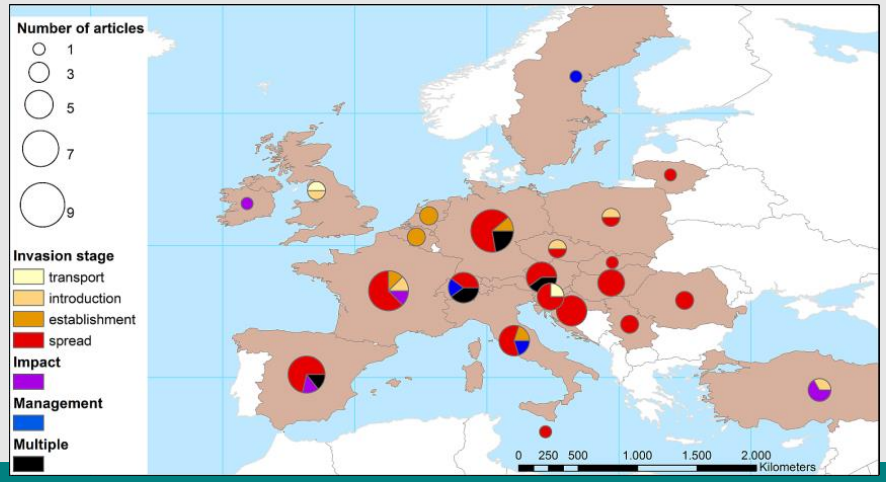



# Alien species and human health impacts:
## Evidence syntheses and the role of climate change

**S. Schindler, F. Essl, H.R. Bayliss, M. Adam, H.-P. Hutter, A.S. Pullin, S. Follak, P. Wallner, M. van Hove, F. Unterhofer, K. Lemmerer & W. Rabitsch**

# Background
## Alien species

**Alien species** redefine biogeography in the Anthropocene

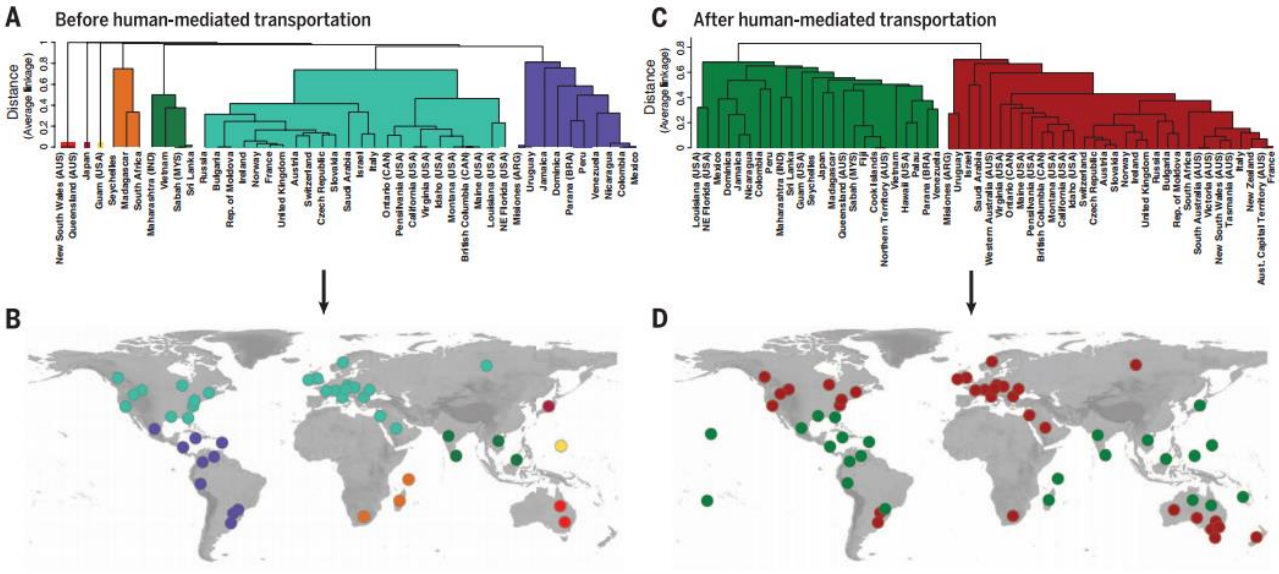
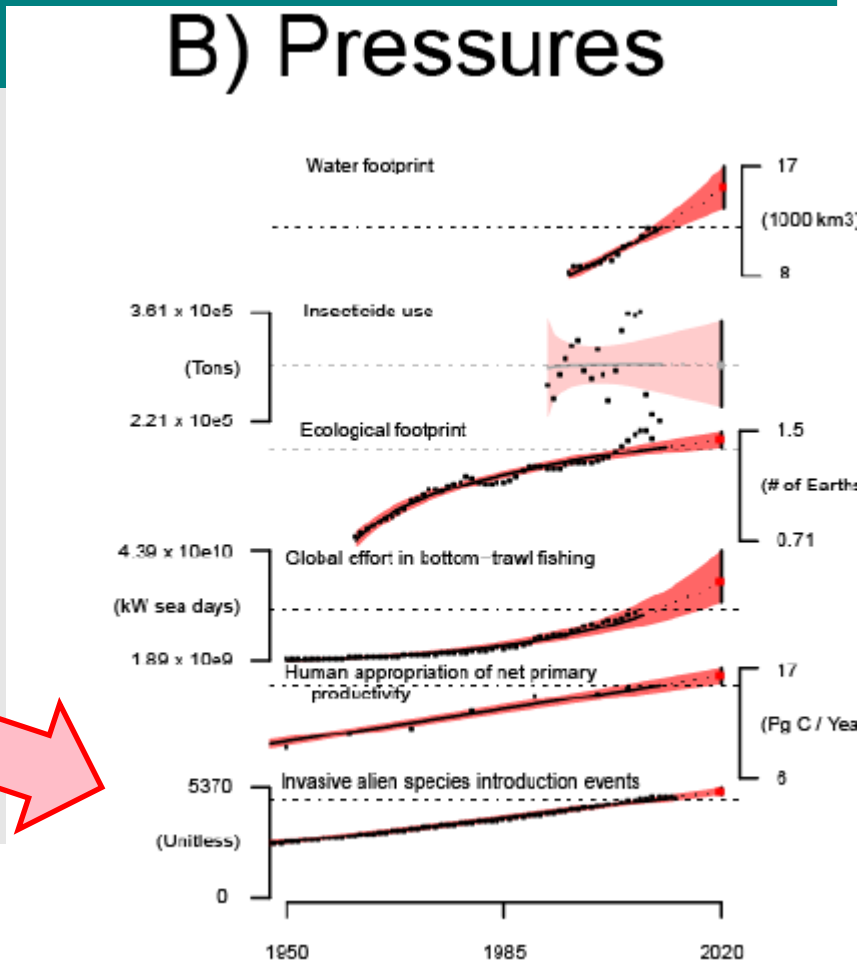



**Fig. 1. Dendrogram and map of compositional similarities among lists of alien terrestrial gastropods.** (**A** and **B**) Before dispersal by humans. (**C** and **D**) After dispersal by humans. Compositional dissimilarity was measured by the $\beta_{sim}$ index. Clusters were built through the minimization of the average compositional dissimilarity of one location to the others [i.e., UPGMA (unweighted pair group method with arithmetic mean) grouping]. Colors indicate main clusters identified by the dendrogram and their corresponding locations in the world map.

Capinha et al. (2016) Science

# Background
## Alien species

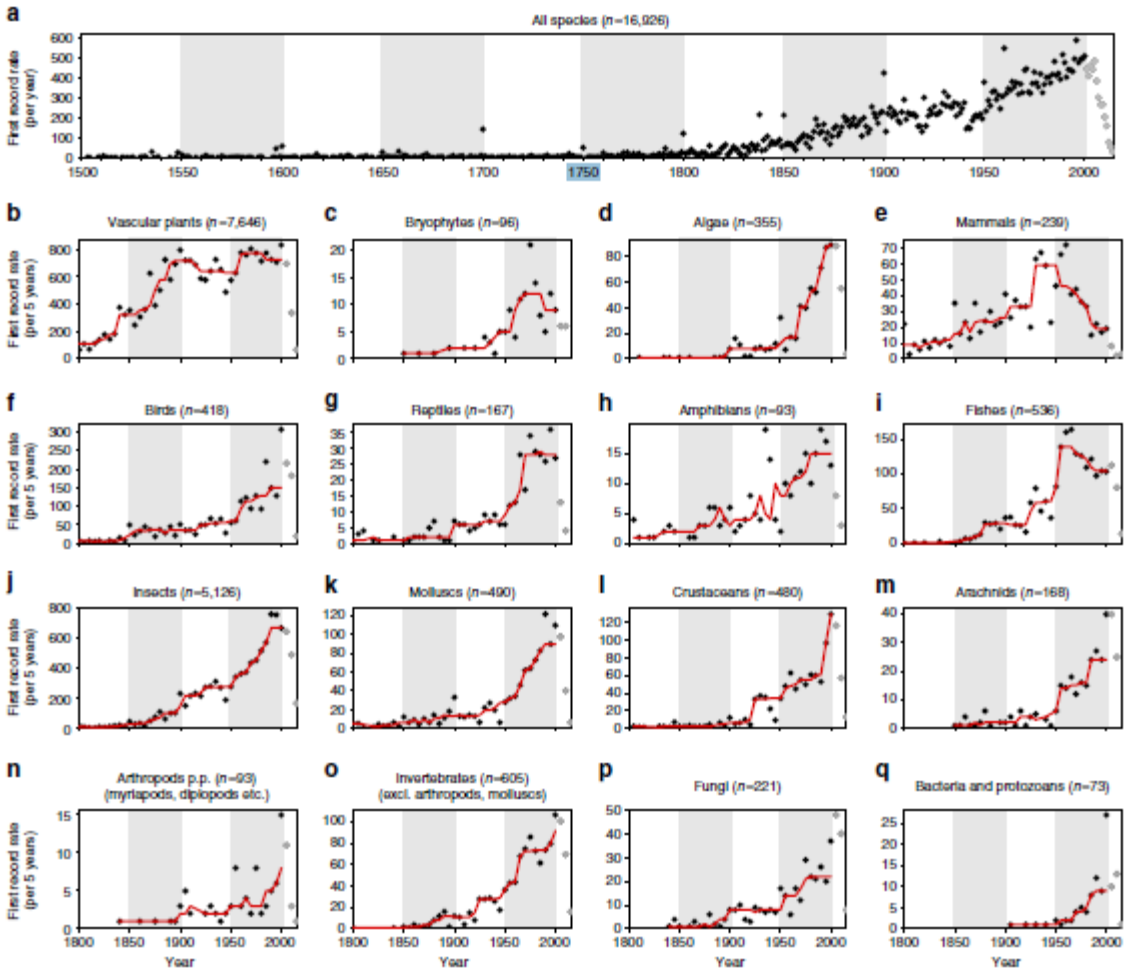
**Alien species** are relevant biodiversity pressures and biodiversity indicators




Tittensor et al. (2014) Science

# Background
## Alien species

**Alien species** are accumulating globally




Seebens et al. (2017)
Nature Communications

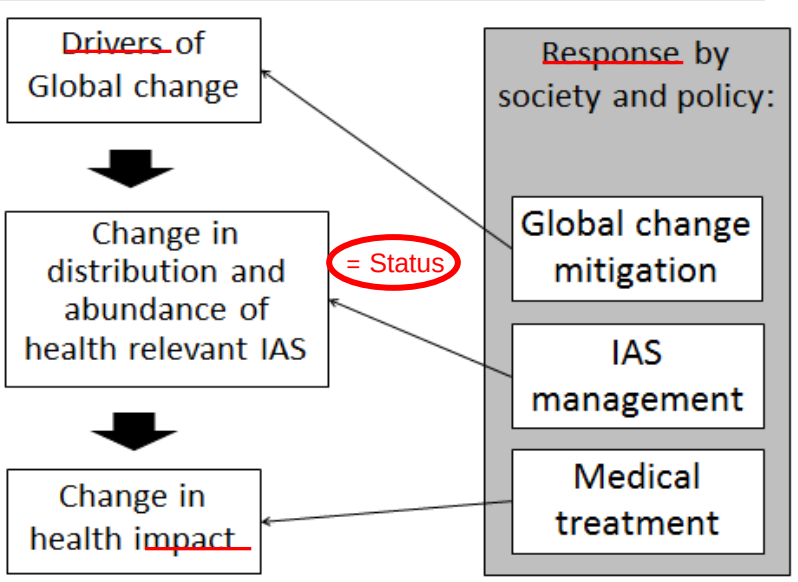
# Aliens_Health
## The aims

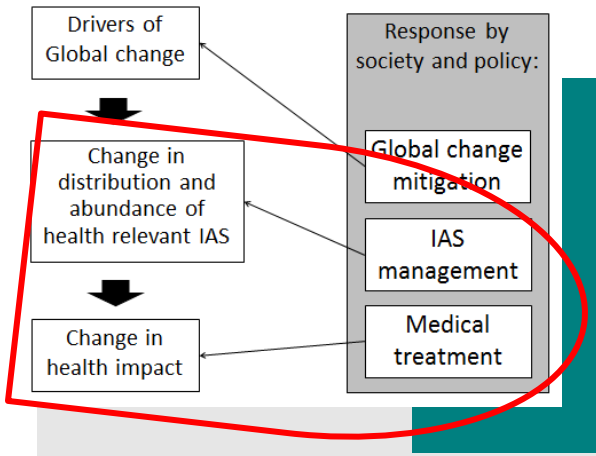
*Project **ALIENS_HEALTH** granted by the 6th Austrian Climate Research Programme (duration April 2014 - **June 2017**):*

-) To synthesize evidence for answering the question **"which public health risks emerge from AS under climate change"**

and

-) To evaluate **"potential environmental and medical mitigation measures"**



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# Aliens_Health
## Online Survey - Methods

**Alien species: public health risk and management options**

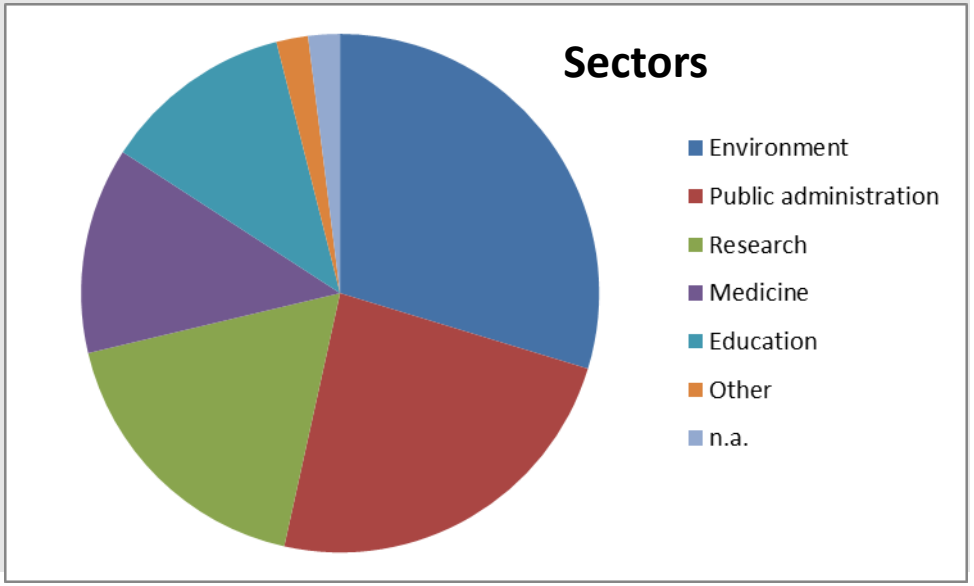
Online Survey among Austrian stakeholders on health relevant alien species

**53 responses (40 % return rate)**

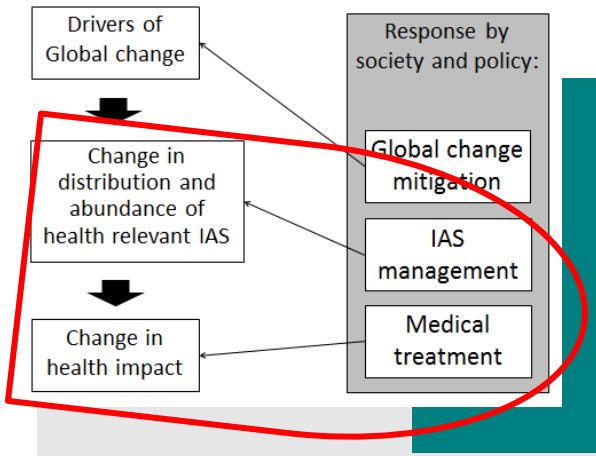
Active in the **sectors**:

Environment: 30%
Public administration: 24%
Research: 18%

→ **Good coverage of Austrian expertise**




Schindler et al., in prep.

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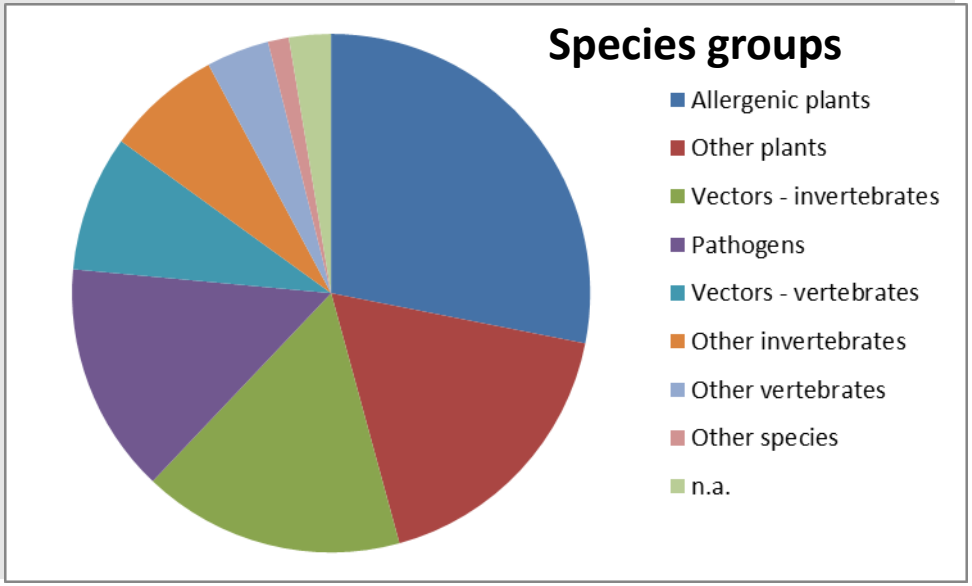
# Aliens_Health
## Online Survey - Results

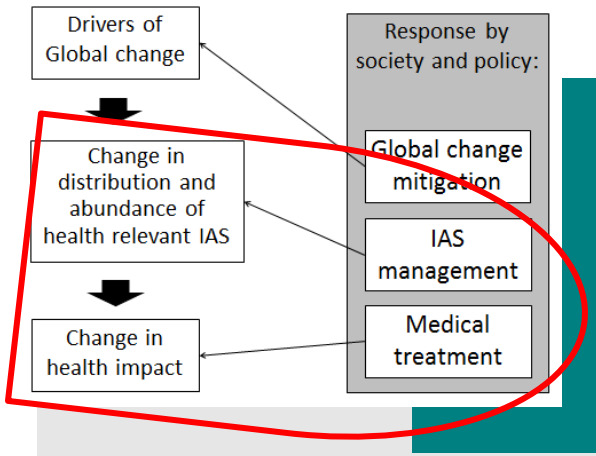
**Question: Which species groups are the most relevant?**

**Allergenic plants: 88%**
**Other plants: 55%**
**Vectors – evertebrates: 51%**

n = 49 respondents
providing totally 149 answers
(multiple answers possible)




Schindler et al., in prep.

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# Aliens_Health

## Online Survey - Results

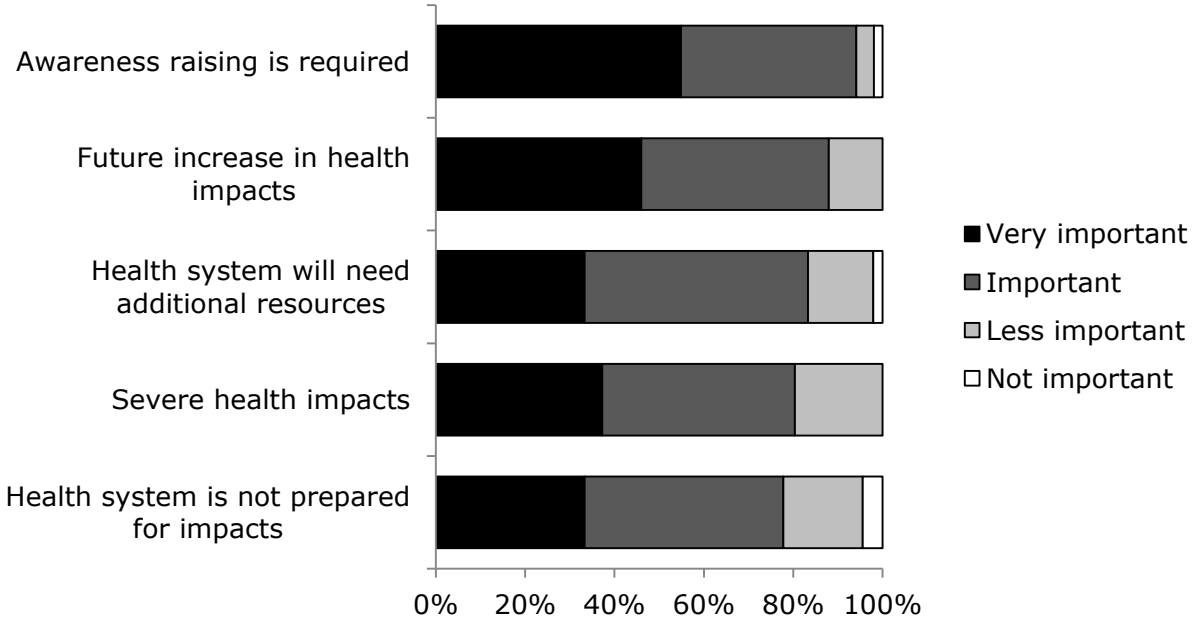
**Question: Which problems are particularly concerning?**

% (very important + important):

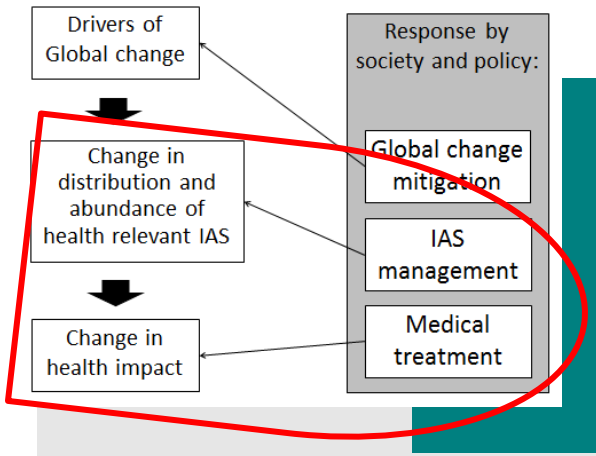
Awareness raising: 94%

Future increase in health impacts: 88%

n = 45 to 51 valid answers per subquestion




Schindler et al., in prep.

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# Aliens_Health

## Online Survey - Results

**Question: Which kind of measures were implemented, discussed or can be recommended?**

**Preventive environmental:**
37% / 52% / 58%

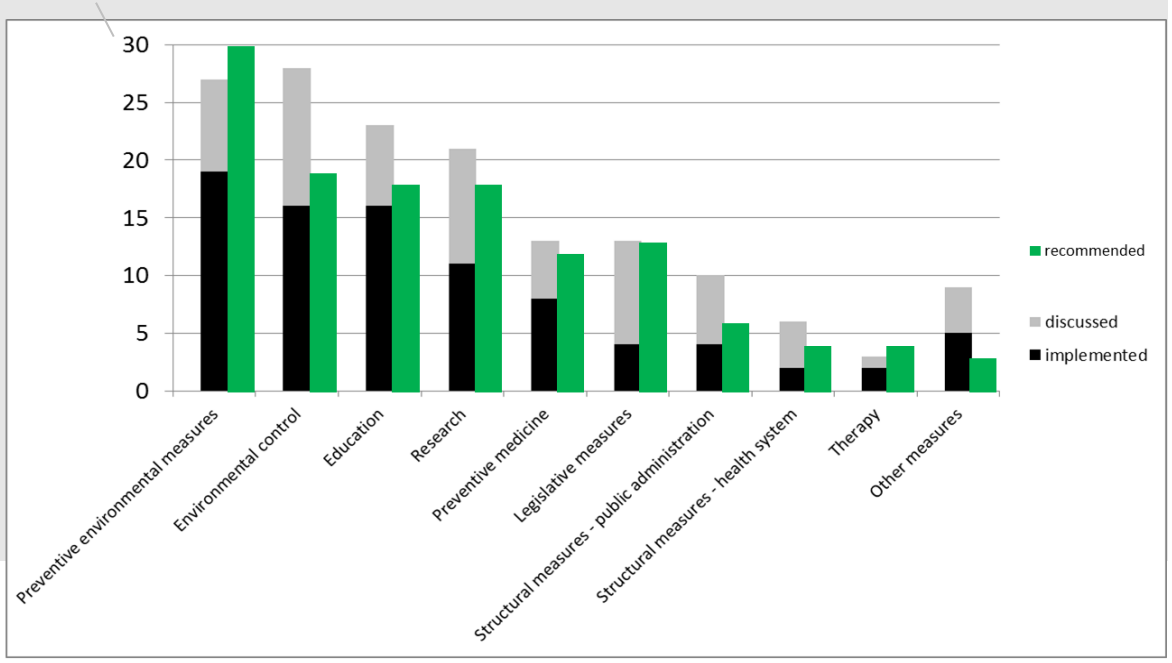
[Implem. / Disc. / Recomm.]

**Environmental control:**
31% / 54% / 37%

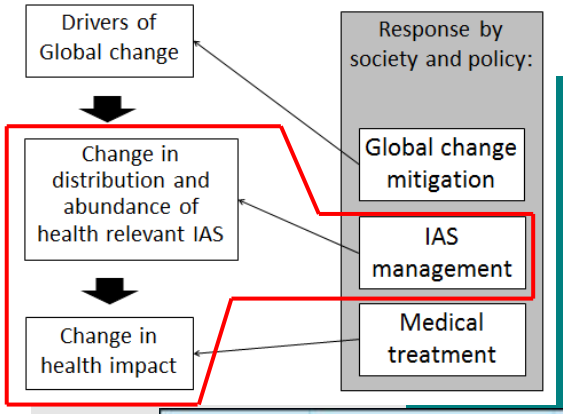
**Education:**
31% / 44% / 35%

**Research:**
22% / 40% / 35%

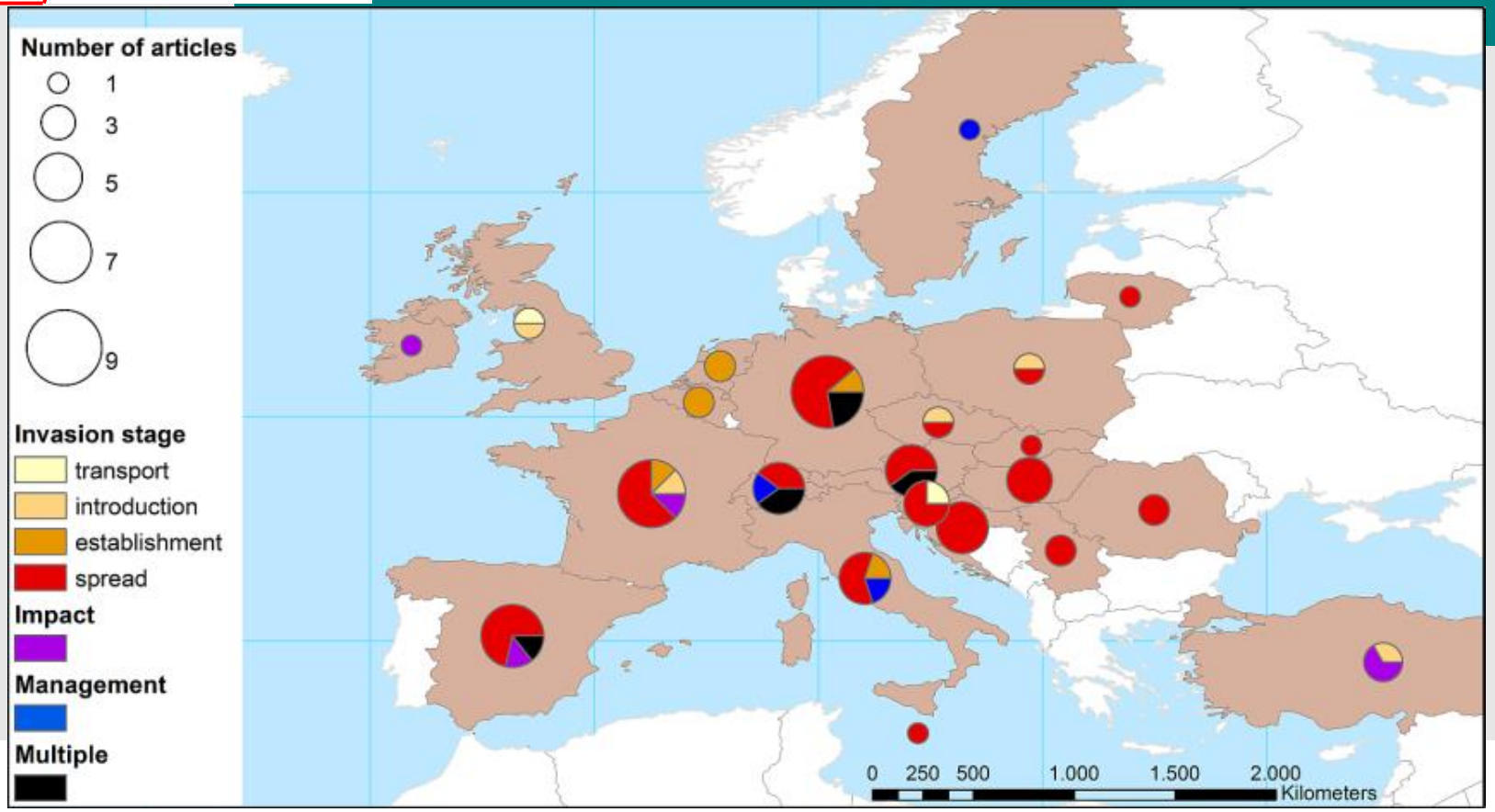
n = 51-52 respondents



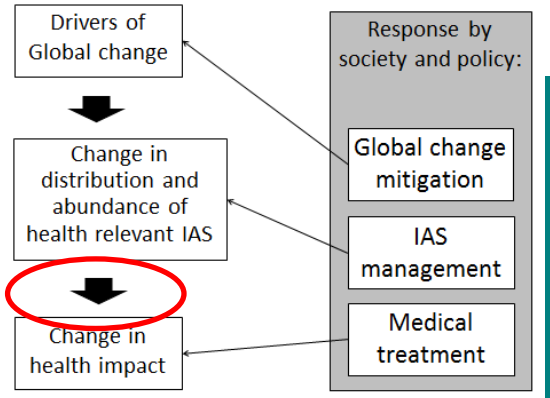

Schindler et al., in prep.




# Aliens_Health
## Scoping Review
## (Schindler et al. 2015)




Schindler et al. (2015) Alien species and public health impacts in Europe: a literature review. Neobiota

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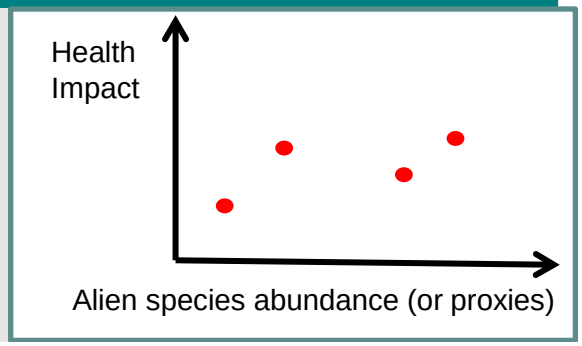
# Aliens_Health

## Systematic map - Methods

**What evidence exists for changes in the occurrence, frequency or severity of human health impacts resulting from exposure to alien species in Europe?**




**7 Literature databases explored**

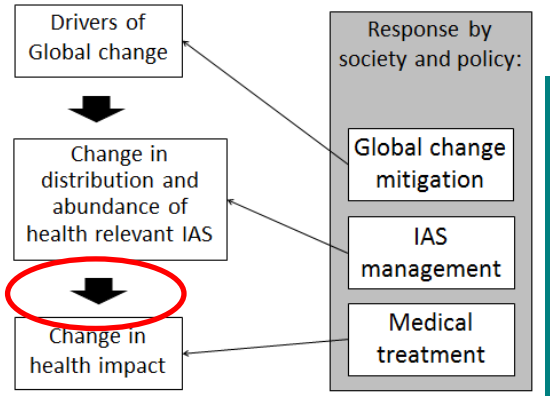
CAB Direct including CAB Abstracts and Global Health
Web of Science
MEDLINE
…

***+ specialist sources (journals & projects)***

Bayliss et al. (2015) Environmental Evidence

**APPENDIX 2: DRAFT LIST OF INVASIVE SPECIES WITH HUMAN HEALTH IMPACTS PRESENT IN EUROPE**

| Type | Species n=193 | Hulme 2014 | Mazza et al. 2014 | Schindler et al. 2015 | GISD search | Other (added by authors) |
|---|---|---|---|---|---|---|
| Plant | Acacia spp. | | x | x | | |
| Plant | Acer spp. | | x | | | |
| Vertebrate | Acridotheres tristis | | | | x | |
| Invertebrate | Aedes aegypti | | x | x | x | |
| Invertebrate | Aedes albopictus | x | x | x | x | |
| Invertebrate | Aedes atropalpus | x | | | | |
| Invertebrate | Aedes japonicus | x | | x | | |
| Invertebrate | Aedes koreicus | | | x | | |
| Vertebrate | Agapornis cana | | | x | | |






# Aliens_Health
## Systematic map - Results

**Less than 30 original articles (out of 13304 detected ones)**:
e.g.:

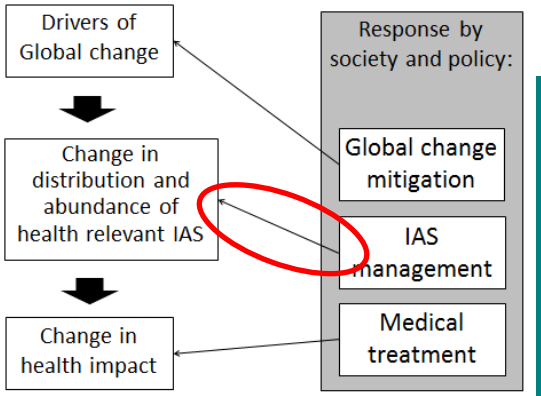
**changes in sensitization levels**, e.g. to *Ambrosia artemisiifolia*, or

**first reports of illness or injury** resulting from exposure to alien species such as:

- Autochthonous transmission of exotic diseases (Chikungunya virus and Dengue fever) by alien mosquitos *Aedes spp*.
- Significant health impacts along Mediterranean coasts due to blooms of alien unicellular algae such as *Ostreopsis* spp.
- Dermatitis associated e.g. to the oak processionary moth *Thaumetopoeia processionea*.

→ **surprisingly little studies directly related or even confirmed changes in health impacts to alien species in Europe**

Bayliss et al. (submitted)

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# Aliens_Health

## Systematic Review

## Ambrosia control - Results

**What is the effectiveness of management options used for control of Common ragweed *Ambrosia artemisiifolia*?**

Methods specified in Systematic Review Protocol (Schindler et al. 2016):

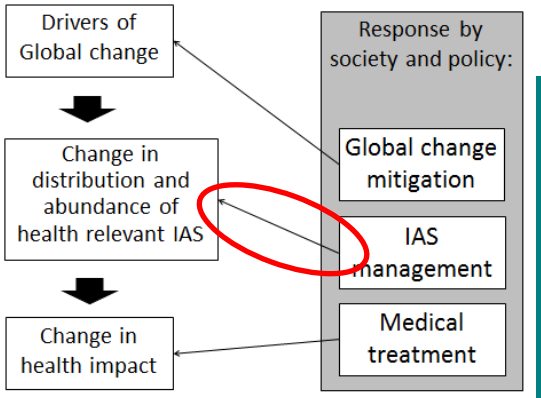
Articles for abstract check: n = 1431

Remaining articles after abstract check: n = 385

| Type of treatment | Number of articles |
|---|---|
| Chemical | 212 |
| Biological Control | 45 |
| Physical (incl. management, crop rotation) | 30 |
| Combined | 20 |
| Unclear, if indeed relevant | 78 |
| SUM | 385 |

**Status:** Articles completely reviewed: n=64; cases extracted from 64 articles: n=734

Schindler et al. (2016) Environmental Evidence

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# Aliens_Health

## Systematic Review

## Ambrosia: BIOLOGICAL control

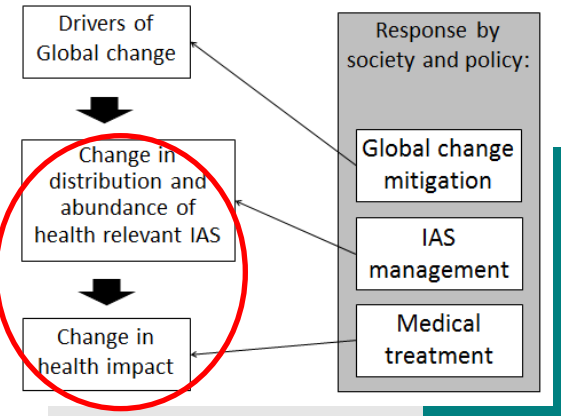
## Evidence for performance of Ambrosia biocontrol agents

**Table 1** Host range, prioritisation and management approach for proposed biological control candidates against *Ambrosia artemisiifolia* in Europe (see text for details)

| Taxon | Host range* | | Biosafety/feasibility | Priority for Europe | Management approach |
|---|---|---|---|---|---|
| | Field observations | Experimental studies | | | |
| **Insecta** | | | | | |
| Coleoptera | | | | | |
| *Ophraella slobodkini* | AMBEL | AMBEL, Ivafr | | 1 | Classical/ inundative? |
| *Smicronyx perpusillus* | AMBEL | ? | | 1 | Classical |
| *Smicronyx tesselatus* | AMBEL, *Ambrosia* | ? | Attack of *Ambrosia maritima*? | 2 | Classical |
| *Trigonorhinus tomentosus*† | Ambca, FRSCO, Ambce, AMBDU, AMBER | AMBEL‡ | Attack of *A. maritima*? Establishment? | 1 | Classical |
| *Zygogramma bicolorata*§ | AMBEL, *Parthenium* | ? | Attack of *A. maritima*? | 2 | Classical |
| *Zygogramma disrupta*† | AMBEL | AMBEL‡ | Establishment? | 1 | Classical |
| *Zygogramma tortuosa*† | AMBER | *Ambrosia* | Attack of *A. maritima*? | 2 | Classical |
| Diptera | | | | | |
| *Callachna gibba* | AMBEL, AMBPS | ? | Attack of *A. maritima*? | 2 | Classical |
| *Contarinia partheniicola* | Ambca, FRSCO, AMBDU, AMBER, AMBPS, Parin | ? | Rare in native range? | 2 | Classical |
| *Euaresta bella*† | AMBEL | AMBEL‡ | Establishment? | 1 | Classical |
| *Euaresta toba* | AMBEL, AMBCU, AMBTE | ? | Attack of *A. maritima*? | 2 | Classical |
| *Rhopalomyia ambrosiae* | AMBEL, AMBPS | ? | Rare in native range? | 2 | Classical |
| Hemiptera | | | | | |
| *Stobaera concinna*§ | AMBEL, *Parthenium* | ? | Attack of *A. maritima*? | 2 | Classical |
| Lepidoptera | | | | | |
| *Adania ambrosiae* | FRSAC, AMBEL, Ambca, AMBER, AMBPS | ? | Attack of *A. maritima*? | 2 | Classical |
| *Bucculatrix agnella* | AMBEL | ? | Attack of *A. maritima*? | 2 | Classical |
| *Schinia rivulosa* | AMBEL, AMBPS, *Ambrosia* | ? | Attack of *A. maritima*? | 2 | Classical |
| *Tarachidia candefacta*† | AMBEL, FRSCO, AMBPS | AMBEL¶ | Attack of *A. maritima*? | 1 | Classical |
| *Tischeria ambrosiaeella* | AMBEL, AMBTE | ? | Attack of *A. maritima*? | 2 | Classical |
| **Fungi** | | | | | |
| Ascomycota | | | | | |
| Dothideomycetes | | | | | |
| Capnodiales | | | | | |
| Mycosphaerellaceae | | | | | |
| *Septoria ambrosiicola* Speg. | *Ambrosia* | | Attack of *A. maritima*? | 2 | Classical/ |

Following review of Greber et al. (2011), who present 23 species of insects and fungi.

Articles from SR plus specific searches with 23 species names

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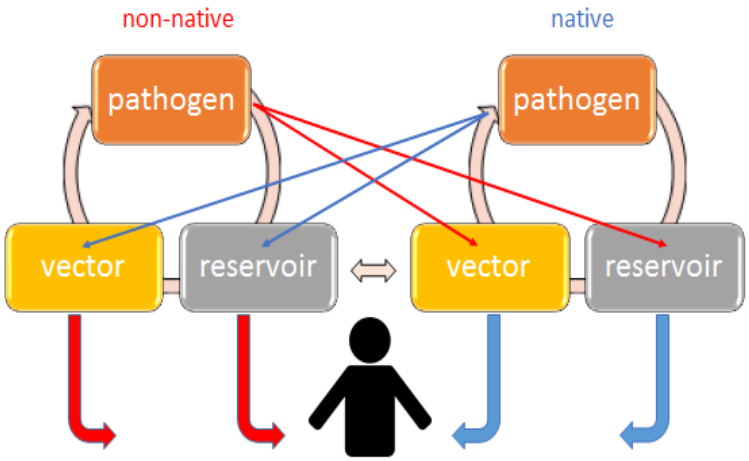
# Aliens_Health

## Dissmination

## Book Chapter „Non-native vectors and reservoirs“

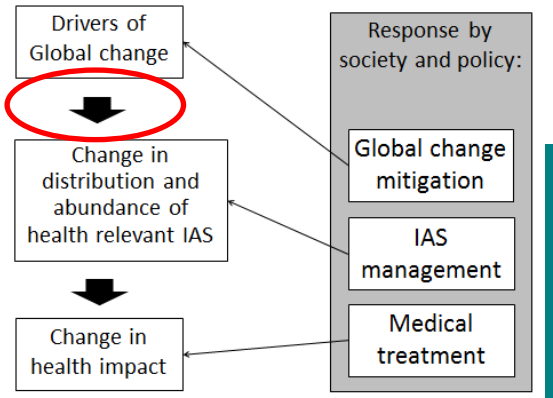
**Rabitsch et al. (2017) The rise of non-native vectors and reservoirs of human diseases**




### Conclusions

- Patterns and processes of emerging infectious diseases, parasites and biological invasions share similarities
- CBD and IPBES should reinforce their participation to the **‘One Health’-initiative**

Rabitsch et al. (2017) In: Vilà M, Hulme PE (eds), Springer Series in Invasion Ecology

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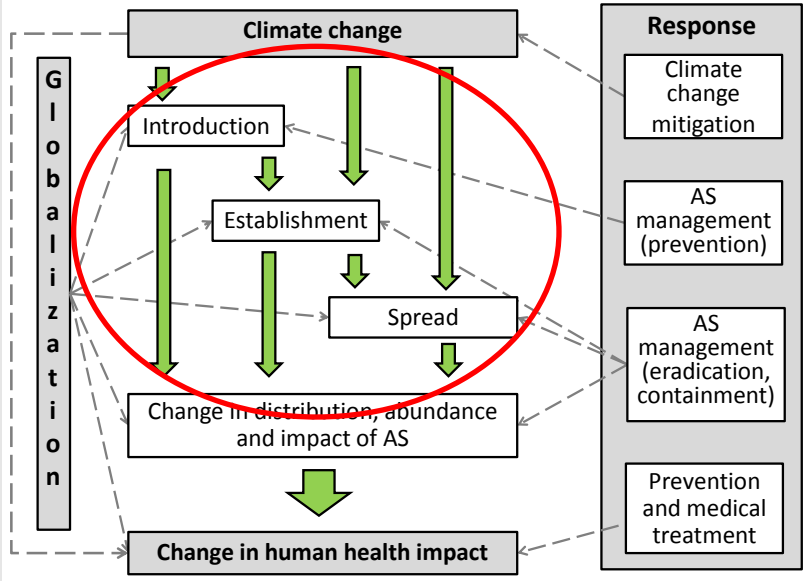
# Aliens_Health

## Dissmination

## Book Chapter „CC effects on health relevant AS“

**Schindler et al. (in press) CC and increase of impacts on human health by alien species**




**Climate change**

directly relevant for establishment & spread

(only) indirectly for introduction & impacts

Schindler et al. (in press) In: Tricario E, Mazza G (eds), Invasive Species and Health, CABI

# Aliens_Health
## Dissmination
## Book Chapter „CC effects on health relevant AS“

**Schindler et al. (in press) CC and increase of impacts on human health by alien species**

**Uncertainties:**

- Pathogens, vectors and reservoir hosts interact in different native/alien combinations (Rabitsch et al., 2017);
- general difficulties to predict invasions (Leung et al., 2004; Seebens et al., 2013);
- the inherent ecological complexities of multi-species interactions (Lafferty, 2009; Hatcher et al., 2012; Smith et al., 2012);
- difficulties of disentangling CC impacts from other factors (La Ruche et al., 2010);
- climatic niche shifts during the invasion process (Medley, 2010);
- uncertainty of future human actions (Fischer et al., 2011; Thomas et al., 2011; Smith et al., 2012);
- CC affecting relevant species in a nonlinear fashion (Lafferty, 2009);
- stochastic climatic extreme events (Parmesan et al., 2000; Battisti et al., 2006; Diez et al., 2012);
- difficulties to disentangle human-mediated movements and natural migration processes (Walther et al., 2009);
- lack of data or limitations in data quality (Lobo et al., 2010; Smith et al., 2012)

# Aliens_Health
## Overall Conclusions (1)

**Evidence base and interdisciplinarity:**

- European literature on alien species of human health concern is focused towards few well studied species of Asteraceae (mainly *Ambrosia artemisiifolia*) and Diptera (mainly *Aedes* spp.). This is worrisome as the risks may not be fully recognized.

- Original research combining ecology and health impact of alien species hardly exist in Europe. It would be important to counteract the implications of alien species risks posed for human health.

Richter et al. (2013) J Applied Ecology
Roy et al. (2017). Conservation Letters

# Aliens_Health
## Overall Conclusions (2)

**Concerns and recommendations:**

- Concerns about the future are prevailing concerns about the current situation
- Preventive environmental measures highly recommended
- Allergenic plants: Eradication of ragweed recommended – high cost benefit (Richter et al. 2013).
- Vectors and pathogens: more complex systems, more species involved, higher uncertainties (analogy to wildlife pathogens, Roy et al. 2017)
- CC: mainly effects on establishment and spread of alien species
- Improved understanding of the ecology of pathogens, vectors, reservoirs and transmission cycles, and of the role of human activities under different climates is required to reduce uncertainties
- There is a need for action and research, particularly in the fields of pathway management, epidemiology, modelling and vector monitoring and control.

Richter et al. (2013) J Applied Ecology
Roy et al. (2017). Conservation Letters

# Acknowledgements


## Project partners

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Helen Bayliss

**Medical University Vienna (Vienna, Austria):**
Hans-Peter Hutter
Petter Wallner

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*6th Austrian Climate Research Programme*
*(Grant Number KR13AC6K11141)*

# Thanks for your attention!

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