *Bidens melanocarpa* to riparian zones of ditches), however most neophytes were not specialized and occurred in all habitats (e.g. *Impatiens parviflora, Conyza candensis, Solidago gigantea,* and *S. canadensis*). Moreover, the group of the worst neophytes was surprisingly uncommon, with only two records of *Reynoutria japonica* as an example. Limited numbers and scattered distribution of neophytes in semi-natural habitats of SW Poland indicates that traditionally managed and diverse farmlands are resistant to invasion of alien plants which threat diversity of indigenous flora.

TRANSFORMER SPECIES AMONGST THE INVASIVE PLANTS OF WESTERN AUSTRALIA

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The concept of transformer species provides a useful tool for ranking the seriousness of invasive plants and, therefore, for targeting preventative or other management measures against the most harmful species.

The invasive plant list for Western Australia (WA) now totals 1,233 species of vascular plan, most of which are primarily environmental weeds. Many of the species are poorly known, which makes their prioritisation hard to achieve.

The paper will present an analysis of WA's invasive plant list for species that fit the criteria for transformer species or which are already recognised as such in other parts of Australia or worldwide.

PLANT INVASIONS IN ITALY

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In this study, we present the main results of a project designed to develop a databank of the flora of Italy, financed by the Ministry for the Environment and concluded in the year 2006.

The project considered various aspects of plant invasions in Italy; in this paper,

particular attention is paid to variations in the distribution and the importance of invasive plant species along with the latitude and in the various biogeographical regions.

Owing to the latitudinal and altitudinal extremes of the territory, to differences in land use and to variations in the degree of disturbance, the distribution, status (from casual to invasive) and impact patterns of alien flora in Italy vary considerably, from species 2.100 metres above sea level in the Alps to those threatening the persistence of endemic taxa on Mediterranean islands.

The database shows the distribution, invasive status (casual, naturalised, invasive), and type of impact of alien flora in 21 administrative regions, along the coasts, on 47 small islands and in the 5 largest cities in Italy. Besides biogeographical variations, the flora displays differences in distribution trends related to human impact, such as the degree of urbanization and population density.

This database, which is the first of its kind for Italy, constitutes a tool for setting intervention priorities on both a national and local scale and for monitoring the Italian allodiversity. It is available on CD ROM.

INVASIVE PLANT SPECIES ON ITALIAN ISLANDS

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In Italy, there are more than one hundred marine islands whose latitude ranges from 44°02'30'' (Palmaria) to 35°29'24''(Lampedusa). Although human pressure has been intense for millennia, these Mediterranean islands are peculiar on account of their high biodiversity and the density of endemic plants. High levels of endemism and the threat posed by non native taxa make the monitoring of alien flora and the drawing up of specific control plans a priority in national conservation policies. In 2006 a project on the alien flora of Italy provided a general overview of the distribution and invasive status of alien plant species in 49 Italian islands, revealing that these systems are indeed under threat.

Here, we present results of a related project that focuses on the role of invasive plants species on small Italian islands, and attemps to identify the most threatening taxa to include in action plans. Surveys were carried out on the Pontine islands. Sample units were selected using a random-stratified method. Data on the presence and cover of alien plants were recorded. Information on propagule pressure, residence time, ways of introduction and land use history was collected. Differences in population, size, shape and distance from the mainland were used to compare trends between the islands.

The results shed light on (1) the most invasive species at present and potentially in the future into natural, semi-natural and human-made ecosystems, (2) the relationship between invasion success, vegetation types and disturbance level, (3) the attributes of species associated with invasiveness in island habitats.

INVASIVE ALIEN PLANTS IN MEDITERRANEAN ISLANDS: SETTING PRIORITIEIS FOR ALIEN LISTS IN CORSICA AND SARDINIA

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Alien plant species have been introduced to Europe since ages throughout history. There are regions, such as the Mediterranean basin, where for thousands of years man has been responsible for the spread of ever-increasing numbers of plants taxa introduced for different purposes and quite often entered accidentally and rarely controlled. The two geographically close islands of Corsica and Sardinia share similar features concerning the geological history, the native vegetation, the endemism rate and the land use in the coastal areas and surrounding islets. Nevertheless there also very peculiar differences, mainly in the inner mountain areas, where average altitude is markedly higher in Corsica then in Sardinia.

These insular systems represent a local hotspot on native biodiversity and an area of international interest for habitats and nature conservation.

Coastal areas of both islands share also similar features concerning the composition of their exotic floras and the distributions patterns and impacts of the main invasive aliens, such as *Carpobrotus* spp., *Cortaderia selloana*, *Oxalis pes-caprae*. Due to the geographical position, the two islands are in fact interconnected and there are frequent trade exchanges and tourism flux between them, thus with a higher probability for similar sensitive habitats to be invaded by the same invasive taxa.

Thus, the Conservatoire botanique de Corse is promoting the realisation of regional alien lists with the purpose of setting priorities for intervention (impact assessment, public awareness, removal, control, monitoring), control future introductions from the continental Europe or from other external regions, control the movements of alien species between the two islands, coordinate legislation proposals.

CHANGES OF WEED SEED FLORA IN IMPORTED WHEAT OVER THE PAST TEN YEARS

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Grain trade is supposed to be a major channel of weed seed migration between borders. Many weeds, which occurred in grain field of exporters, are harvested together with crop, and their seed are transported to trading partner regions as mixture of grain and weed seed even after rigorous cleaning process. Those "imported weed" might escape to open environment and can be established as new Invasive alien plant that cause damage to agricultural production or native communities. Because of recent advances of GM crops or newly developed agrochemicals, it is expected that weed species composition in grain fields may have been changed or it can boost even appearance of new-type weed. Those transitions would cause changes of weed seed flora in imported grains, which are potential invasive plant, together with varied method or intensity of grain cleaning system. Therefore, understanding the changes has significance in predicting high-risk invaders and then prevention of new invasion.

In this study, we show the change of weed seed compositions, which contaminated in imported wheat from Canada to Japan, between censuses of 1993-95 (Asai et al., in press) and 2006 under the relation to field abundance of weed. Canada is one of the major exporter of wheat and has well-documented weed flora (Leeson et al., 2005) over the crop production areas. Then, this is a good example for the aim of this study. According to the results, amount of contaminated weed seed dramatically dropped from 1993-95 to 2006 though the field abundances of weed were almost same between 1990's and 2000's. We also found that percentage change of contamination in wheat had no correlation with change of abundance in field, i.e., weed seed that increased percentage in imported wheat were not necessarily a weed that increased abundance in field. These results suggested that the factors excepting field abundance might be important to predict the composition of weed seed in wheat.

THE INVENTORY OF THE ALIEN FLORA OF CRETE: STATE OF THE ART

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The island of Crete (8,729 km2) lying between Greece and Libya, is the most southerly region of Greece and Europe. Relatively high mountains dominate the rugged landscape: the Lefka Ori or White Mountains (2,452m) in the west, Ida or Psiloritis (2,456 m) in the centre, with Dhikti (2,155 m) and Sitia Ori (1,476 m) in the east. The climate of Crete is typically Mediterranean where mean annual rainfall decreases from west to east and from north to south, but increases with altitude. As generally recognised, the potential damage to biodiversity on small and isolated islands is usually greater than that caused on the mainland due to the high proportion of endemic species jeopardised by displacement by alien invasive species and because remote islands typically lack competitors and predators present in the native range of alien invasive species. The Mediterranean basin region has been subject to human intervention for millennia, so that little remains of indigenous ecosystems, especially in the coastal area, where urban and tourism pressure are remarkable severe. Yet the region in general and Crete in particular, is still an important biological resource for native phytodiversity.

Despite the relevance of the processes in act, the actual documentation on the alien flora of Greece, and in particular of Crete, is incomplete and fragmentary.

The aim of this study, started in 2005 and presently in progress, is therefore to carry out the first comprehensive inventory of the alien flora of Crete and distribution mapping of the main invasive alien species. Data from literature and field observations were used to develop a preliminary information database for the inventory that includes, so far, 219 alien taxa. For each species the following information has been collected: origin, status, distribution, life form, phenology, habitat preferences, altitudinal range and introduction pathway.

Mapping data has been stored in a geodatabase using GIS software, and preliminary analysis of the main features of the Crete alien flora is herewith presented. The most abundant and invasive alien species in Crete are *Oxalis pes-caprae, Ailanthus altissima, Robinia pseudoacacia, Carpobrotus edulis, Nicotiana glauca* and *Ricinus communis*.

THE EXOTIC FLORA OF RHODES: PRELIMINARY ANALYSIS

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The Mediterranean island of Rhodes (1.398 km2, 220 km coastline) is one of the largest between the Greek islands of the Aegean sea. The Mediterranean basin region has been subject to human intervention for millennia, so that little remains of indigenous ecosystems, especially in the coastal area, where urban and tourism pressure are remarkable severe. The actual documentation on the native and alien flora of Rhodes is incomplete and fragmentary.

The aim of this study, started in 2004 and presently in progress, is therefore to carry out the first comprehensive inventory of the alien flora of Rhodes. Data from literature and field observations were used to develop a preliminary information database for the inventory that includes, so far, 180 alien taxa, while the former available data accounted for only 90 taxa. For each species the following information has been collected: origin, status, distribution, life form, phenology, habitat preferences, altitudinal range and introduction pathway.

These 180 alien taxa, belonging to 73 families, represent the 15% of the flora of the island. Phanerophytes and therophytes are the most common biological forms.

For the main common invasive species, distribution maps have been produced after GPS field surveys, i.e. for *Ailanthus altissima* (Miller) Swingle, *Agave americana* L., *Arundo donax* L., *Carpobrotus acinaciformis* (L.) L. Bolus, *Carpobrotus edulis* (L.) N.E.Br., *Cortaderia selloana* (Schultes) Asch. et Gr., *Eucalyptus camaldulensis* Dehnh., *Eucalyptus globolus* Labill, *Melia azedarach* L., *Mirabilis jalapa* L., *Nicotiana glauca* Grahm., *Opuntia ficus-indica* (L.) Mill., *Oxalis pes-caprae* L., *Ricinus communis* L., *Xanthium strumarium* L. The main invaded areas are located along the coast and in disturbed, urbanised sites, but also in agricultural areas and in semi-natural habitats.

IS AMBROSIA ARTEMISIIFOLIA SPREADING IN GERMANY? RESULTS OF A SURVEY IN 421 DISTRICTS.

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Common ragweed (*Ambrosia artemisiifolia*) is native to North America and was unintentionally introduced to Europe in the 19th century. The inconspicous plant belongs to the Asteraceen family and produces great amounts of pollen, which may cause allergic rhinitis (hay fever) in humans. Asthma is induced by Ambrosia pollen about twice as often than by other pollen allergens. In highly infested countries such as France and parts of Italy, up to 12 % of the population suffer from allergies to ragweed pollen. During the last decades, Common ragweed spread in various European countries such as Hungary, France, Nothern Italy, parts of Switzerland, and Austria. In Germany, the species first appeared in 1863. Up to the end of the 1970s, only a few, mostly small, established ragweed populations were reported. Since the beginning of the 1990s, however, spreading of *Ambrosia artemisiifolia* has been observed in Baden-Württemberg, in the southern part of Germany. Little information has been available on the species´ distribution in other parts of the country, although a higher public awareness on the plant – mostly raised by the media - suggested an increased occurrence.

In order to get tangible information about the occurrence and spread of Common ragweed in Germany, as well as of pathways of introduction and possible problems resulting for nature conservation, the Federal Agency for Nature Conservation conducted a german-wide survey at the nature conservation authorities from 421 districts ("Landkreise" and "Kreisfreie Städte").

284 districts (67 %) took part in the survey. In 150 (53 %) districts, *Ambrosia artemisiifolia* was found, occurring mostly in small local populations (1-9, respective 10-100 individuals). The species mainly grew in private gardens where it was mostly introduced with contaminated bird seeds. Small populations were distributed over the whole country. Larger populations (> 100 plants), on the other hand, were mainly found in the southern and eastern parts of Germany, predominantly in the federal states Bavaria, Baden-Württemberg, Hesse, Northrhine-Westfalia, and Berlin. These large populations were found not only in gardens, but in different habitats like fallows, in settlements, beside roads or in agriculturally-used areas. The species thus is able to spread from bird feeding places into the surroundings. Human activities like transport of seed-contaminated soil favour its spreading process. This may become problematic when natural habitats are affected. Although *Ambrosia artemisiifolia* does currently not represent a major threat to biodiversity, it seems to have the potential of becoming invasive in the future: 22 districts considered the species problematic for nature conservation, and it was reported to occur already in seven protected areas.

The results of the survey show that indeed *Ambrosia artemisiifolia* more commonly occurs throughout Germany, indicating an expansion of the species' range. In order to prevent further spreading of this potentially invasive plant, monitoring and rapid measures should be considered.

ADAPTATING THE AUSTRALIAN WEED RISK ASSESSMENT SYSTEM FOR USE IN JAPAN

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The Invasive Alien Species Act came into effect in Japan in 2005. To make the Act more effective, it is critical to stiffen regulation of new species introduction. To this end, the establishment of a system to assess the potential risk of all newly introduced plants is necessary. Since the Australian Weed Risk Assessment (AWRA) system has been effective in several regions and formally adopted as a quarantine tool by two countries, a study to adapt the AWRA system for use in Japan was commenced. To this aim, 300 plants present in Japan were selected, and classified by 20 plant experts as "non-weed", "minor weed" or "serious weed" respectively. Each plant was assessed by one or two scientists using a slightly modified version of the AWRA system designed to fit Japanese conditions. The plant experts' classification was subsequently converted to a score (0, 1 or 2 respectively) and averaged. The 300 plants were divided into two groups and two logistic regression curves, namely the probability of a species being a non-weed and of being a serious weed as a function of the system score, were calculated using half of the data sets. The p-values of the deviances were 0.78 and 0.87 for non-weeds and serious weeds, respectively. The WRA scores at which the probability of non-weeds was 90 % and that of serious weeds was 10 % were calculated and a 95 % confidence interval was calculated for each. Based on these values, cut-off levels were set as follows; if the plant scores less than 3, it is accepted for import, a plant scoring 3 to 12 requires further evaluation and if the score is greater than 12, the plant is rejected. These levels were then verified with the other data sets. When the 300 plants were classified according to these levels, 77 species (26%) fell into "further evaluation" category. To reduce this number, a second screening system was considered. When the two-step assessment system was run on the entire number of species, 40 non-weeds (13%) were rejected and 14 species (5%) needed "further evaluation". All of the serious weeds, however, were rejected. From these findings the modified AWRA system was considered to be effective for Japan.

INTRODUCTION, ESCAPING AND HYBRIDIZATION OF COMMERCIALLY PRODUCED NATIVE PLANT MATERIAL FOR LANDSCAPING AND HORTICULTURE ~ A CASE STUDY OF AUCUBA JAPONICA

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Landscaping and horticulture are recognized as major consumer of plant materials. As a result of negative effects of exotic plant materials, people re-evaluate native plant species and tend to use native plant materials. However, commercially produced native plant materials may cause genetic pollution to local populations when the provenances of plant materials are inconsistent with local populations.

Therefore, we investigated the current status of planted *Aucuba japonica* (Aucubaceae) in urban and suburban with molecular information; ploidy level, cpDNA sequence and DNA fingerprint by AFLP. *A. japonica* is a good model species to investigate the impact to local plant population because it has been widely used in gardens, parks and public greening. The objectives of this study were revealing provenance of commercially produced materials and detecting escaping of planted individuals to semi-arable suburban landscape and hybridization between introduced and local plants.

The polidy level and cpDNA sequence analysis showed that limited types of *A. japonica* were used for production in many nurseries despite at least eight types of *A. japonica* were recognized in natural distribution. At the urban site where many commercially produced plant materials were planted, almost half of *A. japonica* sampled was introduced or descendent of those introduced plants, which was incompatible with local population. And at the suburban site, introduced or descendent of those introduced individuals were recognized in some woodlands of semi-arable land where artificial planting was not supposed. It was likely resulted from seed dispersal by frugivore birds of planted *A. japonica* in urban area. In addition, phylogenetic network analysis based on AFLP suggested the hybridization between local and introduced or descendent of those introduced individuals in suburban area, because some clusters in the network contained those two different haplotypes.

Our study showed that a commercially produced native plant material which has different genetic provenance had been distributed and been introduced to the new sites, then, escaped outside and may have hybridized with local wild individuals. It was suggested that there may be some genetic impact of native but commercially produced plant materials in urban and suburban on local populations.

IMPACT OF FALLOPIA × BOHEMICA AND HELIANTHUS TUBEROSUS ON THE RICHNESS AND COMPOSITION OF PLANT COMMUNITIES IN WESTERN HUNGARY

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Fallopia × bohemica and *Helianthus tuberosus* belong to the most dangerous alien environmental weeds in Western Hungary. They are generally considered by plant ecologists and nature conservationists as a threat to biodiversity, but until now there were no quantitative data about their effect on the vegetation of invaded areas in this region.

In this study a comparative approach was use to estimate the impact of these two invasive species on the (semi)natural plant communities. The impact of Fallopia and Helianthus was studied in 41 and 23 sites, respectively. Three plots were sampled in each site: one in the dense Fallopia/Helianthus stand, one in the non-invaded plant community and one in the transition zone between them. The percentage cover of plant species were visually estimated and then the following characteristics were calculated: species richness, Shannon diversity, proportion of shadow tolerant plants and proportion of Grime's strategies. These calculated characteristics of three phases of invasion (i.e. uninvaded area, transition zone and close stand) were compared by Friedman's non-parametric ANOVA.

Species richness and diversity decreased due to invasion of both plants. They were significantly lower even in the transition zone than in the original vegetation. The proportion of shade tolerant species did not change. It indicates that decreasing species richness is caused not only by shading of invasive species. Proportion of specialists decreased during invasion in both cases. *Helianthus* invasion did not influence significantly the proportion of competitor and ruderal species, while in the case of *Fallopia* proportion of ruderals slightly decreased, proportion of competitors slightly increased during invasion.

This so-called comparative approach supposes that before invasion there was no differences between plots of a site, therefore the data are not considered to be a rigorous proof of the causal relationship between the invasion and differences between invaded and uninvaded plots. However, this comparative approach, often used in studies on vegetation succession, where it is termed a 'space for time substitution', allows to account for a wide range of invaded communities and regions and yield general conclusions.

ECOLOGICAL IMPACT ASSESSMENT OF AN INVASIVE TREE PROSOPIS JULIFLORA IN A PROTECTED AREA IN INDIA

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Invasive plants have been identified as one of the major threats to ecosystem functioning and biodiversity. A study was conducted in early 2006 using random sampling method and quadrat as the sampling unit, in a protected area situated in the outskirts of the National Capital Territory of Delhi in India, to investigate the relationship of *Prosopis juliflora*, an invasive tree species, with species diversity and native species of the area. The results reveal that the most dominant species of the area was *P. juliflora* exhibiting highest values of density, frequency and basal area. There was a declining trend in the population of most of the native species of the area. Correlation analysis reveals a significantly negative relationship of *P. juliflora* density with tree species diversity, density of some native species of trees and shrubs. Regression analysis further establishes that tree density of *P. juliflora* negatively affected species diversity in the area.

The goal of many invasive species control strategies is to reduce the density of the invasive species to a certain safe level or threshold. The results, in the present study, reveal that individuals of some native shrub species and the younger age classes of native tree species were more abundant when the *P. juliflora* tree density was below the range of 600 individuals per hectare. This density of the invasive species, P. juliflora, may be considered as a threshold while planning control strategies.

PSIDIUM CATTLEIANUM: ECOLOGY AND IMPACTS OF AN INVASIVE TROPICAL TREE

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Psidium cattleianum Sabine (strawberry guava) is a small tree introduced to Hawaii in 1825 from Brazil and considered one of the state's most disruptive alien weeds. On all the major Hawaiian islands as well as on many other tropical islands in the Pacific and Indian Oceans, nearly monotypic stands of this species infest thousands of hectares of mesic and wet forest. It is a serious threat to native forest ecosystems due to its ability to invade even relatively undisturbed wet forests and form thickets up to 10 m high with dense mats of feeder roots. On Hawaii Island, *P. cattleianum* infestation impedes *Acacia koa* silviculture and, because it is a wild host of economically important fruit flies, limits crops grown by Hawaii farmers. We report on studies of the ecology and economics of strawberry guava on Hawaii Island. In lowland wet forest dominated by *Metrosideros polymorpha* (900 m asl), demographic studies document high rates of population growth through both seedling and sprout recruitment contributing to high local stem densities (>15,000 stems/ha). Density and diversity of native species are inversely correlated with *P. cattleianum* basal area. *P. cattleianum* seed banks are ephemeral (< 6 mo), however, with most seed depletion due to rapid germination and seed predation by rodents. The lack of a persistent seed bank suggests that coupling biological control with chemical and mechanical treatments may be able to reduce impacts in target areas. Using Genetic Algorithm for Rule Set Production (GARP) to project the potential range of *P. cattleianum* on Hawaii Island, we estimated economic impacts on agriculture, silviculture and conservation reserve management. Our data suggest that *P. cattleianum* has almost reached the extent of its potential range on the island and that actual and potential costs to conservation, agriculture and silviculture are high.

WEED INVASION IN EPHEMERAL FLOODPLAIN WETLANDS ALONG THE MURRAY RIVER, SOUTH-EASTERN AUSTRALIA: A CONSEQUENCE OF RIVER REGULATION?

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Riparian ecosystems are particularly susceptible to weed invasion. Their high vulnerability suggests that, as well as invaders driving invasion, the characteristics of riparian zones are important. Indigenous vegetation is adapted to the natural conditions of riparian zones, so changes to these conditions may disrupt life history processes and may ultimately prevent regeneration. Human-induced eutrophication, increased grazing pressure and altered flooding regimes of riparian zones may provide conditions that advantage exotics over natives. This study examined whether riparian weed invasion is principally driven by the characteristics of the invaders or characteristics of the ecosystem, with a particular focus on flooding regime.

Vegetation in 50 ephemeral floodplain wetlands along the Murray River was surveyed at a number of spatial scales. Floristic patterns were examined in relation to species and site characteristics, including the recent and historical flooding regime of the wetlands. The distribution and abundance of particular native and exotic plant species were examined in more detail, especially in relation to hydrology.

This study will determine whether particular exotic and native plants have specific water regime requirements or whether they are able to occupy areas with a variety of conditions. The spatial distribution of weeds may suggest whether weed infestation is chiefly controlled by species and the opportunity to invade or by environmental conditions, like water regime. If weeds have specific hydrological requirements for example, water regime management could be a way to manage riparian weed populations. Conversely, if invasion is driven by the invading-species rather than site conditions, then weed management should focus on reducing the avenues of introduction and possibly promoting the health of indigenous plant populations.

THREATS TO BIODIVERSITY IN PERTH URBAN REMNANT VEGETATION FROM NITROGEN DEPOSITION

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Nitrogen deposition effects on plants have been studied extensively in the Northern Hemisphere but there has been little research within Australia. Studies have shown that vegetation biodiversity and community composition change as a result of airborne nitrogen (N) enrichment with species rich low nutrient regions sensitive to small changes in N deposition (<10kg N ha-1 y-1) at greater risk. Enhanced nitrogen inputs and therefore availability may lead to the competitive exclusion of native species by invasive nitrophilic species, especially on nutrient-poor soils. The Perth urban area is part of a South-west Biodiversity Hotspot supported by mainly low nutrient soils. Therefore understanding the potential for change to Perth's existing remnant vegetation diversity, structure and abundance from N deposition is vital. This study has made a preliminary assessment of species diversity and abundance at nine locations across the Perth Metropolitan area. Sites are located on the same soil/vegetation (Spearwood Dune/Karrakatta Soils – *Banksia* Woodland) complexes to minimise non-targeted variables. Further work to quantify the gradient of NOx deposition rates across the Perth metropolitan area through analysis of targeted species leaf nutrient concentrations, isotope (leaf 15N signature) analysis, Glasshouse trials of N additions (fertiliser) and atmospheric N modelling to determine N gradients is ongoing.

COGONGRASS (IMPERATA CYLINDRIA (L.) BEAUV.) INVASION OF FOREST COMMUNITIES OF THE U.S. SOUTH: DOES DIVERSITY MATTER?

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Cogongrass (*Imperata cylindrica* (L.) Beauv.), a perennial grass native to southeast Asia, has become one of the most serious exotic pests in the southeastern U.S. The forestlands in the Southeast are being occupied by this non-indigenous species at an alarming rate threatening their ecological integirty. In the 1950s Charles Elton hypothesized that more diverse communities should be less susceptible to invasion by exotic species (biodiversity-invasibility hypothesis). The biodiversity-invasibility hypothesis postulates that species-rich communities are less vulnerable to invasion because vacant niches are less common and the intensity of interspecific competition is more severe. We conducted a mesocosm experiment in which the role of species and functional richness in resisting invasion of cogongrass was tested. Preliminary results indicate that diversity and functional richness are both important in resisting invasion of cogongrass. However, certain species are better in competing with cogongrass than other species and their presence in the communities may be more important than the mere number of species. Results will be discussed with respect to the mesocosm experiment and prior field experiments in which Elton's hypothesis was tested.

PATTERNS OF DISTRIBUTION OF ALIEN PLANT SPECIES IN LARGE RIVERS VALLEYS OF CENTRAL EUROPE

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Rivers' valleys create significant routes of migration for plants, animals and people. They also create environment of occurrence of many plant species and communities, frequently attached in great measure to riparian habitats (Burkart 2001). These areas undergo particularly intensive changes owing to natural processes in rivers' valleys as well as to man's activities. Both factors cause that rivers valleys have become suitable places for colonising them by alien species. Distribution and occupancy in river valleys by native and alien species is not uniform considering frequency, abundance and occurrence in particular sections of a valley (Anioł-Kwiatkowska et al. 2005). However, investigations conducted by the authors have revealed some regularities in distribution of alien species that may be presented as two basic patterns: a linear and a point ones. Linear patterns of distribution are typical for majority of alien species and depending on a valley's character, they can be differentiate on linear-continuous, linear-polar, linear-interrupted and linear-dispersed ones. The point pattern of distribution refers to species recorded quite recently as introduced plants in a valley. The remaining patterns are characteristic for naturalized species. Different patterns of alien species' distribution result, among others, from a stage of their invasion. Neophytes also show tendencies to change a pattern that may be caused by progressive degradation process of the valleys environment. Simultaneously, a distinct relation between occurrence and invasion of some alien species and a type and degree of anthropogenic transformation of various river's sections is perceptible. The greatest number of neophytes penetrating natural or semi-natural ecosystems is observed in sections with the highest degree of transformation of the riverine environment and with rich shipping infrastructure (Dajdok et al.1998, Dajdok, Kącki 2003).

Dajdok Z., Anioł-Kwiatkowska J., Kącki Z. 1998. Impatiens glandulifera Royle in the Floodplain Vegetation of the Odra River Valley (West Poland) [w:] Starfinger U., Edwards K., Kowarik I., Williamson M. (eds.) Plant Invasions: Ecological Mechanisms and Human Responses: 161-168, Backhuys Publishers, Leiden, The Netherlands.

Burkart M. 2001. River corridor plants (Stromtapflanzen) in Central European lowland: a review of a poorly understood plant distribution pattern. Global Ecology & Biogeography 10: 449-468

Dajdok Z., Kacki Z. 2003. Kenophytes of the Odra riversides. [w:] Zajac A, Zajac M., Zemanek B. (eds.). Phytogeographical problems of synanthropic plants: 125-130

INFLUENCE OF THE NEOLITHIC SETTLEMENT ON DISTRIBUTION AND CONCENTRATION OF ANTHROPOPHYTES

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Man's influence on species dispersion and unconscious or conscious introduction of them into new environments have already had their beginning in early stages of Central Europe colonization by the Neolithic people in the postglacial period. Fundamental changes in a primeval landscape during people' expansion onto Central Europe area caused the first invasion of many plants, in them of native taxa synanthropizing themselves. Records of these changes have been visible till today in distribution of selected taxa and in their distinct concentration on areas covering sites of the Neolithic settlements. In the presented work, we have undertaken an attempt to follow both development and rate of occupancy in new areas by anthropophyte species in the subsequent Neolithic phases (early, middle and late). This problem has been analyzed in an area well recognized archaeologically (Kulczycka-Leciejewiczowa 1993). A relationship between plant species occurrence and the Neolithic settlement sites has been examined in a grid of squares with a minimum area of 100 km2. Positive correlation between settlements' distribution and both sites and plant species richness has been revealed. In particular, the correlation is noticeable in case of calciphilic archaeophytes of Mediterranean-Iranoturanian origin (Anioł-Kwiatkowska, Kącki 2006). This relationship refers also to many species regarded as native elements of floras. The obtained results may be applied in an analogous way to newcomer species, which first stages of colonization or introduction have been recorded in places transformed by man (settlements). Therefore, has the contemporary expansion of neophytes similar genesis to the historical dispersion of archaeophytes or is similar in consequences?

Anioł-Kwiatkowska J., Kącki Z. 2006. Species diversity of segetal plant communities in the early-Neolithic settlement area of the Ślęża Landscape Park. Acta. Soc. Bot. Pol. 75/3: 257-262

Kulczycka–Leciejewiczowa A. 1993. Neolithic Settlement in South-Western Poland. An Outline of Spatial Organization. Instytut Archeologii i Etnologii, PAN, Wrocław. (in Polish with English summary)

NEGLECTED, ADJOINING TO THE MANSION PARKS AS A PLACE OF THE OCCURRENCE AND EXPANSION OF ALIEN AND INVASIVE PLANT SPECIES

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Adjoining to the mansion parks are permanent element of landscape in many regions of Poland. Such parks were being established in the 19th century, mainly. Many alien plant species have been introduced into their areas. After the World War II, due to the change of the geopolitical situation, numerous parks were neglected and wrongly managed. Therefore they are perfect study areas where the naturalization and expansion of alien taxa can be observed. Also, they can play a role of the centres of expansion of alien species into the local flora. Twenty one objects in south west Poland were researched for a few years. The proportional participation of alien species in the flora, dynamic tendencies, degree of hemeroby, and ability of expansion beyond the park area were determined. The hitherto investigations shown that from among 401 plant taxa recorded in all researched abjects, up to 95 are alien plants. The dominant group of anthropophytes are rare taxa, occurring in 1-3 parks. The majority of alien species does not revive, some of them reproduce vegetatively and frequently conquer considerable park areas. Part of them f.e. *Robinia pseudoacacia, Amelanchier spicata, Euonymus latifolius* are characteristic of expansiveness, appearing with their penetration into the plant communities bordering on the parks.

COMPARISON OF PHENOTYPIC PLASTICITY IN GROWTH RESPONSES TO LIGHT OF TWO INVASIVE SPECIES AND THEIR NON-INVASIVE CONGENERS.

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Alternanthera philoxeroides (Alligator weed) and *Phyla canescens* (Lippia) are two exotic weeds invading wetlands and riparian habitats in Australia. Current management methods are only partly effective in controlling the invasion. To develop more effective management methods, we need to understand how ecosystem properties are linked with community invasibility. Recent theory has emphasized the concept of niche opportunity, which is comprised of enemy escape and resource availability. Greater phenotypic plasticity may give invasive species an advantage over native species when competing for limiting resources.
In this study, we compare the growth response of two invasive plants along with their native non-invasive congeners: Alternanthera denticulata and Phyla nodiflora at two light levels under glasshouse conditions. Reduced light availability had a negative effect on the biomass of all species; it reduced their relative growth rate significantly. As expected *Alternanthera* species responded to shading by an increase in leaf area. However, *Phyla* species didn't respond to shading by increasing leaf area. In this presentation, we discuss further results (morphology, allocation and physiology) and implications for managing these two introduced weeds.

NEW ZEALAND'S NATIONAL PEST PLANT ACCORD: MANAGING INVASIVE PLANTS IN THE HORTICULTURAL TRADE

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A challenge in invasive plant management is the popularity of some invasive plants in horticulture and home gardens. The National Pest Plant Accord is one approach used in New Zealand to the problem of managing invasive plants that are in the horticultural trade. It is a cooperative agreement between central government agencies, local government agencies and the Nursery and Garden Industry Association.

Decisions on which species to include in the Accord are based on a combination of weed risk, management benefit of inclusion in the Accord and costs, e.g. costs to the garden industry. The decision on which species to include is made by a Steering Group, made up of representatives of the agencies that are parties to the Accord. The steering group is advised by a Technical Advisory Group which is comprised of scientists with knowledge of various aspects of weed management. The public is able to comment on species proposed for inclusion in the Accord list prior to the final decision.

The Accord has advantages associated with both voluntary and legislative approaches to managing invasive plants. As with a voluntary agreement, species are only included on the Accord with the agreement and support of the Nursery and Garden Industry Association, but once included on the Accord they are legally prohibited from sale, propagation and distribution under provision of the Biosecurity Act 1993.

The list of species prohibited under the NPPA was reviewed in 2006 and comprises 109 species and four genera.

FACTORS AFFECTING ALIEN WEED SPECIES COMPOSITION AT INITIAL INTRODUCTION BY GRAIN TRADE: COMPARISON AMONG THREE COUNTRIES.

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Many worldwide invasive plants were introduced accidentally or intentionally through global commerce. Identifying general attributes of introduced species is effective step to prevent their establishment and spread. It has been reported that various kinds of weed seeds were contained in imported grain seeds. For understanding opportunities for alien species introduction by grain trade, it is needed to take account the human-mediated processes such as harvesting and cleaning. In this study, we analyzed the effect of the field abundance of weed and the human-mediated processes on the weed seed quantity included in wheat. We surveyed wheat imported from Australia, Canada, and USA to Japan. Although the introduced species compositions were different among countries, common trends were detected: the field abundance of weed was positively correlated with weed seed quantity; only a few seeds of Asteraceae were found in wheat irrespective of the dominance of Asteraceae species in wheat fields. This is because many species of Asteraceae produce seeds with pappus, which were easily eliminated from wheat in the cleaning process or might be dispersed at harvest time. Now, newly appeared noxious weeds are expected because the adoption of genetic modified crops, changes in herbicides and tillage systems, and crop diversification have brought about changes in weed communities. Therefore, information on how many propagules of each species were introduced becomes increasingly important because the information is essential for assessment of the invasiveness.

WEED MANAGEMENT PRACTICE CHANGE WITHIN THE VICTORIAN GARDEN INDUSTRY

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Many popular and beautiful garden plants have escaped from the garden environment and become invasive, infesting agricultural areas and natural places. The Victorian garden industry is a key ally in helping to prevent invasive plants from being introduced, distributed and promoted, and in educating the community about this issue.

To encourage and motivate the garden industry to take leadership on the issue of invasive plants, the Victorian Government's Tackling Weeds on Private Land Initiative has engaged with several industry segments. A range of engagement tools and approaches such as information dissemination, education, sharing of knowledge, building trust and developing partnerships have paved the way for ongoing communication and opportunities for all to work together. The result of this approach has been an increase in industry awareness, acceptance and action on weeds.

Key garden industry associations, such as the Nursery and Garden Industry Victoria and Landscape Industries Association Victoria, have worked collaboratively with the Department of Primary Industries on several projects to support minimising weed spread across the industry and community. These projects include; industry certification, staff training, an industry forum and the development of a booklet promoting alternatives to some potentially invasive garden plants that are currently for sale in nurseries.

This poster demonstrates how through; stakeholder analysis, industry mapping, attitude benchmarking and identification of barriers to, and drivers for, adoption, engagement strategies targeted at different segments of the industry can be developed and implemented to successfully achieve practice change within the garden industry.

PREDICTING WHERE TO FIND NEW WEEDS AND RARE PLANTS USING GIS

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In order to protect conservation resources managers must know where resources are located. This is particularly difficult in the case of rare or special status plant species. This project uses GIS to evaluate how environmental and topographic characteristics can be used for spatial modelling of rare plants – both new incursions of weed species and existing populations of rare plants. A model is developed for the 17 known locations of Hulsea brevifolia, a California endemic, within Yosemite National Park, USA. Two types of habitat models were produced: 1) an expert-based, non-statistical, habitat model derived as a weighted overlay in ArcGIS 9.1 and 2) a statistically based, empirical model derived in a statistical software program and applied in GIS. This modelling technique is then applied to a New Zealand weed species using known weed ecology parameters, human impact/disturbance delineations, and terrain indices derived from digital elevation grids (including slope position, terrain ruggedness, solar radiation, and other indices).

SEARCHING FOR WEEDS – HOW TO LOOK IN PLACES WHERE THE WEEDS ARE.

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Sampling for rare events, such as a new weed incursion, is not easy. At most of the sample points weeds will be absent. This means that the resultant sample of weed densities has many zero-values, and typically a few large values.

The optimal survey design would be one where initial sample effort is focused on locations where there is a high likelihood of a weed being present. Adaptive, unequal probability survey designs can be used to improve survey efficiency, so that time in the field is spent within locations where weeds are present and minimal time spent where weeds are absent.

We use a GIS spatial model of weed incursion and growth to define optimal surveillance and monitoring strategies for weeds. We develop multi-stage adaptive unequal probability sample designs where, as new information on habitat suitability becomes available, sample designs are modified. The sample designs will include a measure of the trade-off between the cost of failing to detect a weed at a site, and the cost of failing to visit all sites.

COMPARING STATISTICAL MODELS APPLIED TO THE DISTRIBUTION OF ALIEN AND NATIVE PLANTS IN SARDINIA

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A key requirement for the effective management of invasive plants is the ability to identify, map, monitor actual invasions and predict future trends. Biological invasions are considered to pose a threat to the conservation of natural habitats and native species worldwide and the islands of the Mediterranean basin are highly vulnerable to the entrance of alien species due to their dependence on external trade, the high rate of urban development in coastal areas, land use change trends and the dense communication network.

The distribution of 14 alien, 1 cryptogenic and 2 native species in the Mediterranean island of Sardinia has been recorded in the field by GPS and stored in a geographical database.

We used regression models to assess relationships between actual distributions and environmental predictors and to evaluate possible range expansion. The analysis showed that ecological gradients of temperature and precipitation strongly influence the distributions of both native and alien species. But human activities also appear to affect species distributions: e.g. distance to roads, which we interpret as an indicator of disturbance as well as intensity of human dispersal, is positively associated with many alien, but few native species. The models are generally much improved by including spatial random effects, indicating that there is much spatial pattern that the environmental variables do not explain. For the alien species, we propose that spatial association is so important in explaining current distributions because many of these species are not in equilibrium with the present environment, and therefore range expansion is to be expected.

Time plays an important role for the establishment and spread of alien plant species, thus distribution pattern as well as the degree of naturalization will generally be a function of time. Our analysis suggests that the distribution of some of Sardinia's alien species is far from equilibrium, whereas some of them appear to have already attained a post-invasive status, i.e. archeophytes or neophytes with a stable (not increasing) or even decreasing population and range.

DESIGNING A CONTROL STRATEGY FOR MICONIA CALVESCENS IN HAWAII USING SPATIAL MODELING

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Knowledge of the extent of an invasive species' distribution is necessary for effective control, eradication, and evaluation. In addition, prediction of the potential distribution is useful for planning control efforts and evaluating success. Considerable time and resources have gone into the control of the widespread weed, *Miconia calvescens* DC (Melastomataceae), in Hawaii, since the early 1990's. *Miconia* threatens wet and mesic forests of Hawaii and infestations currently range from incipient on Kauai and Oahu to widespread on Maui and Hawaii. Eradication is the goal for all islands except Hawaii, which has the largest infestation, and whose goal has been containment. The spatial niche model, Desktop GARP (Genetic Algorithm for Rule-set Production), provides a means to predict potential distribution of the weed *Miconia* in Hawaii. The GARP model was used to analyze the relationship between GIS-based information on environmental gradients (in this case, elevation, precipitation, slope and windwardness) and *Miconia* presence to develop a set of rules describing constraints on the range of *Miconia* in Hawaii. Two maps of the potential distribution of *Miconia* in Hawaii were produced: the first with data on rainfall and elevation parameters derived from *Miconia* locations in Tahiti; the second map derived from a GARP model using current *Miconia* presence in Hawaii. These models, along with maps of predicted tree densities and information on control costs were used to develop a long-term containment strategy as well as to direct control and monitoring activities for the Big Island Invasive Species Committee on the island of Hawaii.

POTENTIAL EXPANSION OF THE INVASIVE ALIEN OPUNTIA FICUS-INDICA S.L. IN SARDINIA UNDER CLIMATE CHANGE

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Cactaceae is a diversified group of New World plants presenting a wide array of evolutionary and ecological strategies, and adapted to many different habitats. Within this family, the species of the genus *Opuntia* are remarkably successful and widespread throughout the globe. One hypothesis is that they occupy areas where there is little competition from other plants, particularly when growing under extreme conditions (e.g. arid zones in the Mediterranean region). Nevertheless the distribution of *Opuntia* spp. in the Mediterranean is influenced by different factors. Among them, anthropogenic activities through repeated introductions, cultivation as crop or forage, utilization in agricultural areas for fencing, are probably the most important factors explaining the current distribution of the species. Land use changes and especially land abandon, could promote further range expansion. List but not last, birds and other animals spread fruit and seeds.

In the Mediterranean basin, the distribution of *Opuntia* is clearly delimited in altitude suggesting thus that colder climatic conditions found at the higher altitude are strongly constraining the widening of the invaded area. This implies that the altitudinal expansion of its range is likely to be greatly favoured by warmer climatic conditions expected by the end of this century.

For the present study, the distribution of *Opuntia ficus-indica* has been recorded in 2000-2005 in the island of Sardinia by GPS field surveys, collecting presence (and abundance) data in 1,400 sites and absence in 6,600 sites. The surveyed road network of Sardinia has been estimated of 12,060 km. The field survey was performed on the total asphalt road network but also on secondary non-asphalt roads and small paths, mainly in inner mountain areas, along the coast and in agricultural and forestry areas.

In order to estimate the potential impact of climatic changes of the Mediterranean distribution of *Opuntia* during the coming century, we used a niche model to predict the species occurrence. This model is based on machine learning techniques, which present some advantages with respect to statistical methods: they are able to deal with complex relationships between predictors, are able to process non-linear relationships between them and are able to process complex and noise data. The model has been calibrated for using the above mentioned *Opuntia* distribution dataset as well as a set of 5 bioclimatic variables (mean temperature of the coldest month, mean temperature of the warmest month, growing season warm, number of chilling days and a drought index) calculated from daily climatic values coming from about 240 meteorological stations homogeneously spread in Sardinian territory for the period 1961-1990. We then used these 5 bioclimatic variables calculated on two climatic scenarios from the HadCM3 GCM to estimate *Opuntia* distribution for the periods 2041-2050 and 2091-2100.

PREDICTING THE RELATIVE SEED LONGEVITY OF QUEENSLAND WEED SPECIES

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Management of weed species is often complicated by the unknown status of their soil seedbanks. The complexity of soil-seed interactions means that persistence of seeds in a particular environment is often difficult to quickly and accurately predict. Field trials, although accurate in their context, are time-consuming and expensive to conduct for individual species. Laboratory-based life expectancy tests do exist, but these fail to simulate the environmental complexity of field conditions and it has been questioned whether or not tests such as the accelerated ageing test are useful indicators of field persistence. This study aimed to test the suitability of the accelerated ageing test (seed ageing at 45°C and 60% RH) for predicting field persistence of weeds in Queensland. It was motivated by a comparison of the field persistence of northwest European species with their longevity as measured using the accelerated ageing test, which demonstrated a significant positive correlation and thus a role for this simple test in estimating field persistence.

Thirteen species of emerging and common weeds of Queensland – including *Gymnocoronis spilanthoides* DC. (Senegal tea plant), *Gomphocarpus physocarpus* E.Mey (balloon cotton bush), and *Ligustrum lucidum* L. (broadleaf privet) – were assessed for their seed longevity using the accelerated ageing test. By ranking these species based on their performance in the test, predictions about their relative longevities were made. Ideally, in the future these predictions should be compared to results of field trials to verify the test's applicability to Queensland weed species and conditions, and moreover to inform and refine future laboratory-based tests for predicting weed seed persistence.

CAN INVASIVENESS OF NATURALIZED PLANTS BE EXPLAINED BY USING REPRODUCTIVE CHARACTERISTICS?

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Attempts to predict which species will become invasive are an important part of research in plant invasions. Traditional approaches searching for species attributes as determinants of invasiveness have been based so far on different characteristics, some of which are difficult to obtain for a large numbers of species. There is an agreement that reproductive characteristics are crucial for the outcome of invasion, but for these traits usually only vague estimates are available. To obtain solid information on reproductive characteristics for a large number of species, we sampled naturalized neophytes of the Czech flora in the field and laboratory. About 80 species were selected in order to include both widely naturalized and invasive aliens and those with limited distribution, in order to cover various types of invasive behaviour. Obtained information on fecundity, pattern of germination and dormancy, diaspore morphology, dispersibility, seedling RGR, breeding system, clonality, and genome size were analysed by maximal adequate models. Parameters of invasion in the Czech Republic (degree of naturalization, total number of localities, rate of spread, year of introduction, etc.) were used as dependent variables and reproductive traits as predictors of invasiveness. By employing a comparative ecological approach, we tried to diminish the gap between comparative studies of alien floras and detailed case studies of particular species.

INVASIVE SPECIES INFORMATION MANAGEMENT AND EXCHANGE IN THE AMERICAS: I3N

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In the Western Hemisphere, few countries have collected and organized their information on invasive alien species (IAS), and technological barriers often prevent or inhibit access to it, even for local users. Informatics tools for collecting and organizing IAS information can help countries to better manage biological invasions. To overcome this problem, the Invasives Information Network (I3N) of the Inter-American Biodiversity Information Network (IABIN) created a distributed network of IAS databases. I3N is composed of in-country information providers working to implement common standards for IAS information exchange. Each data provider controls its information, though information is documented and posted in a standard format. The public can search the records for free from a single Web page. Software tools to assist with cataloguing and distributed searching were developed by the National Biological Information Infrastructure (NBII, USA), Instituto Horus (Brazil), and Universidad Nacional del Sur (Argentina). Invasive alien species profiles or fact sheets and occurrence information can be collected using the I3N Database for Invasive Alien Species Template, served on the Internet using the I3N Web Template, and exchanged in the globally recognized Extensible Markup Language (XML). The I3N facilitates cooperation among countries and provides education and training on the importance of IAS information exchange and the use of I3N tools. Interest in the I3N concept and tools continues has spread beyond the Americas. Representatives in Africa and Asia are now seeking to collaborate with the I3N and learn how to implement similar networks in their own countries.

REMOTE SENSING AND GIS TO ASSESS INVADED HABITATS IN THE LA MADDALENA NATIONAL PARK (SARDINIA, ITALY)

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In parks and protected areas of almost every country, alien plants may represent a significant percentage of the total flora and invade different sensitive habitats. With increasing rate of human disturbance and visitation rates, in many parks and reserves inside Mediterranean islands, alien plants are a growing threat to native, endemic or endangered species, and may drive significant changes in the native ecosystems and landscapes. Although Italian legislation in force forbids the introduction of exotic species inside National, regional parks and sites of community interest (i.e. protected by the environmental European Union legislation) and lay down management guidelines, there is already a noteworthy presence of exotic plants in all Sardinian protected areas, due a very long history of introductions, deliberately and accidentally human-driven and incomplete awareness of the problem.

Since 1991, the Italian framework law on protected areas, has been calling for the establishment of an Italian "Carta della Natura", i.e. a mapping document on the national environmental resources. On the basis of this legal commitment, the APAT (the Italian national agency for the environmental protection) has established a national network, with regional focal points responsible for the RS/GIS/mapping project. The presence of invasive alien in protected habitat represent an important parameter for the evaluation of the general environmental quality of the sites and of each single protected habitat. The methodology in use is comparable with those applied in the other regions of the Italian territory, with the necessary modifications and integrations, to fit with the regional peculiarities. Satellite imagery (Landsat TM) represents the fundamental informative layer to provide a synoptic view of the whole territory at a single to few date(s), as well as as for further monitoring. Other remotely sensed imagery of higher resolution (IKONOS) although less radiometrically informative, are very useful for providing precise updates on land-use changes. The classification methodology (i.e. supervised classification) basically uses spectral features of the data (after radiometric and geometric correction) and ground control points (or areas) acquired by GPS positioning. Furthermore, in a second proceeding step, classification is thematically enhanced by using logical niche models of species and habitats derived from assessed relationships between species-habitats known distributions patterns and available predictors, i.e. GIS thematic layers such as DTM, soil types, geology and land-use and land-use change.

APPROACHES TO SELECTING REPLACEMENTS FOR INVASIVE PLANTS FOR USE BY FRUGIVOROUS BIRDS

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Invasive plants can be a source of conflict for conservation managers. While the detrimental impacts of plant invasions on biodiversity and ecosystem function are well known, invasive plants can perform important roles in supporting fauna. Fleshy-fruited invasive plants, for example, can provide food that subsidises indigenous frugivore populations. How can such conservation vs. invasive plant control conflicts be managed? We suggest one approach in which indigenous plants that are functionally similar from the perspective of indigenous frugivores are identified. These could then be used to replace the invasive plants in ecological restoration projects, at highly modified sites where fleshy-fruited plants are an ecologically appropriate part of the goal community, natural seed sources are insufficient and support for frugivore populations is required, and in urban gardens and parks. We demonstrate approaches based on either fruit characteristics or the frugivore communities of the invasive and indigenous plants. We illustrate these methods using *Lantana camara*, the most significant invasive plant problem in south-east Queensland, as the target species. Those indigenous plants identified as functionally similar on the basis of fruit characters were used by more of the frugivores of *L. camara* than randomly, providing limited validation of the approach.

ROLE OF BIRDS IN THE SEED DISPERSAL OF INVASIVE PLANT SPECIES LANTANA CAMARA (LINN.) IN A TROPICAL DECIDUOUS FOREST OF CENTRAL INDIA

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The tropical forest of central India have suffered the most disruption from exotic hedge plant species, *Lantana camara*. Eight species of birds (*Carpodacus erythrinus, Dicaeum agile, Psittacula cyanocephala Psittacula krameri, Pycnonotus cafer, Sturnus malabaricus, Sturnus pagodarum , Turdoides striatus*) have been found to feed on the ripe fruits of *Lantana camara* in a tropical deciduous forest of Chhuhia, Rewa (M.P), India. Birds usually swallowed whole fruit and voided seeds by defecation or regurgitation (*Sturnus* sp.) beneath the canopy of perching trees and shrubs of the forest. Each frugivore consumed an average of 5.32 fruits during any foraging bout. The frugivorous birds removed approximately 276.57 seeds per day per plant of the shrub in the forest. Out of eight birds *Turdoides striatus, Pycnonotus cafer* and *Sturnus pagodarum* performed much of potential seed dispersal events and proved themselves as principal seed dispersers of *Lantana camara* in the forest.

WEED MANAGEMENT PRACTICE CHANGE WITHIN VICTORIAN LOCAL GOVERNMENT

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Victoria's Tackling Weeds on Private Land Initiative has worked with and influenced a range of key stakeholders over the past three years that has lead to increased partnership development, collaborative pest management projects and practice change.

Municipal Councils play a key role in the management of weeds in Victoria as an educator, priority setter, advocate and land manager. Partnership based projects built around strategic weed management themes have supported local government investment and increased their capacity to undertake long term and best practice weed management. Victoria's Department of Primary Industries (DPI) delivers a Local Government Weed Management Grant program on behalf of the Department of Sustainability and Environment. The program incorporates the implementation of the Government's Victorian Pest Management Framework – A Framework for Action (VPMF) which sets direction for pest management within Victoria.

This poster presents results from a working program and is an example of how structured engagement based on collaborative concepts has increased organisational capacity and created improved inter-council partnerships for pest management. These transferable skills and learning's have already lead to significant practice change within Municipal Councils, contributing to the overall statewide pest management approach.

Victorian Municipal Councils are moving through a continuum of awareness, acceptance to action in fulfilling their weed management roles and responsibilities. The Tackling Weeds on Private Land Initiative promotes the concept of creating partnerships and sharing knowledge. By assisting Municipal Councils to develop sustainable capacity building projects, weed management is becoming a core business consideration.

A CANADIAN INVASIVE PLANT FRAMEWORK

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An invasive plant is a harmful organism whose introduction or spread threatens the environment, the economy, or society including human health. The number of new plant incursions and their impacts have increased each year in Canada accelerating over the last decades due to exponential increases in air travel, the increased speeds at which commodities and people traverse the globe, increased ports of entry, expanded exports and imports into new international markets, increased interest in the use of exotic plants in gardening and water gardening, and increased access to foreign ecosystems. It is estimated that these invasive plants are costing the Canadian economy millions of dollars annually. Hence, there is a need for a Canadian Invasive Plant Framework (CIPF) that enhances collaboration among governments, economic sectors, stakeholders, and the international community. The Canadian Food Inspection Agency (CFIA) is leading the development of an invasive plants framework, partnering with other federal departments, provinces and territories, industry and Canadians concerned with invasive plants. A Canadian Invasive Plant Framework will be consistent with the Invasive Alien Species Strategy for Canada, focussing on prevention, early detection, rapid response and management of invasive plants. The objective of this paper is to introduce and discuss the Canadian Invasive Plant Framework (CIPF).

A STRATEGIC APPROACH TO BIOSECURITY THREATS POSED BY INVASIVE PLANTS IN AUSTRALIA

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Weed management in Australia was historically the responsibility of the affected primary industry, with government representation through State agriculture and forestry departments and the Australian Weeds Committee (a sub-committee of Federal standing committees). Environmental weed research priorities were set by an Australian & New Zealand Environment & Conservation Council through limited pooled funding from State bodies. The inadequacy of this situation for addressing research and stakeholder needs of a $4B agricultural and huge environmental problem was recognised in the 1990's setting the stage for national policy in a context of Federal responsibility for the international border and incursion prevention and State responsibility for legislative and on ground management. With significant support for agricultural weeds from rural industry research councils, this national focus was directed more towards environmental weeds. The National Weeds Strategy launched in 1997 was the catalyst to implement and coordinate national management strategies across Australia and included the establishment of the 20 Weeds of National Significance (WONS), icon species. Initial funding came from the Natural Heritage Trust (a Federal Government – DAFF & DEH - investment in NRM issues). In 2004 weeds were allocated a dedicated source of Federal government funding under the "Defeating the Weed Menace" programme. Since 1995 the science ministry (DEST) has also supported two sequential Weed Management Cooperative Research Centres. This paper describes how Australia has effectively raised awareness and support of invasive plants at the Federal level that has led to significant improvements in Australia's weed management and a revised Australian Weed Strategy under an overarching Federal Australian Biosecurity System (AusBIOSEC), which will arguably be the best in the world.

THE WESTERN AUSTRALIAN WEEDS COMMITTEE-COMMUNITY AND GOVERNMENT WORKING TOGETHER FOR STRATEGIC STATEWIDE POLICY ADVICE AND CO-ORDINATION

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The Western Australian Weeds Committee (WAWC) was established in 2004 by the State Government as a major recommendation of the State Weed Plan and is led by, and consists of, a majority of community representatives. Terms of Reference direct the committee to provide policy and planning advice to Government, facilitate linkages between State Government agencies, Local Government bodies, industry groups, community groups and weed research agencies to optimise action on significant weed issues and to identify potential and emerging weed problems and opportunities for improved management. Early in its existence the WAWC identified a lack of understanding of the roles and responsibilities of stakeholders and a general lack of awareness of weed management issues, as key barriers to the effective implementation of the State Weed Plan. To begin to address these barriers the WAWC initiated a Forum of State Government Departments. The objectives were to establish an understanding of the importance of incorporating effective weed awareness and management into day to day activities, identify methods for departments to work together to facilitate improved communication, integration and participation and create a wider recognition of the increased resourcing levels required to minimise the economic and environmental impacts of weeds in Western Australia. During its three years of operation a number of successful outcomes have been achieved and lessons learnt about the effective functioning of the WAWC, which has been recognized nationally as an important Group to assist provide co-ordination and strategic community advice to government. Following the development of solutions to significant teething issues, the WAWC has been able to demonstrate a positive way forward to ensure effective operation to assist with the co-ordination of stakeholders and provision of policy and strategic advice.

PATTERNS OF DISPERSAL AND ESTABLISHMENT OF BIRD-DISPERSED EXOTIC AND NATIVE PLANT SPECIES IN DIFFERENT HABITAT TYPES IN NORTHERN NEW SOUTH WALES

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Frugivores act as the main dispersal agent for a large proportion of native subtropical rainforest plant species in south-eastern Australia as well as many weeds in this region. Taking a multi-species approach this study compares patterns of seed dispersal and seedling establishment of bird-dispersed exotic and native species in three habitat types in Northern New South Wales: tree regrowth (dominated by exotic camphor laurel), shrub regrowth (dominated by exotic wild-tobacco), and restoration plantings, (comprised of a mix of native rainforest species). The aims of the study are: (1) To determine how seed rain of bird-dispersed exotic and native species differs between these habitats, (2) To determine whether spatial concordance exists between seed rain and seedling recruitment and to what extent this varies between habitats, (3) To determine whether particular exotic or native species tend to be associated with one another (contagious dispersal) and (4) To make predictions regarding the long-term successional trajectories of these systems. Identity and abundance of seedlings and saplings were recorded in quadrats at three representative study sites for each habitat type. Seeds arriving at these sites were monitored over a twelve month period using seed traps. Seeds were also germinated from soil samples to determine which species were present in the soil seed bank. Other variables including light, soil moisture, distance to edge/gap, herbaceous cover, and substrate were recorded in order to determine their influence on seed deposition and seedling establishment. We present preliminary results from this study.

ACETOSA VESICARIA- THE CASE OF THE MISTAKEN WILDFLOWER

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Acetosa vesicaria L. formerly known as *Rumex vesicarius* is an environmental weed invading large areas of arid Australia. Because of its striking nature *A. vesicaria* attracts public attention by its large, often bright red purplish tinged valves. In the Pilbara this species flourishes in response to anthropomorphic ground disturbance and therefore is abundant at highly disturbed sites associated with mining operations, mineral exploration activities and road maintenance. However, this environmental weed is not confined to areas of anthropomorphic disturbance and often invades bushland subject to natural disturbance regimes such as along creek lines and on rock scree slopes.

Research focused on two core areas to assist the establishment of a management strategy for control of the environmental weed *Acetosa vesicaria*. 1. Seed studies to understand key areas associated with germination, dormancy, longevity and soil seed banks in an effort to diminish and manage this weed and 2. Herbicide trials to determine the most effective herbicide/s, surfactant and dose rates required control.

The results have shown that *A. vesicaria* can flower and set seed in adverse environmental conditions such as drought. There is no physical dormancy preventing germination because water uptake (imbibition) is rapid. Germination of fresh seed is very low, but 12 weeks after seed fall from the parent plant the percentage of seed germination reaches a maximum (ca 80%), with 50% of seed able to germinate after four weeks. There is a chemical inhibitor in the tissues of the perianth preventing precocious germination. An adequate rainfall event is required to wash this inhibitor from the tissues for germination to occur, particularly when the seed is fresh. Seeds remain within the fruiting valves (perianth) and form dense mats that slowly break down over time to fibrous husks. *A. vesicaria* seeds respond with greater germination numbers to the stimulant gibberellic acid however, butenolide (the active smoke chemical) is more effective as a germination stimulant when sprayed on seed contained within the perianth.

Five herbicides were evaluated however, only glyphosate was effective for controlling *A. vesicaria* particularly when the surfactant Pulse® is added. Many glyphosate-based herbicides have a surfactant added but we recommend purchasing glyphosate without a surfactant. This research has demonstrated that the surfactant Agral® decreases the effectiveness of glyphosate.

WHAT MAKES ANTHEMIS COTULA L. (ASTERACEAE) INVASIVE IN KASHMIR HIMALAYA, INDIA?

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The complexity of biological invasion dynamics hampers generalization, prediction, or management of invasions, as the idiosyncrasies of individual invaders (and their interactions with the environment) confound simple predictive models. Notwithstanding its many eccentric idiosyncratic attributes like bi-parental reproduction and low competitive ability, *Anthemis cotula* L. (Asteraceae), an alien invasive plant species in the Kashmir Himalaya of southern Europe-west Siberian origin, grows luxuriantly in a range of terrestrial and riparian habitats wherein the soil is disturbed to varying spatial extents either due to anthropogenic or natural factors. The germination of achenes in this species is triggered by the soil disturbance mediated environmental cues, like favourable light regime obligatory for stimulation of germination in positively photoblastic achenes and increased soil nitrogen content, either in the form of NO3- or NH4+ , that also positively influences achene germination. These cues aid the species to sense the conditions suitable for achene germination, seedling recruitment and establishment. Furthermore, *A. cotula* is not only able to maintain fitness across a broad range of environments, a characteristic related to the concept of a 'general purpose genotype' and of fitness homeostasis, but is also able to increase it in favourable riparian habitats (Jack-and-master strategy). Moreover, an ecological trade-off between survival and fecundity was detected in relation to seedling emergence time, as striking differences in survivorship and fecundity among pre- and post-winter population cohorts were observed. Allelopathic activity of the aqueous leaf leachate against a broad range of co-existing plant species and crops, over-compensatory growth in the herbivored individuals and high incidence of root colonization by arbuscular mycorrhizas are other key attributes that contribute to the invasiveness of this species in the Kashmir Himalaya.

GENETIC RELATIONSHIP AMONG SICYOS ANGULATUS POPULATIONS IN JAPAN

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Burcucumber (*Sicyos angulatus*), which is one of the most serious exotic weeds in Japan, has been regulated by the Invasive Alien Species Act since 2006. Many riversides have been infested by the species, which suppresses the native vegetation with its rapidly growing vines. Although the original seed source of the species has been considered to be soybean consignments imported from the United States, the relationship between the riverside populations and the original seed source is unclear. To clarify the genetic relationship among burcucumber populations in Japan, we conducted ISSR (Inter-Simple Sequence Repeat) analysis for 131 individuals from 43 populations in two areas, i.e., the Tohoku and Chubu areas. A total of 23 polymorphic bands were obtained using 5 ISSR primers. A UPGMA dendrogram was generated based on Nei's (1978) genetic distance calculated using those ISSR polymorphisms. As a result, the populations in the Chubu area were found to be relatively similar to each other, suggesting that those populations have developed a genetic relationship in this area during their spreading process. Populations distributed along common water courses showed especially close genetic relationships to each other. This finding suggests that water may be one of the most significant seed vectors. In Japan, it is known that many kinds of exotic weed seeds have been imported mixed in feed grain and are excreted in manure, which is then spread over crop fields as fertilizer. In this study, populations of burcucumber in crop fields, abandoned fields and grassland showed high genetic divergence among them. This result may support the hypothesis that crop fields tend to be the first habitats invaded by burcucumber.

JOURNEY THROUGH THE SECRET LIFE OF GIANT HOGWEED (HERACLEUM MANTEGAZZIANUM)

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One of the most aggressive invasive plant species in Europe and North America, which receives a high publicity, is Giant hogweed (*Heracleum mantegazzianum*). Public awareness of this species is due to its exotic appearance, enormous size and risk to human health. The flowering individuals can reach up to 5 m height, leaves are up to 2.5 m long, terminal flowering umbels are up to 80 cm in diameter and the whole plant contains phytotoxic sap, which causes, upon contact, burnings and blistering on human skin. *Heracleum mantegazzianum* was introduced from its native range in high mountain meadows in Caucasus to European gardens as an ornamental species during the 19th century. Then it started its successful tour through Europe and nowadays is considered as invasive in many European countries. What makes it so successful and is there any potential way how to control its distribution? These two questions summarize the key issues of an EU funded international project "Giant Hogweed (*Heracleum mantegazzianum*) a pernicious invasive weed: developing a sustainable strategy for alien invasive plant management in Europe". Here we present the highlights and important aspects of the ecology of this species. Our research covered topics from its basic biology such as reproductive characteristics, floral biology, seed ecology, seed bank dynamics and population ecology to more specific areas of research on the patterns of distribution at small (landscape) and large (country) scales, studies on range expansion, distribution limits and the regeneration ability of the species. During the research several popular myths about this species' biology were refuted. The key for the invasion success of *H. mantegazzianum* is the synergistic effect of several characteristics: (i) early spring germination, (ii) fast growth of seedlings and rapid formation of dense cover, (iii) no principle constraints to flowering in the massively invaded area in the Czech Republic, (iv) high fecundity, although not as high as often indicated and cited in literature!, (v) ability for self-pollination producing viable offspring, (vi) high germination rates, (vii) a large, short-term persistent seed bank and (viii) high regeneration ability. Nevertheless, the species does not seem to possess any special characteristic/mechanism; extremely high fecundity, rapid growth, capability of self-pollination, extended germination period by means of short-term persistent seed bank, high germination, negligible impact of natural enemies – all these characteristics can be found in other plant invaders. Therefore, it is a combination of superior traits associated with a single species, and acting at different stages of the life cycle, what provides *H. mantegazzianum* with remarkable invasion potential and makes it a 'master-of-all-traits' of plant invasions. This has practical implications, as the species does not seem to have a weak link in its life cycle, on which the control measures could be most efficiently targeted.

THE DISTRIBUTION OF YELLOW FIELDCRESS (RORIPPA SYLVESTRIS (L.) BESSER) SPREADING IN A MOUNTAINOUS REGION IN NORTHERN-CENTRAL PART OF JAPAN

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Yellow fieldcress (*Rorippa sylvestris* (L.) Besser), a native of Europa, was introduced into Japan in the 1950s after world war II, and was reported as an aggressive weed in Hokkaido island in the 1960s. The species is widely distributed in roadsides, banks of paddy fields, upland fields, and orchard fields of northern part of Japan. Once the species is established, it is difficult to eradicate because of its vigorous vegetative reproduction by the creeping root system and from fragmented roots. The sexual reproduction of the species is rarely observed in Japan. Therefore, the domestic spreads of the species were developed by vegetative reproduction.

Yellow fieldcress is widely distributes around the ornamental fields in southern Aizu and around the experimental fields of agriculture in the Aizu basin that is approximately 50 km apart from southern Aizu. The plant is commonly observed around the ornamental fields in southern Aizu, although the hamlets and villages of this region have the least traffic and are isolated by steep mountains. Yellow fieldcress is dominant species around the experimental agricultural field of the southern Aizu, particularly at the banks of paddy rice fields. This study summarizes seasonal dynamics of yellow fieldcress in Aizu area, which is located in the northern-central part of Japan. Further, the patterns and the control of its vegetative reproduction have been discussed.

COMPARING THE BIOLOGICAL TRAITS OF SHORT-LIVED AND LONG-LIVED INVASIVE SPECIES USING THE SOURCE-AREA APPROACH

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Several studies support the hypothesis that certain biological traits are generally associated with invasiveness of plant species. However, the recognition, that the group of 'invasive species' is heterogeneous, directs researchers towards categorization of invasive species, when relationship between traits and invasiveness is studied. We asked whether there are differences between short-lived and long-lived herbaceous aliens regarding the biological traits associated with their invasiveness. We used the source area approach to answer the question. We performed a comparative study with those Central-European herbaceous plant species which are naturalized non-invasive or invasive aliens in the US. Biological traits used in the analysis were extracted from European databases. Only three of the 29 traits studied were associated with invasiveness in both short-lived and long-lived species: high relative abundance in their native habitats, mixed-compatibility (species which are not exclusively self-compatible or self-incompatible) and large native range. In addition, invasiveness in short-lived species was associated with plant height, seed weight (the short-lived invasive species has two peaks: one at low and one at very high seed weight), effective seed dispersal by many vectors and specialized dispersal types, such as epizoochory and myrmecochory. On the other hand, high competitive ability, effective vegetative reproduction, wide tolerance of human disturbances and specific abiotic preferences, such as indifference for soil acidity and nutrient content, and preference of nitrogen-rich soils define the perennial invaders.

NICHE CONSTRUCTION AS A MECHANISM DRIVING BITOU BUSH (CHRYSANTHEMOIDES MONILIFERA SPP. ROTUNDATA) INVASION ON THE EASTERN AUSTRALIAN COAST.

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South African bitou bush has the tendency to form monocultures on the south-eastern Australian coastal sand dunes and displace native flora. Hence bitou bush has been classified as Australia's sixth worst weed based on its invasability and impact on the natural environment. Our studies aimed to elucidate the likely mechanisms of invasion through a series of observational and laboratory based approaches. In the field we found that bitou bush significantly altered the canopy layer, reduced ground incident light and moderated the soil surface temperatures by reducing the daily maximum and increasing the minimum temperatures when compared to the native system. Additionally, the soil chemical profile associated with the invasion was substantially different from that found in the native acacia dominated system. The invaded system was characterized by a significantly higher concentration of volatile terpenes which are known to be biologically inhibitory. Bioassays testing the effect of these chemical mixtures on the germination and seedling growth of five native species showed that they have the potential to affect primarily the root and in some cases shoot growth of native plants. Population size structure surveys revealed that native species had senescent populations in bitou bush invaded sites suggesting recruitment limitation. The health and fitness of mature native plants appeared to be unaffected by the presence of bitou bush. Therefore we propose that by significantly altering the soil and habitat characteristics, bitou bush limits the recruitment of native plants and destabilizes native plant populations. The resultant vacant niches are likely to elicit positive feedbacks which facilitate the invasion. Hence niche construction is suggested as a key mechanism driving bitou bush invasion.

STRATEGIC GRAZING FOR THE CONTROL OF THE INVASIVE WETLAND WEED LIPPIA (PHYLA CANESCENS)

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Lippia (*Phyla canescens*) is an invasive weed from South America that is now widespread throughout the Murray-Darling Basin in Australia. Lippia has invaded internationally significant wetlands often forming a dense ground-layer that can exclude co-occurring native species. Traditional weed control measures including herbicides and mechanical means, are often impractical and unsuitable, particularly in environmentally sensitive areas, and alternative measures need to be devised. We investigated the possibility of using strategic grazing to manipulate competitive interactions to favour native species in wetlands subject to long history of continuous/set stocked grazing regimes. In particular, we addressed whether providing rest periods permits native species to develop to a stage that permits increased competition to disadvantage lippia growth and survival. Small exclosure cages (2 m x 2 m) were used on a fixed and rotational basis to preclude grazing stock, thereby providing a rest period at different stages of the year. Preliminary results suggest that maintaining native cover is an effective means of lippia control. Strategic grazing may provide a useful tool for managing weed invasions in areas managed for both conservation and production purposes.

ALLELOPATHIC POTENTIAL OF HYPARRHENIA HIRTA (L.) STAPF. ON NATIVE GRASSES

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Hyparrhenia hirta (L.) Stapf. (Coolatai grass, Tambookie grass) is an invasive, perennial grass from Africa and the Middle East that has infested large areas of northern New South Wales, Australia, and also occurs in other Australian states. Invasive perennial grasses can be aggressive colonisers and a major threat to the biodiversity of native ecosystems. There are many possible mechanisms by which invasive plants may affect native species such as resource competition, habitat modification and altered ecosystem processes. The present investigation studied the allelopathic potential of *H. hirta* on germination and seedling vigour of the Australian native grass species, *Bothriochloa macra* (red grass) and *Dichanthium sericeum* (Queensland blue grass). In an incubator experiment, aqueous extracts derived from root and shoot of *H. hirta* were applied to the target species. The full strength extracts (1:10 w/v plant material in water) of *H. hirta* were used to make the following dilutions: control (deionized water only), 0.1, 1, 10, 50, 75, and 100 % (v/v).

Germination and root and shoot elongation of both target species was more inhibited by the shoot extracts than the root extracts. *Dichanthium sericeum* was generally more sensitive than *B. macra*. Germination and seedling growth were inversely proportional to the extract concentration. *Bothriochloa macra* was more sensitive at lower doses (0.1 – 10%) with an exponential decrease as concentration increased. *Dichanthium sericeum* was less sensitive at the lower range (0.1 – 10%) of concentrations, and the pattern of decrease was linear, being fairly constant over the concentration range. Therefore, allelopathy may be one mechanism underlying the negative impact of *H. hirta* on primary growth of native grass species such as *B. macra* and *D. sericeum*. However, in the field, such impacts are likely to depend, among other things, upon the source of allelochemicals, prevailing soil conditions and the native grass species present.

NATIVE AND INTRODUCED SONCHUS SPECIES IN AUSTRALIA: IMPLICATIONS FOR BIOLOGICAL CONTROL

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Sowthistles, *Sonchus oleraceus* and S. asper (Asteraceae), are widespread invaders of disturbed ecosystems in Australia. *Sonchus oleraceus* has also been identified as one of the major weeds of Australian cropping systems, especially those of south east Queensland and northern NSW. *Sonchus oleraceus* has developed herbicide resistance making it desirable to develop alternative means of control, such as biological control. A preliminary survey of pathogens and arthropods associated with *Sonchus* in Australia has found two widespread organisms, a rust fungus *Miyagia pseudosphaeria* and an apparently undescribed species of eriophyid mite, with biological control potential. The interactions of these two organisms with the only native sowthistle species in Australia, *Sonchus hydrophilus*, are being investigated to establish the origins of these organisms and likely impact, both in natural and cropping ecosystems.

AGRICULTURAL-DISTURBANCE ENCOURAGE EXUBERANCE OF ALIEN PLANTS AND REDUCE BIODIVERSITY

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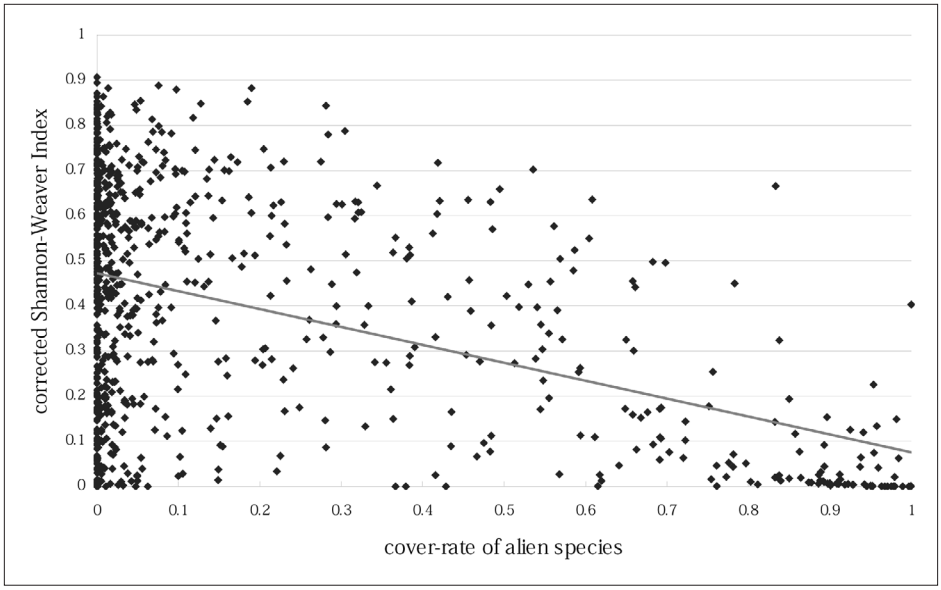
ABSTRACT. This study investigates the effect of agricultural disturbance (fertilization, plowing, or so on) and the difference of management policy on distribution of alien plant species in agricultural fields of Kanto Plain, Japan. We sampled 30-40 plots(1×1m) in each of 32 areas(1×1km) and constructed database of vegetation around agricultural fields at the same time. The sampling plots were classified into five types, Paddy, Abandoned Paddy, Levee of Paddy, Mowed-Slope, and Abandoned Field. Mowed-Slope plots were not fertilized and not disturbed by plowing. Biodiversity of each sampling plots were estimated by Shannon-Weaver index, whose distortion was corrected. The cover-rate of alien species was calculated for each sampling plots. We found that there is negative correlation between biodiversity and cover-rate of alien species(r=0.43**).The diagram below indicates the relationship between cover-rate of alien species and corrected index. Comparing the biodiversity of Mowed-Slope with that of the other types, the corrected index was significantly higher($p<0.01$). The plots in Mowed-Slope were less prone to overgrowth of alien plant species, though it was not significant. It suggested that the agricultural disturbance increased the cover of alien species and reduced biodiversity.



HERBICIDE TOLERANCE IN INVASIVE BUTTERFLY BUSH (BUDDLEJA DAVIDII) POPULATIONS IN EUROPE

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Non-indigenous species cause major environmental damage associated with considerable economic costs. A lot of invasive plants can be found on disturbed habitats, e.g. roadsides and railways. In the latter case plants have to be removed for safety reasons. Most techniques in weed management along railways imply the use of chemical herbicides. By causing environmental and health problems these herbicide treatments induce permanent economic costs. The commonly used herbicide is glyphosate. It inhibits enzymatic reactions and is therefore a broad-spectrum, non-selective systemic herbicide. Several studies demonstrated resistance of various plants to glyphosate. This might be due to rapid microevolutionary changes as a consequence to the herbicide treatment.

We tested sensitivity to glyphosate in the Butterfly Bush, *Buddleja davidii* (Buddlejaceae). *B. davidii* is a 3-5m tall shrub native to China. It was introduced to Europe in 1890 for ornamental reasons and has been undergoing artificial selection by breeders resulting in a high number of cultivars. Despite of glyphosate treatment along railways occurrences of *B. davidii* are still increasing. In this study we investigated whether *B. davidii* developed resistance to glyphosate by comparing mortality rates to the herbicide of populations naive to the herbicide with non naive populations. We sampled seeds of plants from three different habitats in Europe: 1. railways, 2. semi-natural sites like forest edges, gravel-pits released from economical utilisation and riverbanks, 3. rural sites, e.g. brownfields, gaps between buildings, roadsides. Grown up plants in four groups were treated with four different concentrations of the glyphosate. One group served as control, sprayed with Aqua dest.

We found no evidence for herbicide resistance in *B. davidii*. Populations from railways did not react differently than non-railway-populations (ANOVA, $F_{9,36}=1.378$ $p=0.56$). The highest concentration, i.e. the recommended application rate killed all plants. Even a quarter of this concentration yielded the same result. We conclude there has been no adaptation to glyphosate in *B. davidii* populations in Europe.

THE IMPACT OF A NATIVE PARASITIC PLANT ON THE WEEDS GORSE (ULEX EUROPAEUS) AND BROOM (CYTISUS SCOPARIUS)

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Dense growth of the native parasitic plant, *Cassytha pubescens*, has been observed on the introduced species, gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*) in the Mount Lofty Ranges of South Australia. At some sites, dead gorse and broom plants have been found covered in mats of *C. pubescens* whilst at other sites infected gorse and broom plants have low vitality and reduced reproductive output. This study aims to develop a better understanding of the biology of *C. pubescens* and to quantify its impact on native and introduced hosts. Our field observations show that gorse plants infected by *C. pubescens* had impaired photosynthetic activity and were more water stressed than uninfected gorse plants. Pot experiments have examined *C. pubescens* and host growth and physiology in different host –parasite associations. Hosts include the weeds gorse and broom and two native plants, *Acacia myrtifolia* and *Leptospermum myrsinoides*. The parasite could potentially reduce gorse and broom infestations and may be a valuable control tool in association with other biological control agents, particularly in sensitive areas where herbicide application or other destructive control methods are not suitable.

OPEN-FIELD HOST SPECIFICITY TESTS IN THE AREA OF ORIGIN AS A RISK ASSESSMENT TOOL OF POTENTIAL WEED BIOCNTROL AGENTS: CASE STUDY

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Solanum viarum (Solanaceae), known by the common name tropical soda apple, is a perennial prickly weed native to north-eastern Argentina, south-eastern Brazil, Paraguay, and Uruguay, that has been spreading in the USA during the last two decades. It was first detected in the USA in 1988, and it has already invaded more than 400,000 Ha of improved pastures and woody areas in at least seven states. Initial field explorations in South America for potential biocontrol agents were initiated in June 1994 by University of Florida researchers in collaboration with Brazilian and Argentinean scientists. The leaf beetles *Gratiana boliviana*, *Metriona elatior*, and *Gratiana graminea* were evaluated for biocontrol of *S. viarum*. Open field experiments and field surveys were conducted in the area of origin (Brazil, Argentina) to assess the risk of these beetles using solanaceous crops as alternative hosts. The choice & no-choice tests confirmed that these beetles are highly specific feeding and developing only on the target weed *S. viarum*.

HERBICIDAL CONTROL OF BRIDAL VEIL (ASPARAGUS DECLINATUS L.)

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Bridal veil (*Asparagus declinatus* L., Asparagaceae) has become invasive in native vegetation in all southern regions of South Australia (SA). Bridal veil is a former garden plant originating from South Africa, which was known to have been introduced to SA in 1881 but was not recorded as naturalised until 1957. Like its close relative bridal creeper (*Asparagus asparagoides* (L.) Druce), a Weed of National Significance in Australia, bridal veil is highly competitive and can become dominant in the understorey. It forms a dense, subsurface mat of large tubers connected by creeping rhizomes. In autumn, new annual shoots emerge which smother other groundcover plants. Berries are produced in spring, enabling efficient seed dispersal via birds and other vertebrates.

Considerable effort is being made by regional weed authorities to contain the spread of bridal veil and eradicate infestations where possible. This requires effective control techniques. Previous trials in SA and Western Australia had indicated that glyphosate provided a high level of suppression but metsulfuron methyl gave inconsistent results. A field trial was commenced in September 2004 at Victor Harbor, SA, to compare glyphosate with different wetter/penetrant additives, multiple glyphosate applications, grubbing (i.e. digging of tubers) with and without prior herbicide treatment, and the use of metsulfuron methyl. Plots were 1x1m with five replicates per treatment. Herbicide treatments were applied with an electric knapsack sprayer, applied to saturation point.

Glyphosate treatments gave the highest level of control, but there was insufficient replication to detect significant differences between different additives (overall average of 8% shoot cover after 2 years post-treatment). A second glyphosate treatment three years after the first did not give greater control than a single application. Metsulfuron methyl was no different to the untreated control after 2 years. Grubbing took 20-30 minutes per m2 including handling of tubers, which is too time consuming and offered no advantage in terms of reduction in percentage shoot cover compared to glyphosate. However, the removal of the tuber biomass should enable greater recovery of native plants. Glyphosate was found to reduce tuber biomass by 50%, but other studies on bridal creeper have shown that dead tuber mats still act as a barrier to native plant regeneration. Low levels of fruiting (1-30 fruits/m2) had commenced in some glyphosate plots in 2006. Overall there is still no herbicide treatment that gives 100% control of bridal veil.

DISTRIBUTION OF NON-NATIVE PLANT SPECIES IN TWO TIRARI DESERT PLANT COMMUNITIES OF SOUTH AUSTRALIA

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The horizontal structure of the flora of two Tirari desert communities: the perennial flora around Lake Palenkarinna (ungrazed) and the flora on Canniwaukaninna Dune (grazed) was determined by mapping all the vegetation within 5 m of two 420 m long transect lines that began at the salt lake edge and the dune base respectively. Around Lake Palenkarinnina the native species covered 16.7 % , non-native species 3.7%, and bare soil 79.6% of the area, whereas in the Canniwaukaninna dune community native species were 9.7% non-native species 16.1%, and bare soil 74.2% of cover. Association and distribution analysis of the resulting vegetation maps revealed two of the six non-native species, *Salsola kali* L..and *Tribulus terrestris* have distribution characteristics quite unlike the native vegetation in these communities. Native species at the lake site occurred in narrow bands of serially changing species mixtures and at the dune site in either foredune, dune crest or dune swale zones. *S. kali* was found along the entire extent of transects in both communities. Analysis of edaphic characteristics at the lake site revealed the only area where *Salsola kali* was able to form monospecific stands and exclude natives, had sulfates in the soil below 500 ppm, soil pH over 8, and soil relatively high in aluminum. A chi square analysis at the dune site revealed both *T. terrestris* and *S. kali* were associated with native Fabaceae species in the foredune and dune swale. In areas of the dune swale without infestations of *S. kali* or *T. terrestris* eight herbaceous native species were associated with these native Fabaceae species ($p<0.05$). No other significant associations were found among the dune flora.

AN EMERGING INDIGENOUS WEED— THE ECOLOGY AND CONTROL OF THE GRASS LACHNAGROSTIS FILIFORMIS (G. FORST.) TRIN.

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Lachnagrostis filiformis (Fairy Grass), an emerging native weed in Australia, has colonised extensive areas of dry lakebeds in western Victoria during the current drought. Large numbers of the plants' detached mature panicles lodge against housing, fences, railway lines, and other obstacles initiating a fire hazard and general nuisance to communities of lakeside towns. Naturalised in California USA, *L. filiformis* out–competes and displaces native vegetation. Since current control methods only provide short–term solutions it is essential to identify an economically viable long–term solution to the problem. Current control methods will be assessed and reviewed, and potential long–term management solutions developed. To understand the environmental conditions that facilitate its establishment and persistence, the population dynamics of the grass will be investigated on four undisturbed dry lakes in western Victoria. To determine the efficiency of control measures; herbicide, slashing, controlled grazing and seed broadcasting of native species will be applied and monitored over three years on dry lakebeds in western Victoria. Knowledge gained from this study will assist in the development of long-term control measures relevant nationally and internationally. Results may also assist in the development of control of other similar weed species.

THE ROLE OF BIOLOGICAL CONTROL AGENTS IN AN IWM PROGRAM FOR BITOU BUSH, CHRYSANTHEMOIDES MONILIFERA SUBSPECIES ROTUNDATA

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Bitou bush, *Chrysanthemoides monilifera* subspecies *rotundata*, is a native of South Africa, which was used extensively in Australia as a sand stabilising plant and for revegetation of coastal areas mined for mineral sands. It has now become a serious environmental weed in eastern Australia, primarily of conservation areas, where it significantly reduces biodiversity. Since 1989, eight species of insects have been released on bitou bush, four of which have established. These are having varied impacts on bitou bush with bitou tip moth, *Comostolopsis germana* and bitou seed fly, *Mesoclanis polana* being the most successful. An integrated weed management approach appears to be the best option for long-term sustainable control of bitou bush. This paper discusses the use of biological control agents in combination with other control options such as strategic herbicide applications, fire and revegetation techniques.

INVASIVE PLANTS ALLOCATE MORE LEAF NITROGEN TO PHOTOSYNTHETIC MACHINERY AND HAVE HIGHER NITROGEN AND WATER USE EFFICIENCIES THAN THEIR NATIVE CONGENERS

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It has been hypothesized that invasive species have higher resource capture ability and use efficiency than native species. Resource use efficiency affects growth, survival, reproduction and distribution of plants, especially in temporally and spatially changing environments. Nitrogen and water are often the limiting resources for plants in natural ecosystems. Few studies found that invasive species had higher photosynthetic nitrogen- and water-use efficiencies (PNUE and WUE) than native species. The higher PNUE of invasive species was attributed to their lower leaf nitrogen content and/or higher photosynthesis. I hypothesized that nitrogen allocation is another important trait influencing PNUE. If a plant can allocate more nitrogen to the photosynthetic machinery, it will have higher PNUE. The evolution of increased competitive ability hypothesis predicts that a plant will lose defenses against its natural enemies in its native range if it escapes them in introduced range. If the defenses used up precious nitrogen, natural selection should favor the plant investing this part of nitrogen into photosynthesis. Thus, we hypothesized for the first time that invasive species may allocate more leaf nitrogen to photosynthesis than closely related native species that do not escape from their natural enemies. To test this hypothesis, two invasive species, *Amaranthus spinosus* (Amaranthaceae) and *Piper hispidenervum* (Piperaceae), and their native congeners were contrasted in field. The main results were reported as follows:

1. The two invasive species had higher PNUE and WUE than their native congeners, breaking the intrinsic trade-off between PNUE and WUE.

2. PNUE and WUE were positively correlated with leaf photosynthetic rate, but not with leaf nitrogen content and stomatal conductance, indicating that it was photosynthesis not nitrogen content and stomatal conductance that explains the differences in PNUE and WUE between the invasive species and their native congeners.

3. The photosynthetic differences between the invasive species and their native congeners were due to the differences in leaf nitrogen allocation not to those in stomatal conductance. The invasive species allocated more leaf nitrogen to photosynthetic machinery than their native congeners. The fraction of leaf nitrogen allocated to photosynthesis and the nitrogen content in photosynthesis were positively correlated with biochemical capacity for photosynthesis, photosynthetic rate and PNUE.

MYCORRHIZAL STATUS OF SOME KASHMIR HIMALAYAN ALIEN INVASIVE PLANTS.

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Given the recently established facilitative role of arbuscular mycorrhizal mutualists in invasiveness of many alien plants, a comprehensive cataloguing of such plant species in respect of their mycorrhizal colonization and associated implications thereof assume considerable significance. In this context, composite root samples of 30 alien plant species belonging to 11 different families (*Apiaceae, Asteraceae, Brassicaceae, Chenopodiaceae, Euphorbiaceae, Fabaceae, Geraniaceae, Iridaceae, Planteganaceae, Poaceae,* and *Scrophulariaceae*) were scrutinized for type and extent of arbuscular mycorrhizal fungal (AMF) association. The investigated plant species growing in ecologically diverse habitats included 3 naturalized, 2 casual aliens, one cultivated un-escaped alien and 25 invasive species. On the basis of percent AMF root length colonization (%RLC), the species examined were categorized into 5 subjective classes (Class I, 0-5%; Class II, 6-25%; Class III, 26-50%; Class IV, 51-75%; and Class V, 76-100%). This categorization revealed that 5 species belong each to Class I and III, 2 and 3 species to classes II and IV respectively, and 15 species to class V. The species also varied in the type of AM association with 5 species specifically showing Arum type, 2 Paris-type and rest mixed type colonization. *Sisymbrium loeselii*, among the four typical non-host species, showed moderate degree of mycorrhizal colonization. Implications of the present study in the spread and management of invasive plants are discussed.

SEED GERMINATION AND SEEDLING ESTABLISHMENT AS DETERMINANTS OF INVASION SUCCESS IN CONGENERIC PLANTS: A COMPARATIVE STUDY OF ALIEN AND NATIVE IMPATIENS SPECIES

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Traits associated with germination and seedling establishment are among the key factors determining the spread of alien plants in their secondary distribution areas. The role of these traits was addressed by comparing three *Impatiens* species (Balsaminaceae) alien to the Czech Republic, and a native usually co-occurring congener: *Impatiens glandulifera* (native to Asia), widely distributed invasive species rapidly spreading mainly in the last two decades; *I. parviflora* (native to Asia), widely distributed invasive species with less dynamic current spread; *I. capensis* (native to S Africa), which is not present in the Czech Republic yet but invasive in western Europe; *I. noli-tangere*, native to Europe. To compare the basic characteristics of generative reproduction of the species, (1) specific time needed for seed stratification, (2) seed germination, (3) effect of dry seed storage, (4) RGR of seedlings, (5) seedling establishment in the garden and in a field community (i.e. only species occurring in CR), and (6) depletion of soil seed bank were studied. The results showed remarkable differences in stratification requirements and germination between native and invasive species. The native *I. noli-tangere* required the longest time for stratification and had the lowest germination. It seems that the highly invasive species *I. glandulifera* and *I. parviflora* do not form seed banks while *I. noli-tangere* and *I. capensis* have a potential to form seed banks. No significant differences in RGR among the three alien species were found.

The results of all experiments indicate possibility of invasion of *I. capensis* to the Czech Republic.

MICROBIAL COMMUNITIES IN AUTOCLAVED RECOLONIZED AND NATURAL SOILS INFLUENCED BY CENTAUREA MACULOSA AND TWO NORTH AMERICAN NATIVES

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The effect of initial sterilisation of soils on soil microbial community composition and diversity in a greenhouse pot experiment was monitored using total microbial counts (CFU) and time of appearance analysis. The total counts on general microbial media (1/10 TSA) were 2 log units higher in soil samples that were initially sterile compared to soil samples that had not been autoclaved. These figures were obtained when counting the microbial colonies formed after only 12 hours incubation at 30°C. The microbial numbers formed after 18 and 24 hours incubation were still higher in the initially autoclaved soil samples compared to the natural soils. However, the numbers obtained after 72 hours incubation were not significantly different when the sterilized and natural soil values were compared.

Introducing any of the plants *Centaurea maculosa*; *Koeleria cristata* or *Pseudoroegneria spicata* into either the initially sterile or natural soil systems, the microbial numbers were generally higher than in identical soil samples not influenced by plant roots. The presence of plant roots also significantly influenced the time of appearance of microbial colonies resulting in a higher proportion of fast growing bacteria in both soil systems.

We suggest that autoclaved soils should be used with caution in the study of plant-microbe interactions since the microbial populations that invariably recolonize the autoclaved soils under greenhouse conditions appear to differ from the natural microbial populations. Clearly, results obtained from the use of initially sterile soils in experiments involving plants should be interpreted with caution since sterile soils rarely remain so under greenhouse conditions.

WEED RISK ASSESSMENT OF WILLOWS (SALIX SPECIES) IN AUSTRALIA

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Willows have been identified as Weeds of National Significance (WoNS) because they have such a strong ability to invade river margins, preventing the growth of native vegetation and causing significant changes to stream morphology and ecology. There are more than 100 different kinds of willows in Australia and some of them have been used, as shade trees, landscape plants and for streambank stabilisation. Most willows are now banned from sale in Australia and millions of dollars are spent each year removing willows from waterways.

In order to prioritise activities that will stop the further spread of willows and to effectively manage existing infestations, it is important to know:

a) which of the willows in Australia pose the biggest threat to waterways, and

b) which places in Australia are most susceptible to willow invasion.

To address these two questions, willows are being subjected to a national weed risk assessment (WRA) process that calculates the invasiveness, impacts, present distribution and potential distribution of many of the willows that are present in Australia.

The potential distribution of willows can be predicted by determining where in Australia there are suitable climates and habitats for willows to grow. Using evidence from published literature and experts in the field, the WRA gives each willow taxa a score that represents its risk, or threat. Willows can then be ranked from the highest priority to the least. This allows the limited funding to be allocated to the most important problems or priority areas.

EPPO'S WORK PROGRAMME ON INVASIVE ALIEN PLANTS

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The European and Mediterranean Plant Protection Organization (EPPO) was created in 1951 to prevent the introduction of dangerous pests from other parts of the world, and limit their spread within Europe if they were introduced.

In 2002 a special Panel on Invasive Alien Species (IAS) was created and aims at elaborating lists of Invasive Alien Species, collecting data on IAS, performing Pest Risk Analysis, identifying measures to prevent the introduction and spread of invasive plants, and measures to eradicate or contain invasive plants already introduced.

The Panel established the EPPO List of Invasive Alien Plants. EPPO recommends countries endangered by these species to consider measures to prevent their introduction and spread or to manage unwanted populations. Among the 34 species of this list, 5 are now recommended for regulation to the 48 member countries. Pest Risk Analyses performed in the EPPO framework follow the EPPO decision support scheme for PRA for quarantine pests both for plants and other organisms. EPPO also uses climatic prediction models such as the programme CLIMEX.

The EPPO Standard on 'Guidelines for the management of invasive alien plants or potentially invasive alien plants which are intended for import or have been intentionally imported' was approved in 2006. This Standard provides guidance on internal management measures such as publicity, surveillance, restrictions and/or codes of conducts on import, sale, holding, transport, etc.

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