Einfluss von Pflanzeninvasionen auf die Biodiversität

Dopad rostlinných invazí na biodiverzitu

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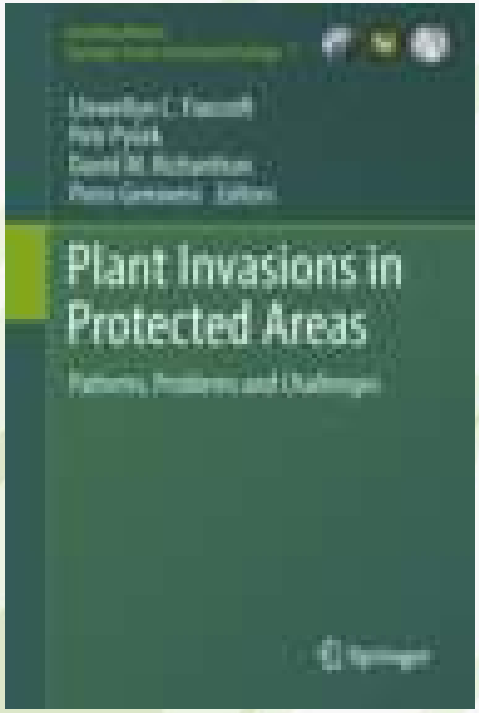


Plant Invasions in Protected Areas
Patterns, Problems and Challenges

Edice:
Invading Nature - Springer Series in Invasion Ecology, Vol. 7

Editoři:
Foxcroft, L.C., Pyšek, P., Richardson, D.M., Genovesi, P.

2013, 656 p.

Themenerweiterung des Vortrags:

Gesamteinfluss der Invasionen (nicht nur auf die Biodiversität) – vor allem der Umwelt- (aber teilw. auch sozioökonomischer Gesamteinfluss) mit Fokus auf Schutzgebiete

Rozšíření tématu přednášky:

Celkový dopad invazí (ne jen na biodiverzitu) – zejména environmentální (ale i částečně socioekonomický) se zaměřením na chráněná území

Impact – The description or quantification of how an **alien species** affects the physical, chemical and biological environment. Parker et al. (1999) proposed that **impact** should be conceptualized as the product of the range size of the invader, its average abundance per unit area across that range and the effect per individual or per biomass unit of the invader. Lockwood et al. (2007) list the following categories of **impacts** associated with **biological invasions**: genetic, individual, population, community, ecosystem, and landscape, regional and global. Another approach, used by the Millennium Ecosystem Assessment, assesses **impacts** relative to specific types of ecosystem services: supporting, regulating, provisioning and cultural (Vilà et al. 2010). Major issues relating to **impacts** of **invasive species** include their perception and recognition with reference to human value systems (Richardson et al. 2008), and the quest for a common and objective currency, including the means for translating **impacts** into financial and other costs (Pyšek & Richardson 2010; Vilà et al. 2010). A fundamental

Impakt (impact) = wie beeinflussen Invasionen physikalische, chemische und biologische Eigenschaften des invadierten Systems

Ökologischer (Umwelt-)Impakt
Sozioökonomischer Impakt

Impakt (impact) = jak invaze ovlivňují fyzikální, chemické a biologické vlastnosti invadovaného systému

Ekologický (environmentální) impakt
Socio-ekonomický impakt

Richardson D. M., Pyšek P. & Carlton J. T. 2011. A compendium of essential concepts and terminology in biological invasions. In: Richardson D. M. (ed.), *Fifty Years of Invasion Ecology: the Legacy of Charles Elton*, p. 409–420, Blackwell Publishing, Oxford.

Definition eines Impakts

Arealgröße (Verbreitung) × Durchschnittsdeckungsgrad auf Flächeneinheit × Impakt auf ein Individuum oder Einheit der Biomasse

!!!!!

1. Impakt ist nicht gleich Invasivitätt

… Kenntnise darüber, was aus Arten invasive Arten macht, KANN NICHT einfach auf einen Impakt angewendet werden

2. Impakt ist scher meßbar
3. Impakt ist vom Kontext abhängig

Definice impaktu

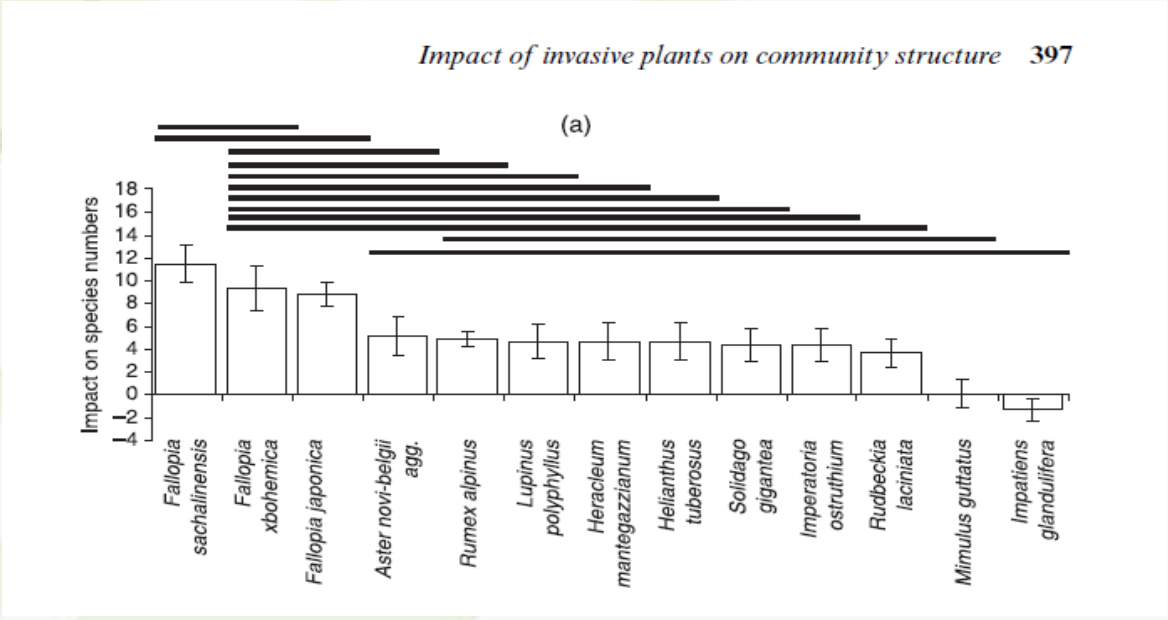
Velikosti areálu (rozšíření) × průměrná abundance (pokryvnost) na jednotkovou plochu × impakt na jedince nebo jednotku biomasy

!!!!!

1. Impakt není to samé jako invazivnost

… znalosti o tom, co dělá druhy invazivním NEMŮŽE být jednoduše aplikováno na impakt

2. Impakt je obtížně měřitelný
3. Impakt je závislý na kontextu



Hejda M., Pyšek P. & Jarošík V. 2009. Impact of invasive plants on the species richness, diversity and composition of invaded communities. *Journal of Ecology* 97: 393–403

Revision existierender Studien zum Impakt gebietsfremder Arten

- Beobachtungsstudie, die invadierte mit nicht invadierten Flächen vergleicht
- experimentelle „Beseitigungs“-Studie

287 Studien
167 Pflanzenarten aus 49 Familien
n = 1551 “Impakte“

Revize existujících studií na impakt nepůvodních rostlin

- observační studie srovnávající invadované a neinvadované plochy
- experimentální „odstraňovací“ studie

287 studií
167 rostlinných druhů ze 49 čeledí
n = 1551 “impaktů“

Zielobjekt eines Impakts

A. Pflanzen
B. Tiere
C. Bodeneigenschaften
D. Abundanz-Regime

Impakt - Unterscheidung

Impakt auf Populationen...
- Sterblichkeit und Überleben
- Fruchtbarkeit
- ...

Impakt auf Gesellschaften...
- Abundanz
- Artenreichtum
- Diversität
- ...

Impakt auf Ökosysteme...
- Inhalt chem. Stoffe im Boden
- Bodenfeuchtigkeit
- pH
- Mineralisierung und Zersetzung
- ...

Cílový objekt impaktu

A. rostliny
B. živočichové
C. vlastnosti půdy
D. režim disturbancí

Dělení impaktu

Impakt na populace...
- mortalita a přežívání
- plodnost
- ...

Impakt na společenstva...
- abundance
- druhová bohatost
- diverzita
- ...

Impakt na ekosystémy...
- obsah chem. látek v půdě
- půdní vlhkost
- pH
- mineralizace a rozklad
- ...

Impakt nepůvodních druhů

Veränderung: ja / nein?

Positive / negative Veränderung?

Reine Zustandsveränderung im Vergleich zur nicht-invadierten Fläche abgesehen von der Impakt-Richtung

63 % markanter Veränderung in beobachteten Systemen

Impakt von Pflanzen auf Pflanzen häufiger, als auf Tiere

Impakt auf Arten und Gesell-schaften gewöhnlich negativ (Rückgang), auf Bodeneigen-schaften positiv (Zunahme)

Impakt nepůvodních druhů

Změna ano či ne?

Je změna pozitivní či negativní?

čistá změna stavu ve srovnání k neinvadované ploše bez ohledu na směr impaktu

63 % výrazných změn ve studovaných systémech

Častěji impakt rostlin na rostliny než na živočichy

Impakt na druhy a společenstva obvykle negativní (pokles), na půdní vlastnosti pozitivní (nárůst)

Pyšek P, Jarošík V, Hulme PE, Pergl J, Hejda M, Schaffner U, Vilà M. 2012. A global assessment of invasive plant impacts on resident species, communities and ecosystems: the interaction of impact measures, invading species' traits and environment. *Global Change Biology* 18: 1725–1737

Impakt auf die Diversität

Impakt na diverzitu

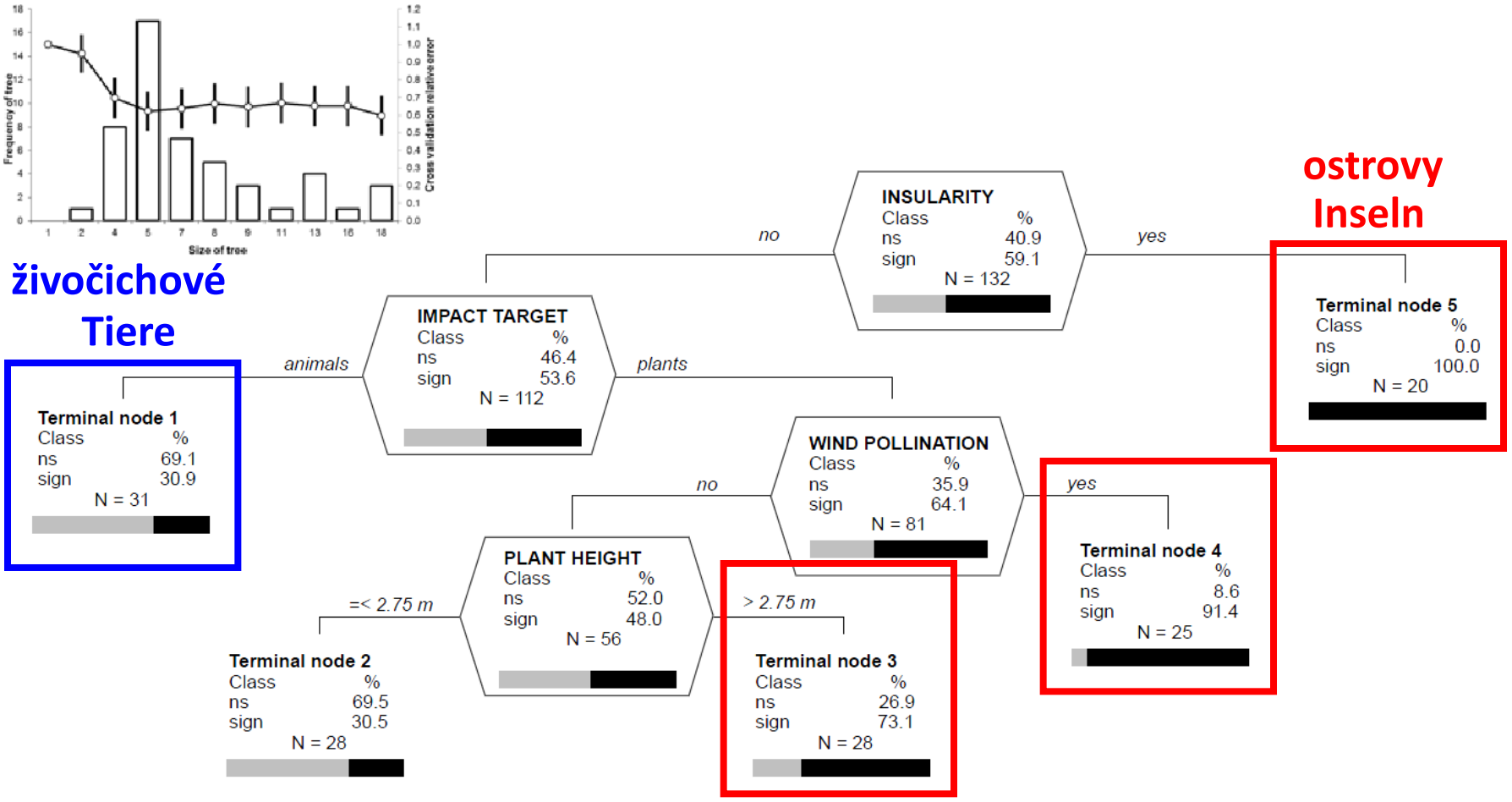
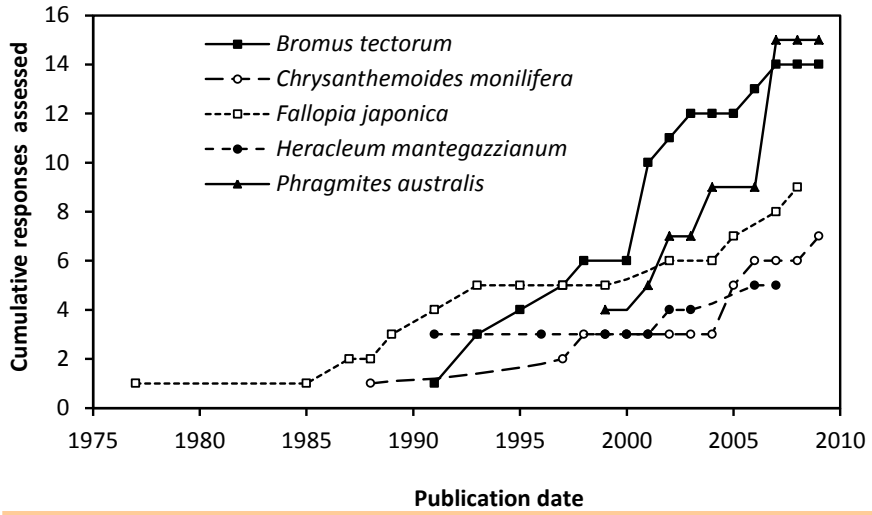
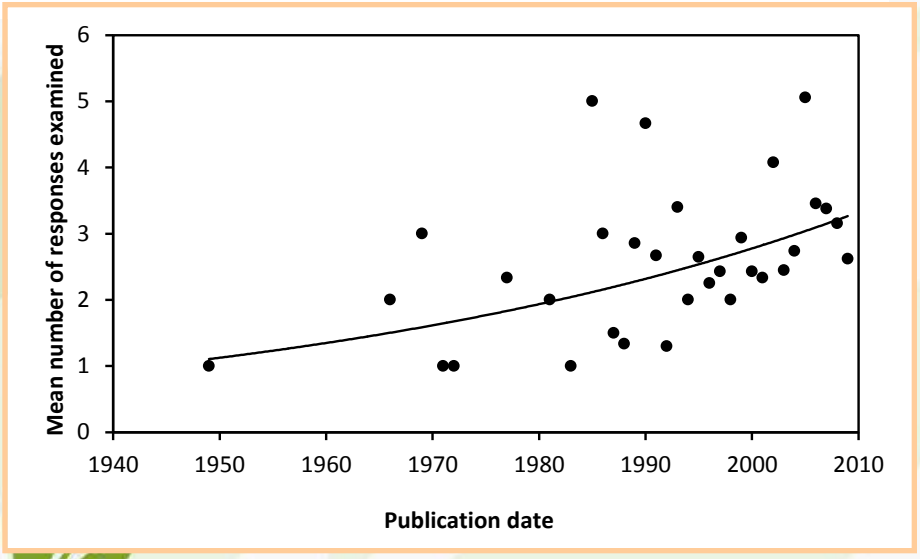


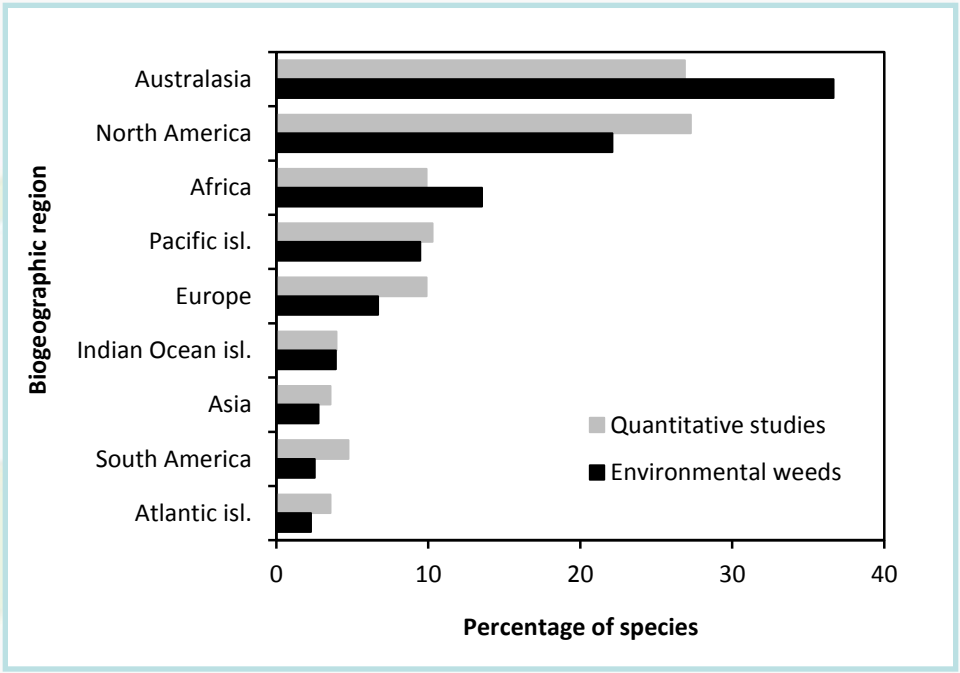
Figure 3 Classification tree analysis of the probability of significant ■ or non-significant ■ impacts on species richness. Overall misclassification rate of the optimal tree is 21.5%, compared to 50% for the null model; specificity (ability to predict that the impact is not significant when it is not) = 0.77; sensitivity (ability to predict that the impact is significant when it is) = 0.61. Inset: Cross validation processes for the selection of the optimal regression tree. The line shows a single representative 10-fold cross-validation of the most frequent (modal) optimal tree with standard error (SE) estimate of each tree size. Bar charts are the numbers of the optimal trees of each size (Frequency of tree) selected from a series of 50 cross-validations based on the one-SE rule which minimizes the cross-validated error within one standard error of the minimum. The most frequent (modal) tree has five terminal nodes. Otherwise as in Fig. 2.

Impaktstudie; Begrenzt uns die Datenerreichbarkeit?

Studie o impaktu; jsme omezeni dostupností dat?



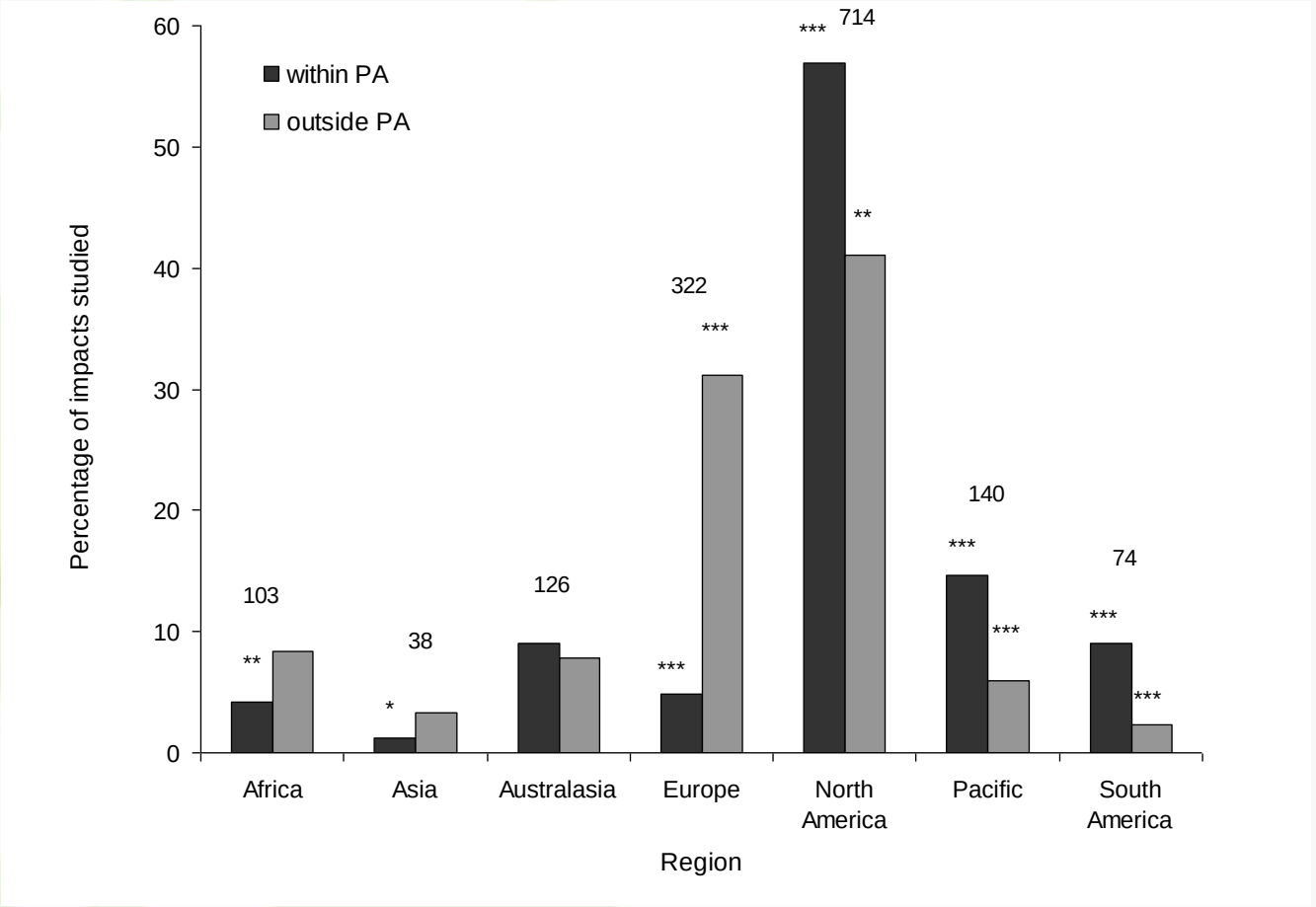




Hulme PE, Pyšek P, Jarošík V, Pergl J, Schaffner U & Vila M (2013): Bias and error in understanding plant invasion impacts. - Trends in Ecology and Evolution (doi: j.tree.2012.10.010)

Impaktstudie und Schutzgebiete

Studie o impaktu a chráněná území



Studie (Pyšek et al. 2002, 2003)

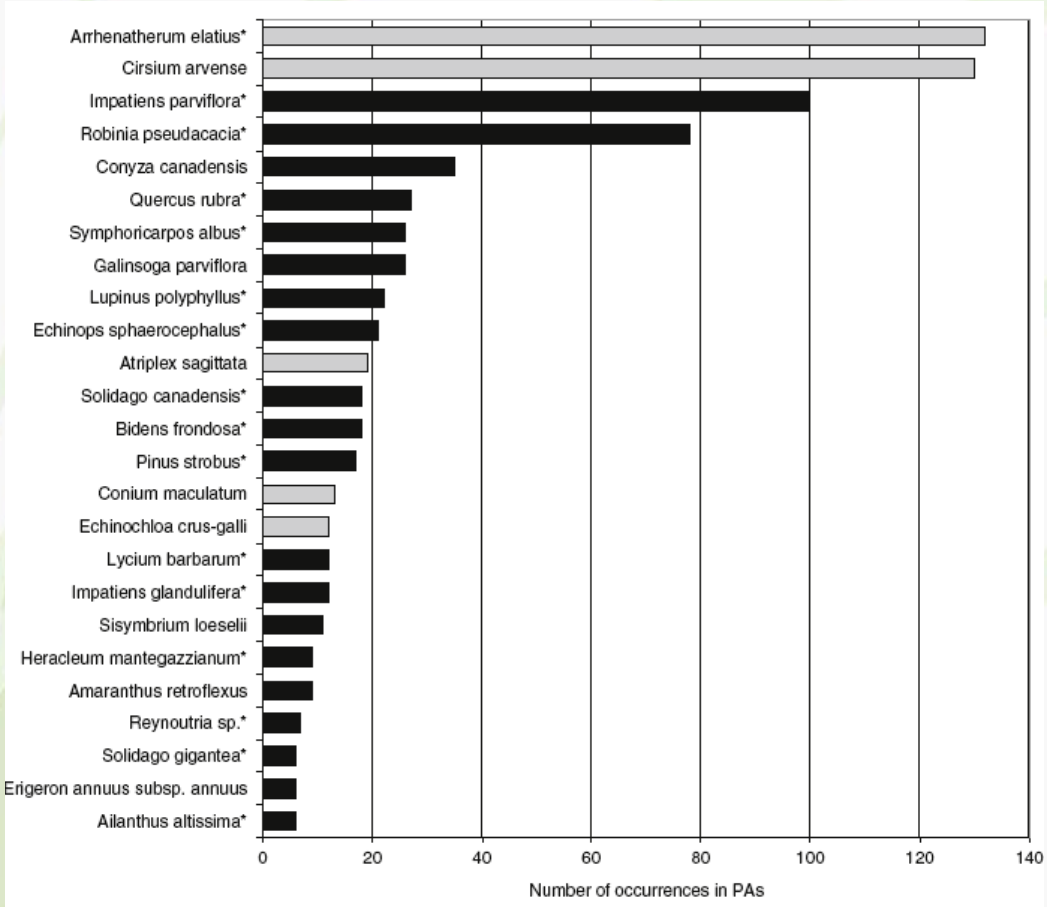


Fig. 11.4 Occurrence of invasive species in protected areas in the Czech Republic, showing the number of protected areas in which the species was recorded. Based on data in Pyšek et al. 2002,

- založena na datech z 300 chráněných území v ČR. Počet neofytů je funkcí environmentálních podmínek a socio-ekonomických faktorů.

Klima (klesá počet alienů s nadmořskou výškou), tlak propagulí (hustota zalidnění, počty návštěvníků...)

- basiert auf Daten aus 300 Schutzgebieten in der ČR. Neophytenanzahl wird zur Funktion von Umweltverhältnissen und sozioökonomischen Faktoren.

Klima (Anzahl der Aliens sinkt mit der Meereshöhe), Propagulen/ /Vermehrungseinheiten/-druck (Bevölkerungsdichte, Besucherzahlen...)

Table 11.2 Plant species reported as most harmful in European protected areas by managers

Taxon	LH	Origin	Number of PAs	Number of European regions
Fallopia japonica et sp.	p	Asia	48	36
Impatiens glandulifera	a	Asia	29	34
Robinia pseudoacacia	t	N America	26	42
Ailanthus altissima	t	Asia	16	36
*Heracleum mantegazzianum**	p	Asia	11	25
Ambrosia artemisiifolia	a	N America	10	33
*Solidago canadensis**	p	N America	9	36
Solidago gigantea	p	N America	8	32
Amorpha fruticosa	s	N America	7	17
*Elodea canadensis**	p	N America	6	38
Acer negundo	t	N America	6	33
Acer pseudoplatanus	t	Europe	6	19
Prunus serotina	s	N America	5	24
*Baccharis halimifolia**	s	N America	4	6
*Buddleia davidii**	s	Asia	4	23
Caulerpa racemosa	al	Africa	4	15
*Echinocystis lobata**	a	N America	4	15
*Heracleum sosnowskyi**	p	Asia	4	7
*Impatiens parviflora**	a	Asia	4	31
*Opuntia ficus-indica**	p	C America	4	13
*Phytolacca americana**	p	N America	4	29
Carpobrotus edulis	p	Africa	4	22
*Asclepias syriaca**	p	N America	3	18
*Datura stramonium**	a	N America	3	42
Rhododendron ponticum	s	Europe, Asia	3	10
*Senecio inaequidens**	a	Africa	3	26
Xanthium italicum	a	N America	3	20

Založeno na web dotazníku (Genovesi a Monaco)
- data z 118 chr. území

Auf Grundlage eines Internet-Fragebogens (Genovesi a Monaco)
- Daten aus 118 Schutzgebieten

Pyšek P., Genovesi P., Pergl J., Monaco A. & Wild J. (2013): Plant invasions of protected areas in Europe: an old continent facing new problems. – In: Foxcroft L. C., Pyšek P., Richardson D. M. & Genovesi P. (eds), Plant invasions in protected areas: patterns, problems and challenges, pp. 209–240, Springer, Dordrecht (doi: 10.1007/978-94-007-7750-7_11)

Welche Risiken sind identifiziert und welche sind die tatsächlichen

Jaká rizika jsou identifikována a jaká jsou skutečná

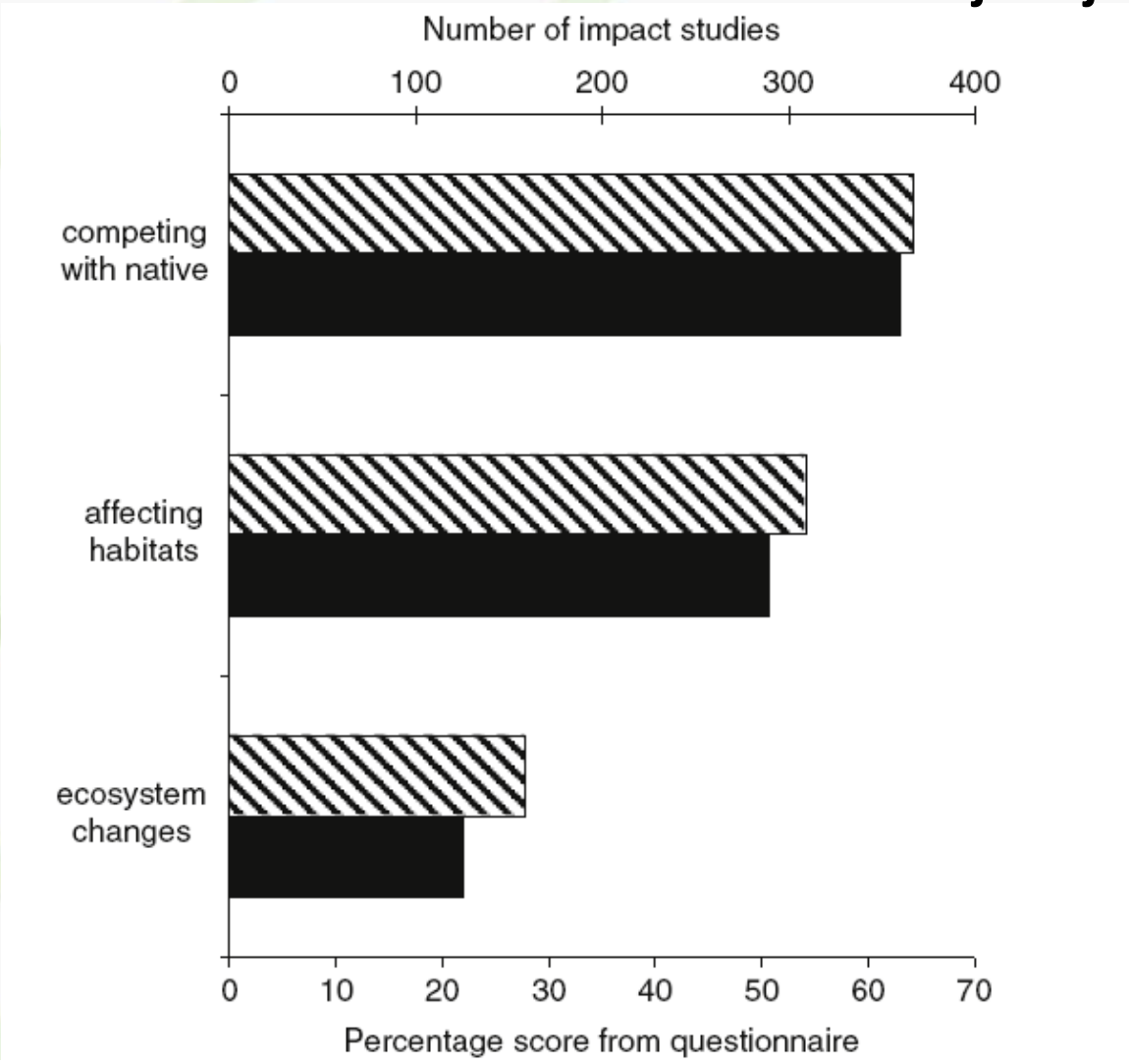
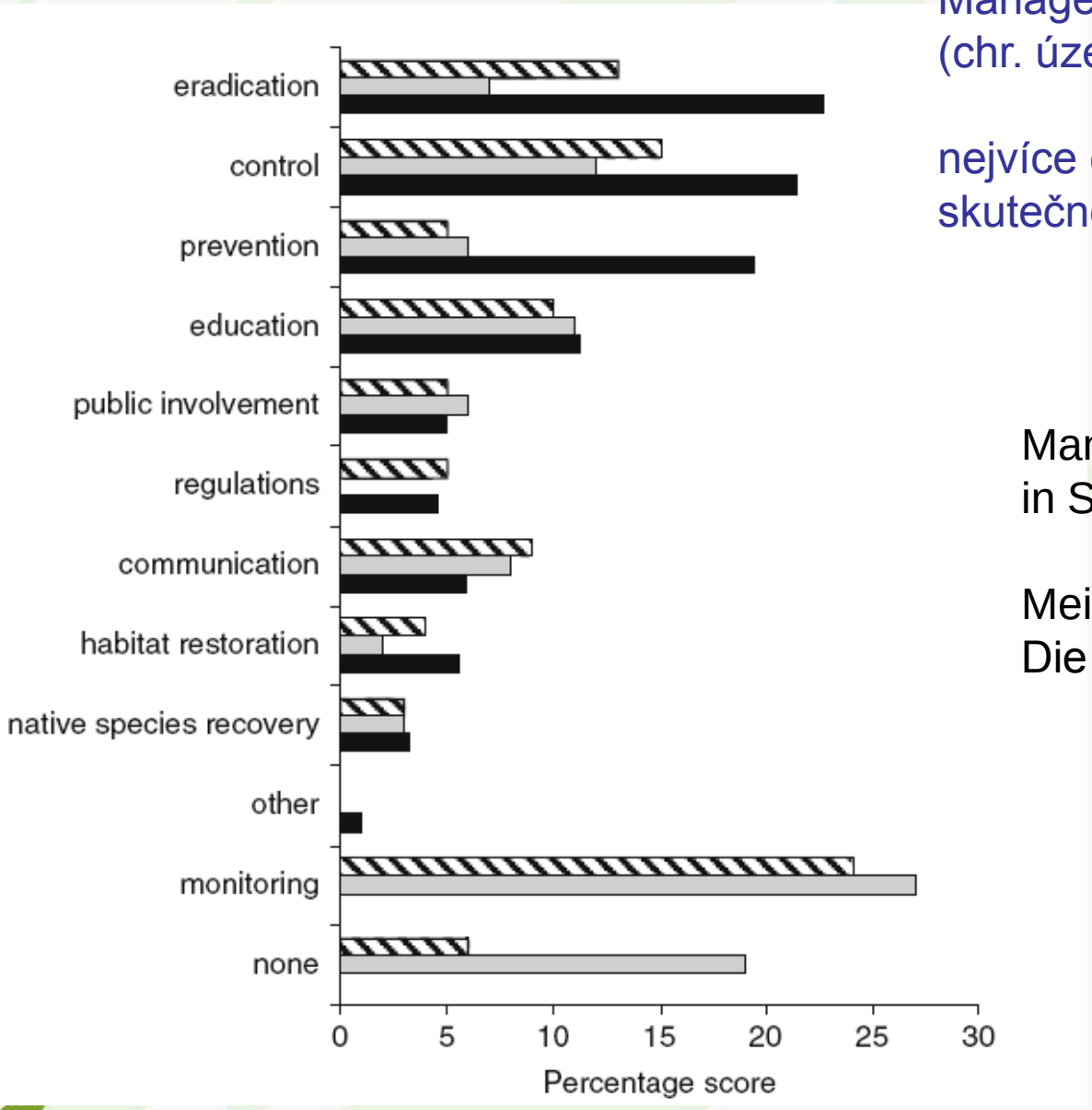


Fig. 11.6 Comparison of the most serious impacts of plant invasions as perceived by managers of protected areas in Europe (based on a web survey of A. Monaco and P. Genovesi, unpublished)



Managementové zásahy v PA (chr. územích)

nejvíce efektivní (černé sloupce) skutečné

proužky - rostliny

šedé - živočichové

Managementeingriffe in Schutzgebieten

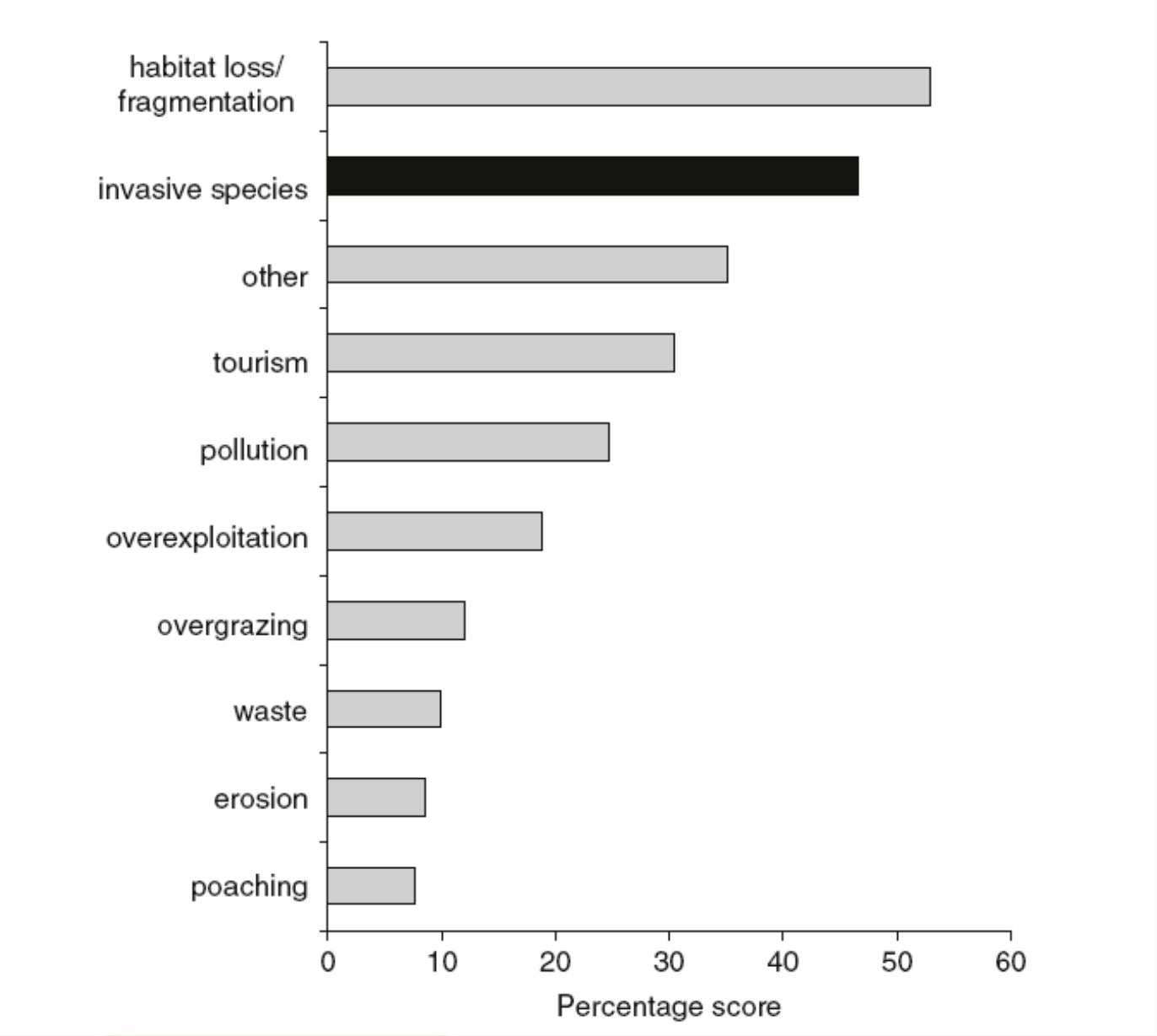
Meisteffektiv (schwarze Säulen) Die tatsächlichen

Streifen - Pflanzen

grau - Tiere

Risiken für Schutzgebiete

Rizika pro chráněná území



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PLOS | BIOLOGY

Essay

A Unified Classification of Alien Species Based on the Magnitude of their Environmental Impacts

Tim M. Blackburn[1,2,3*], Franz Essl[4], Thomas Evans[5], Philip E. Hulme[6], Jonathan M. Jeschke[7], Ingolf Kühn[8,9], Sabrina Kumschick[10], Zuzana Marková[11,12], Agata Mrugała[12], Wolfgang Nentwig[13], Jan Pergl[11], Petr Pyšek[11,12], Wolfgang Rabitsch[14], Anthony Ricciardi[15], David M. Richardson[10], Agnieszka Sendek[8], Montserrat Vilà[16], John R. U. Wilson[10,17], Marten Winter[9], Piero Genovesi[18], Sven Bacher[19]

Impakt-Auswertung

Hodnocení impaktu

Blackburn T. M., Essl F., Evans T., Hulme P. E., Jeschke J. M., Kühn I., Kumschick S., Marková Z., Mrugała A., Nentwig W., Pergl J., Pyšek P., Rabitsch W., Ricciardi A., Richardson D. M., Sendek A., Vilà M., Wilson J. R. U., Winter M., Genovesi P. & Bacher S. (2014): A unified classification of alien species based on the magnitude of their environmental impacts. – PLOS Biology 12: e1001850 (doi: 10.1371/journal.pbio.1001850)

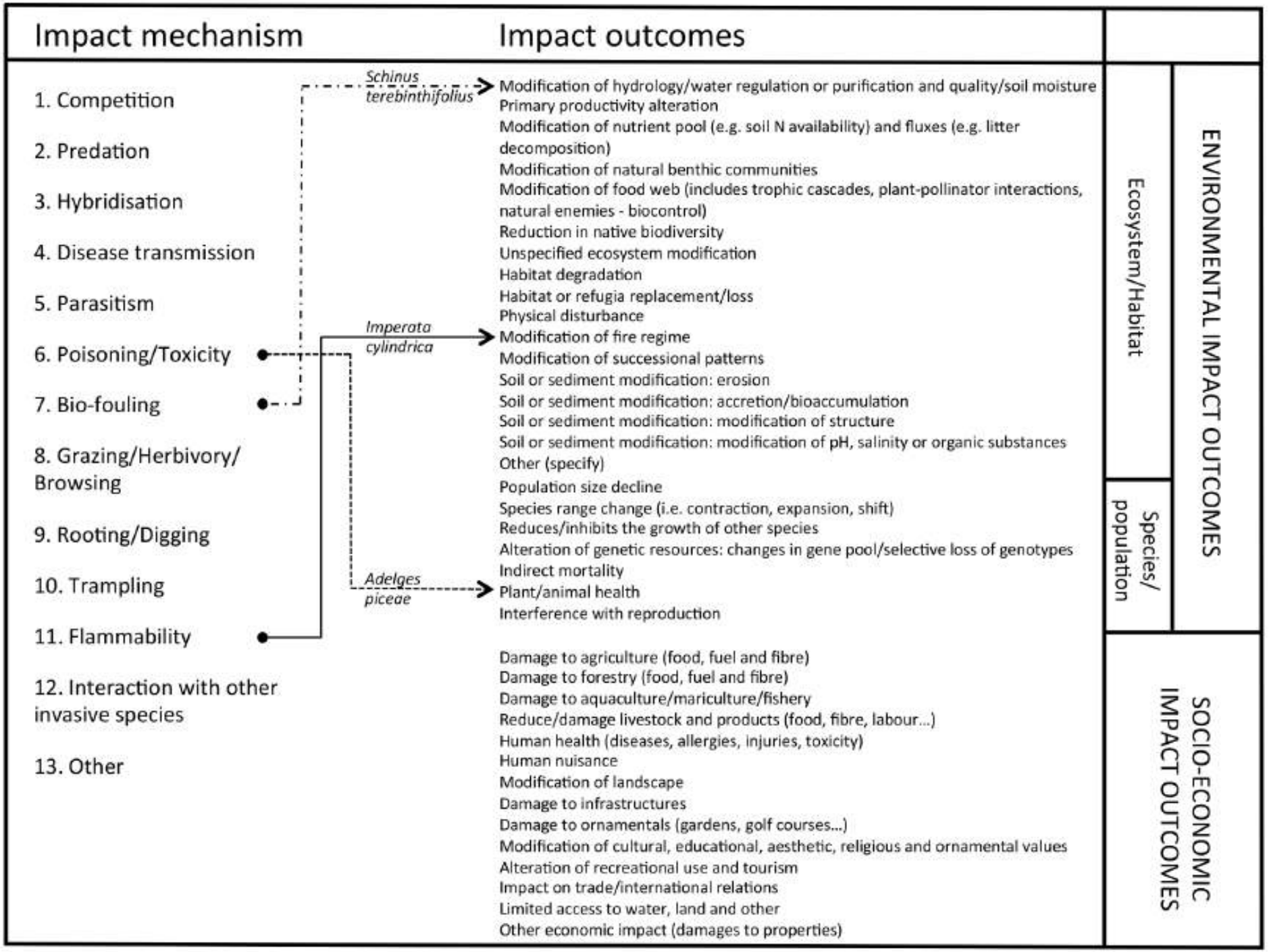

Impact mechanism
Impact outcomes
1. Competition
2. Predation
3. Hybridisation
4. Disease transmission
5. Parasitism
6. Poisoning/Toxicity
7. Bio-fouling
8. Grazing/Herbivory/ Browsing
9. Rooting/Digging
10. Trampling
11. Flammability
12. Interaction with other invasive species
13. Other
Schinus terebinthifolius
Imperata cylindrica
Adelges piceae
Modification of hydrology/water regulation or purification and quality/soil moisture
Primary productivity alteration
Modification of nutrient pool (e.g. soil N availability) and fluxes (e.g. litter decomposition)
Modification of natural benthic communities
Modification of food web (includes trophic cascades, plant-pollinator interactions, natural enemies - biocontrol)
Reduction in native biodiversity
Unspecified ecosystem modification
Habitat degradation
Habitat or refugia replacement/loss
Physical disturbance
Modification of fire regime
Modification of successional patterns
Soil or sediment modification: erosion
Soil or sediment modification: accretion/bioaccumulation
Soil or sediment modification: modification of structure
Soil or sediment modification: modification of pH, salinity or organic substances
Other (specify)
Population size decline
Species range change (i.e. contraction, expansion, shift)
Reduces/inhibits the growth of other species
Alteration of genetic resources: changes in gene pool/selective loss of genotypes
Indirect mortality
Plant/animal health
Interference with reproduction
Damage to agriculture (food, fuel and fibre)
Damage to forestry (food, fuel and fibre)
Damage to aquaculture/mariculture/fishery
Reduce/damage livestock and products (food, fibre, labour...)
Human health (diseases, allergies, injuries, toxicity)
Human nuisance
Modification of landscape
Damage to infrastructures
Damage to ornamentals (gardens, golf courses...)
Modification of cultural, educational, aesthetic, religious and ornamental values
Alteration of recreational use and tourism
Impact on trade/international relations
Limited access to water, land and other
Other economic impact (damages to properties)
ENVIRONMENTAL IMPACT OUTCOMES
Ecosystem/Habitat
Species/ population
SOCIO-ECONOMIC IMPACT OUTCOMES

Table 1. Impact criteria for assigning alien species to different categories in the classification scheme (Box 2).

Impact Class	Massive (MA)	Major (MR)	Moderate (MO)	Minor (MI)	Minimal (ML)
Categories should adhere to the following general meaning	*Causes at least local extinction of species, and irreversible changes in community composition; even if the alien species is removed the system does not recover its original state*	*Causes changes in community composition, which are reversible if the alien species is removed*	*Causes declines in population densities, but no changes in community composition*	*Causes reductions in individual fitness, but no declines in native population densities*	*No effect on fitness of individuals of native species*

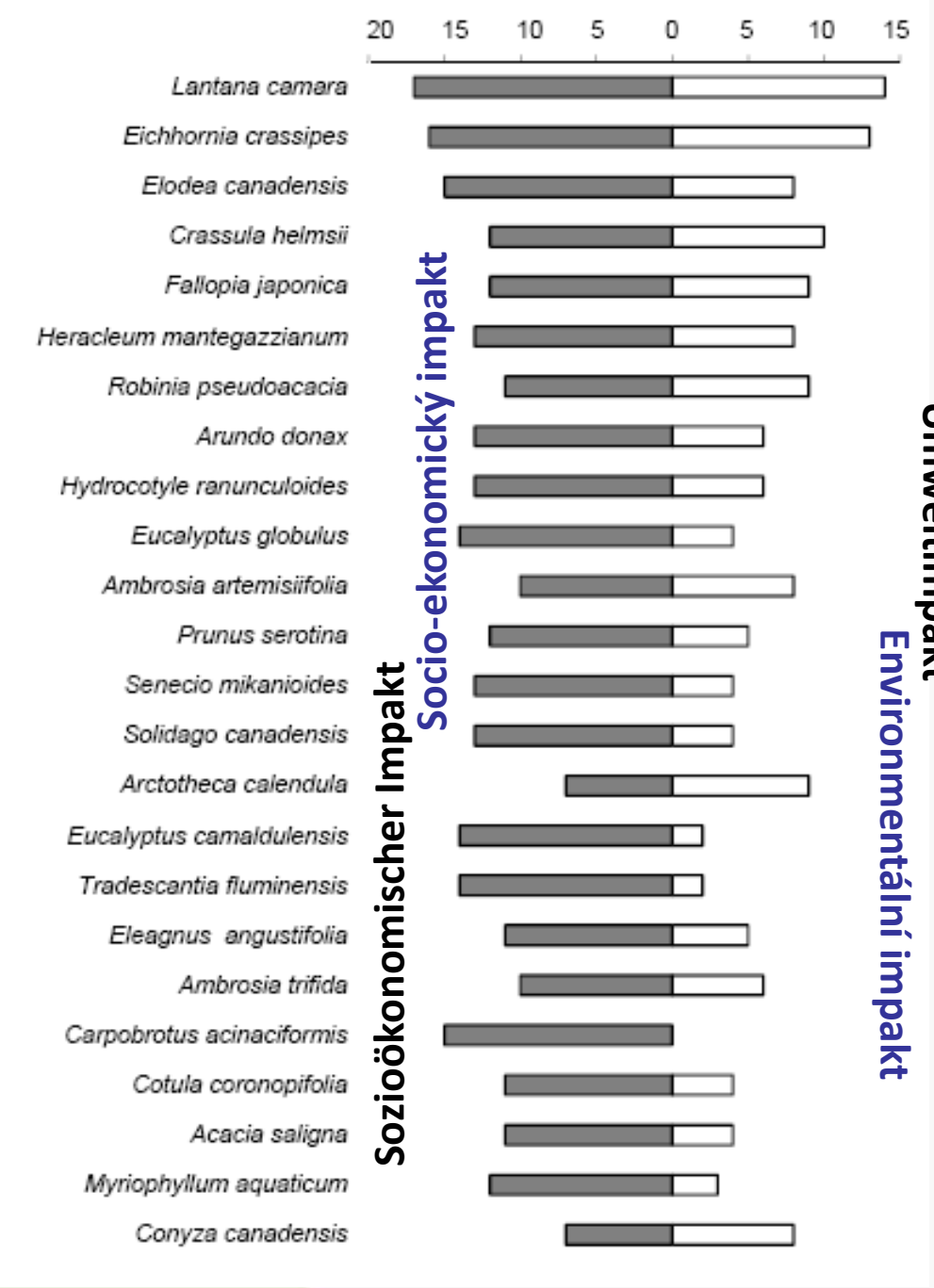
Environmental impact

	med.	sum	Gini	LF	publ.	DAISIE regions
Arundo donax	5.0	13	0.6	per. grass	84	17
Lantana camara	4.5	17	0.4	shrub	282	13
Acacia longifolia	4.5	9	0.7	tree	71	10
Carpobrotus acinaciformis	4.0	15	0.4	per. herb	4	14
Carpobrotus edulis	4.0	14	0.5	per. herb	48	22
Crassula helmsii	4.0	12	0.6	aquatic	2	17
Buddleja davidii	4.0	11	0.5	shrub	27	23
Cotula coronopifolia	4.0	11	0.5	per. herb	9	24
Lupinus polyphyllus	4.0	11	0.5	per. herb	16	30
Rosa rugosa	4.0	10	0.6	shrub	22	28
Tropaeolum majus	4.0	4	0.8	vine	4	27
Elodea canadensis	3.5	15	0.4	aquatic	40	58
Eucalyptus camaldulensis	3.5	14	0.4	tree	104	11
Tradescantia fluminensis	3.5	14	0.4	per. herb	18	15
Acacia dealbata	3.5	7	0.7	tree	39	11
Arctotheca calendula	3.5	7	0.7	ann. herb	23	14
Acacia saligna	3.0	11	0.6	shrub	71	15
Ailanthus altissima	3.0	9	0.5	tree	113	36
Acer negundo	3.0	3	0.8	tree	33	33
Alcea rosea	3.0	3	0.8	per. herb	0	30

Socioeconomic impact

species name	med.	sum	Gini	LF	publ.	DAISIE regions
Crassula helmsii	4.0	10	0.6	aquatic	2	17
Elodea canadensis	4.0	8	0.7	aquatic	40	58
Abutilon theophrasti	4.0	4	0.8	ann. herb	594	34
Eichhornia crassipes	3.5	13	0.4	aquatic	44	11
Lantana camara	3.0	14	0.3	shrub	282	13
Arctotheca calendula	3.0	9	0.6	ann. herb	23	14
Ambrosia artemisiifolia	3.0	8	0.5	ann. herb	301	33
Fallopia japonica	3.0	9	0.6	per. herb	12	36
Cyperus eragrostis	3.0	8	0.5	per. grass	201	20
Ricinus communis	3.0	8	0.5	ann. herb	76	33
Ambrosia trifida	3.0	6	0.7	ann. herb	71	25
Arundo donax	3.0	6	0.7	per. grass	84	17
Elodea nuttallii	3.0	6	0.7	aquatic	10	26
Hydrocotyle ranunculoides	3.0	6	0.7	aquatic	5	12
Opuntia maxima	3.0	6	0.7	shrub	4	10
Ipomoea indica	3.0	3	0.8	vine	0	15
Ipomoea purpurea	3.0	3	0.8	vine	44	25
Conyza canadensis	2.5	8	0.5	ann. herb	10	44
Eleusine indica	2.5	5	0.7	ann. grass	69	33
Galinsoga parviflora	2.5	5	0.7	ann. herb	5	45

Marková et al. submitováno



Marková et al. submitováno

Petr Pyšek, Zuzana Marková, Piero Genovesi, Philip E. Hulme, Montserrat Vilà a další / u.a. **.....**

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