Socio-economic impact assessment of invasive plants: recent developments and limitations

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RESEARCH ARTICLE

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Socio-economic impact classification of alien taxa (SEICAT)

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Assessing effects on human well-being that can often not be measured as monetary costs

TABLE 1 Constituents of human well-being and examples of their subcategories (after MEA, 2005). The overarching premise for all constituents is the freedom of choice and action, i.e. the opportunity to be able to achieve what a person values doing and being

Constituents of human well-being	Examples
Safety	Personal safety
	Secure resource access
	Security from disasters
Material and immaterial assets	Adequate livelihoods
	Sufficient nutritious food
	Shelter
	Access to goods
Health	Strength
	Feeling well
	Access to clean air and water
Social, spiritual and cultural relations	Social, spiritual and cultural practice
	Mutual respect
	Friendship

A formalized impact classification scheme comparable to the IUCN red data listing

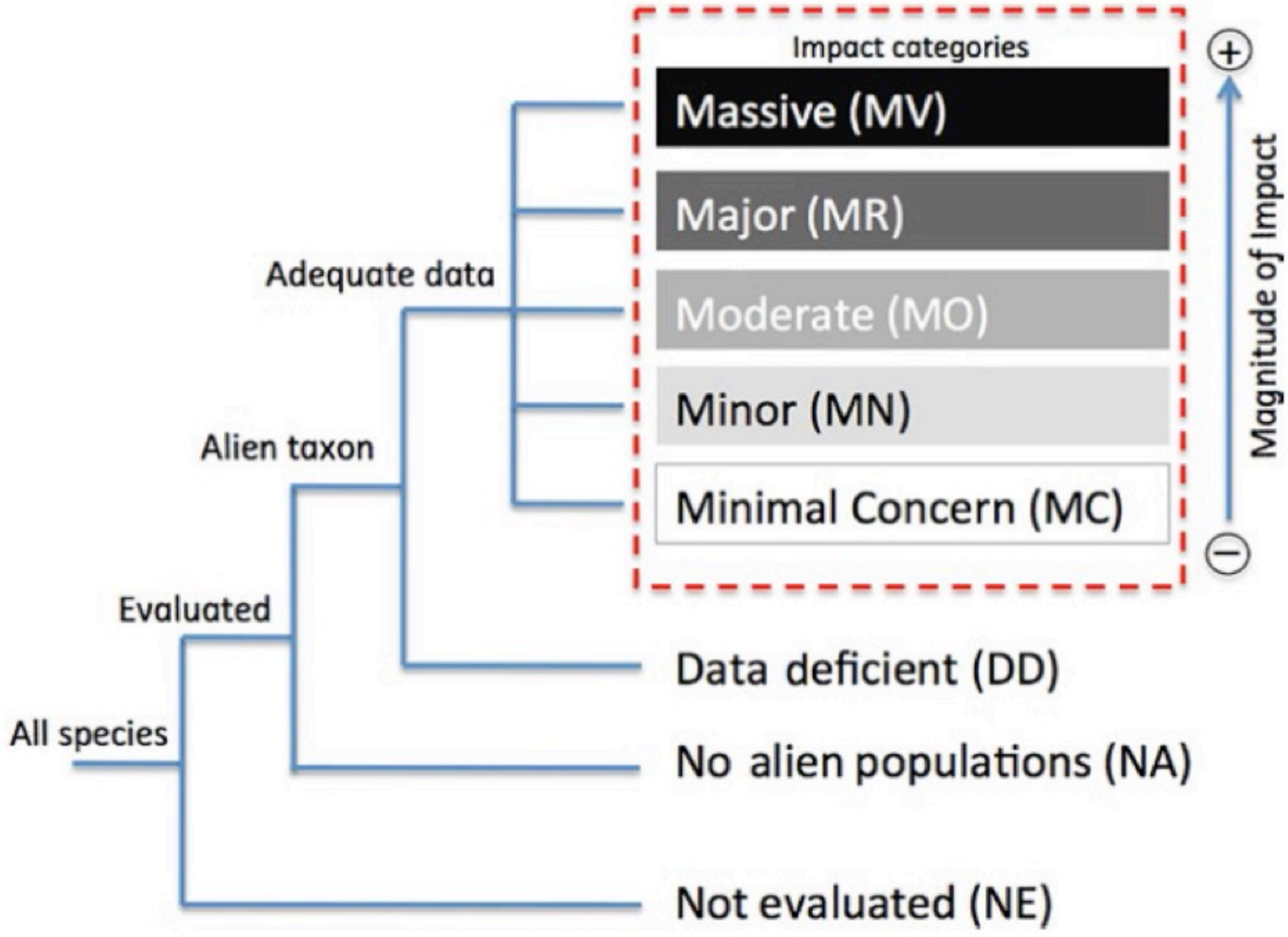


FIGURE 2 Socio-Economic Impact Classification of Alien Taxa (SEICAT) (after Blackburn et al., 2014; Hawkins et al., 2015). Detailed descriptions of the classes are given in Table 2

Bacher et al. 2017. *Methods in Ecology and Evolution*, in press

A person's capability to realize activities as a generalized metrics for comparison

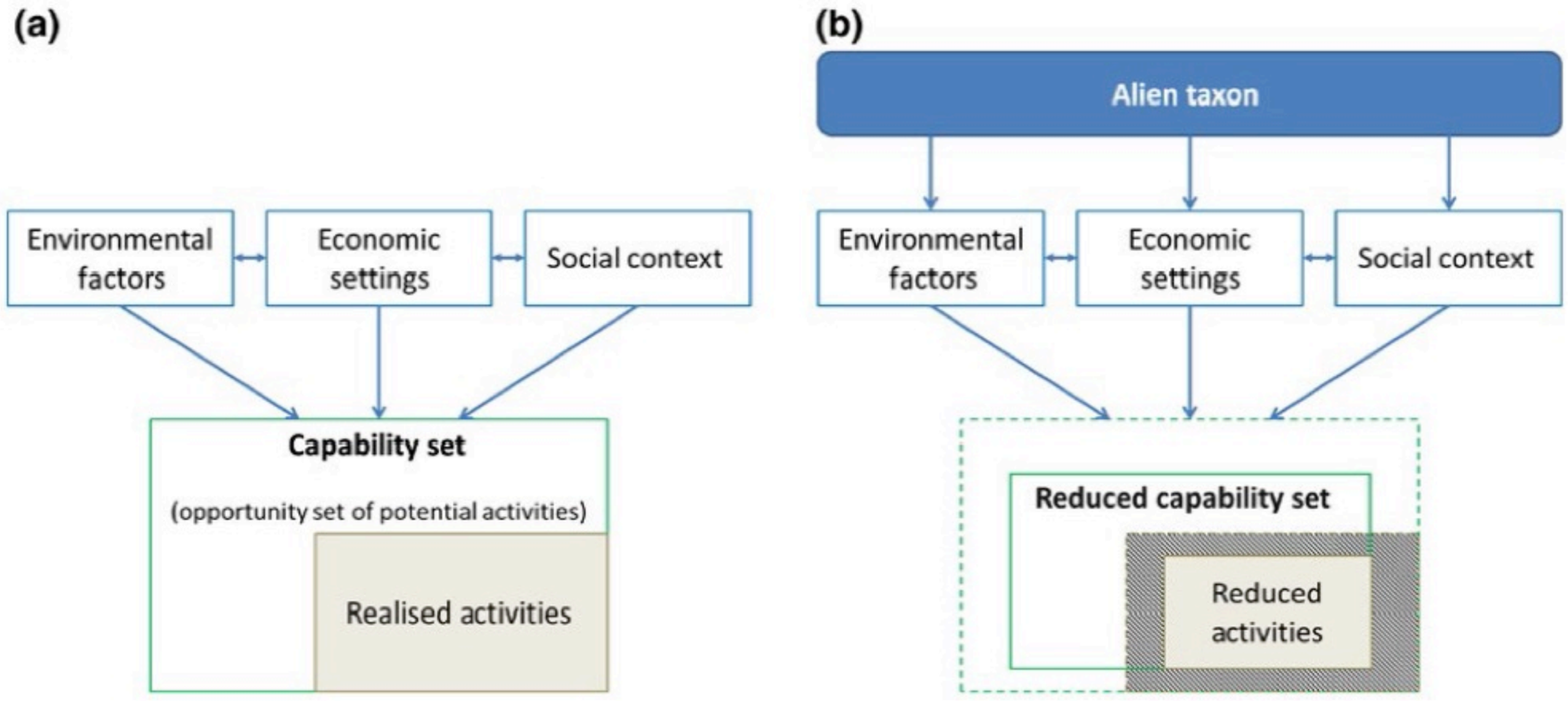


FIGURE 1 (a) A person's capability set depends on environmental factors, economic settings (goods & services), and the social context. From this set, people select the activities they want to achieve (realised activities). (b) Alien taxa can reduce peoples' opportunities via changes in environmental factors, economic settings or the social context. Socio-Economic Impact Classification for Alien Taxa (SEICAT) defines negative impacts as losses in realised activities attributable to an alien taxon (black hatched area)

Bacher et al. 2017. *Methods in Ecology and Evolution*, in press

Classification levels: loss of activity, reversibility

TABLE 2 Description of Socio-Economic Impact Classification of Alien Taxa (SEICAT) according to observed changes in peoples' activities

Impact classification	Description
Minimal concern (MC)	No deleterious impacts reported despite availability of relevant studies with regard to its impact on human well-being. Taxa that have been evaluated under the SEICAT process but for which impacts have not been assessed in any study should not be classified in this category, but rather should be classified as data deficient
Minor (MN)	Negative effect on peoples' well-being, such that the alien taxon makes it difficult for people to participate in their normal activities. Individual people in an activity suffer in at least one constituent of well-being (i.e. security; material and non-material assets; health; social, spiritual and cultural relations). Reductions of well-being can be detected through e.g. income loss, health problems, higher effort or expenses to participate in activities, increased difficulty in accessing goods, disruption of social activities, induction of fear, but no change in activity size is reported, i.e. the number of people participating in that activity remains the same
Moderate (MO)	Negative effects on well-being leading to changes in activity size, fewer people participating in an activity, but the activity is still carried out. Reductions in activity size can be due to various reasons, e.g. moving the activity to regions without the alien taxon or to other parts of the area less invaded by the alien taxon; partial abandonment of an activity without replacement by other activities; or switch to other activities while staying in the same area invaded by the alien taxon. Also, spatial displacement, abandonment or switch of activities does not increase human well-being compared to levels before the alien taxon invaded the region (no increase in opportunities due to the alien taxon)
Major (MR)	Local disappearance of an activity from all or part of the area invaded by the alien taxon. Collapse of the specific social activity, switch to other activities, or abandonment of activity without replacement, or emigration from region. Change is likely to be reversible within a decade after removal or control of the alien taxon. "Local disappearance" does not necessarily imply the disappearance of activities from the entire region assessed, but refers to the typical spatial scale over which social communities in the region are characterised (e.g. a human settlement)
Massive (MV)	Local disappearance of an activity from all or part of the area invaded by the alien taxon. Change is likely to be permanent and irreversible for at least a decade after removal of the alien taxon, due to fundamental structural changes of socio-economic community or environmental conditions ("regime shift")
Data deficient (DD)	There is no information to classify the taxon with respect to its impact, or insufficient time has elapsed since introduction for impacts to have become apparent

SEICAT-type assessments (highly generalized): strengths and weaknesses

Strengths:

- Documentation of non-monetary socioeconomic effects **of worst cases** in a highly aggregated way and therefore independent of context

- Documentation and compilation of case examples
- Identification of very problematic invasions
- Basis for comparative studies: understanding context-dependences
- Awareness building

Weaknesses:

- Limited value for decision-making support
- Assumes that precautionary approach is effective and efficient

- No cost-benefit analysis
- No understanding of willingness to pay / capacity to act
- Does not account for context dependencies (ecological and socioeconomic)
- Neglects shifting baselines in a world of rapid change
- Neglects complexities of perception
- Neglects conflicting perspectives of stakeholders, cultural groups, etc.

Perspectives of actors matter....

Abb 3 Der Asiatische Laubholzbockkäfer (Anoplophora glabripennis) wird oft mit unsachgemäss oder nicht behandelten Lattenkisten und Paletten eingeschleppt. Foto: Beat Wermelinger

Fig. 1 The label template that has been prepared by Swiss environmental authorities for Swiss horticulturalists to inform customers about environmental effects and the handling of Black- and Watch-List plants. The template is available in four languages (German, French, Italian, English). Swiss horticulturalists are free to change the layout of the template (colour, form), and to choose the languages.

Humair et al. 2014. *EPPO Bulletin* 4(2), 1-7.
Kueffer et al. 2014. *Schweiz. Zeitschrift Forstwesen* 165(6): 124–131

Context dependencies: capacity to mitigate impacts

Pauchard et al., Biological Invasions, 2016

Context dependencies:
Humans are part of the system

Kueffer, *Science* 358(6364): 724 -725.

Kull et al., *Geographical Research*, in press

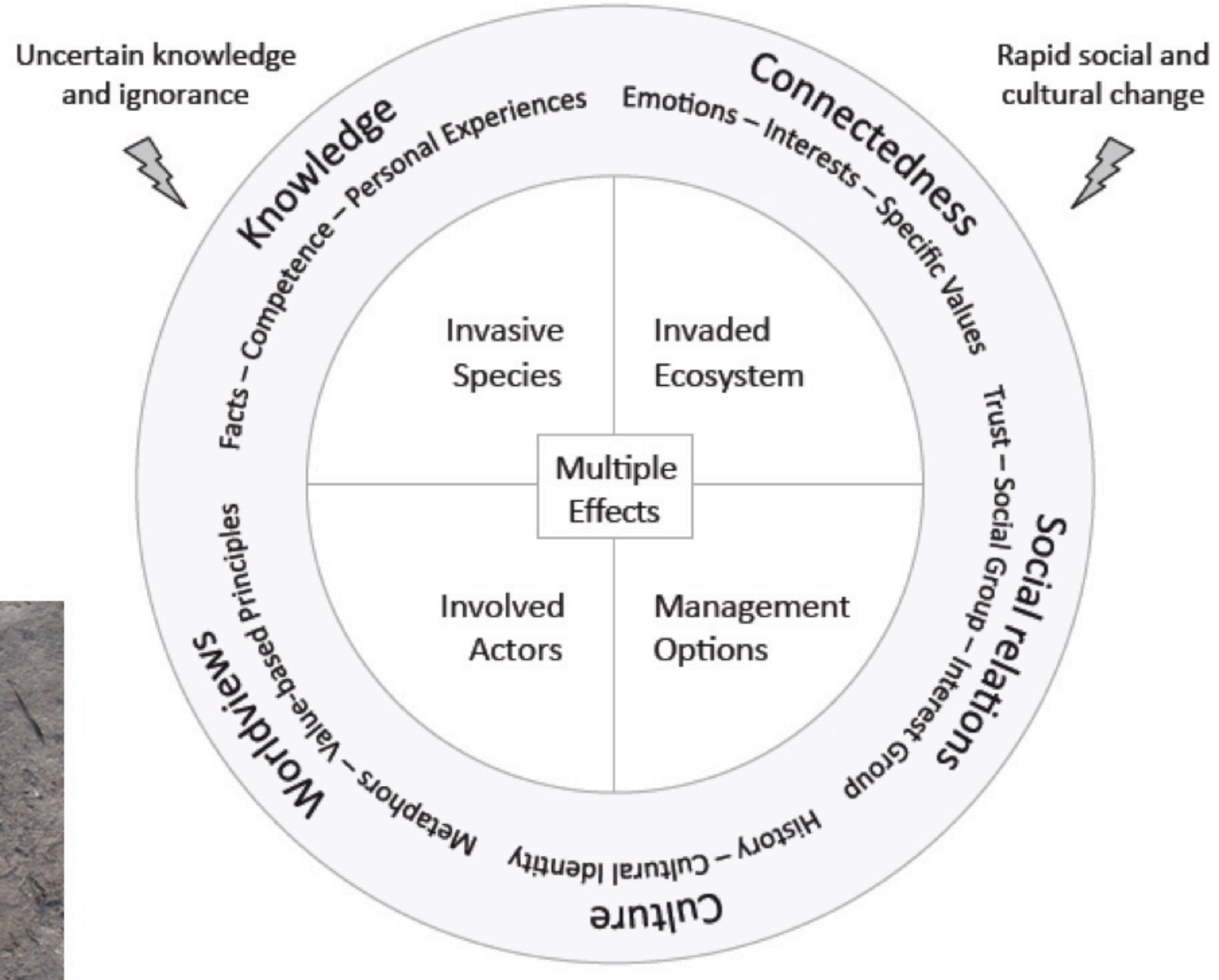
Baselines affect assessments:
a new species might bring benefits or nuisances and replace benefits or nuisances compared to some past or some future scenario

Table 3
Examples of benefits, from ecosystem services (ES – based on CICES), and nuisances from ecosystem disservices (EDS – based on Table 1) and reduced ecosystem services, promoted by plant invasions on human wellbeing dimensions (categories based on Smith et al. (2013)).

Benefits from plant invasions to human wellbeing	**Nuisances from plant invasions for human wellbeing**	
From ecosystem services (ES)	**From reduced ecosystem services**	**From ecosystem disservices (EDS)**
Health		
Provisioning ES: Blood sugar medicine from *Prosopis* species in South Africa (Shackleton et al., 2014);Several medicinal and curative products derived from *Eichhornia crassipes* in Bangladesh (Rana and Akhter, 2010);Styptics or astringents extracted from *Acacia mearnsii* (Kull et al., 2011; de Wit et al., 2001);Other products from *Acacia*, *Cinnamomum* and *Spathodea* species across the globe (Dickie et al., 2014).	Reduction of the provision of medicinal products through the elimination of other medicinal plants, by Australian *Acacia* species in South Africa, Portugal and Chile (Le Maitre et al., 2011).	*Health EDS*: Physical injury due to *Opuntia* thorns in South Africa (Shackleton et al., 2007);Myocardia or gastroenteritis associated to the consumption of flowers and seeds of *Ailanthus altissima* and *Robinia pseudoacacia*, and cardiac problems and poisoning from *Echium plantagineum* and *Rhododendron ponticum* (Pyšek and Richardson, 2010);Pollen allergy and (or) dermatitis caused by *A. altissima*, *Acacia dealbata*, *Ambrosia artemisiifolia*, *Cortaderia selloana*, *Heracleum mantegazzianum* and *Schinus terebinthifolius* (Pyšek and Richardson, 2010);Transmission of human parasites through invasive plants (Schindler et al., 2015).

Vaz et al. 2017. *Ecosystem Services* 23: 94–107

The messy world of perceptions...



Kueffer, ANU ePress, 2013
Kueffer & Kull, In: Hulme et al., Springer, 2017

The messy world of perceptions...

- **Psychology:**

e.g. novelty, charismatic plant or animal

- **Social relationships:**

e.g. between actors involved in management

- **Culture:**

e.g. changing perceptions of a species over time

Kueffer, ANU ePress, 2013
Kueffer & Kull, In: Hulme et al., Springer, 2017

Fig. 20.3 Pillar Rocks, a tourist attraction in the Palni Hills of southern India. Non-native black wattles, *Acacia mearnsii*, planted on montane grasslands for tanbark now contribute to visitor satisfaction but pose challenges related to their invasiveness (Photograph by Christian Kull)