

# An introduction to meta-analyses and systematic reviews

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# Focus....



An introduction to meta-analyses and systematic reviews

# Step back



An introduction to meta-analyses and systematic reviews

# Again...



- G. Seurat: [Un dimanche après-midi à l'Île](#)
- more info: <https://www.boumbang.com/>

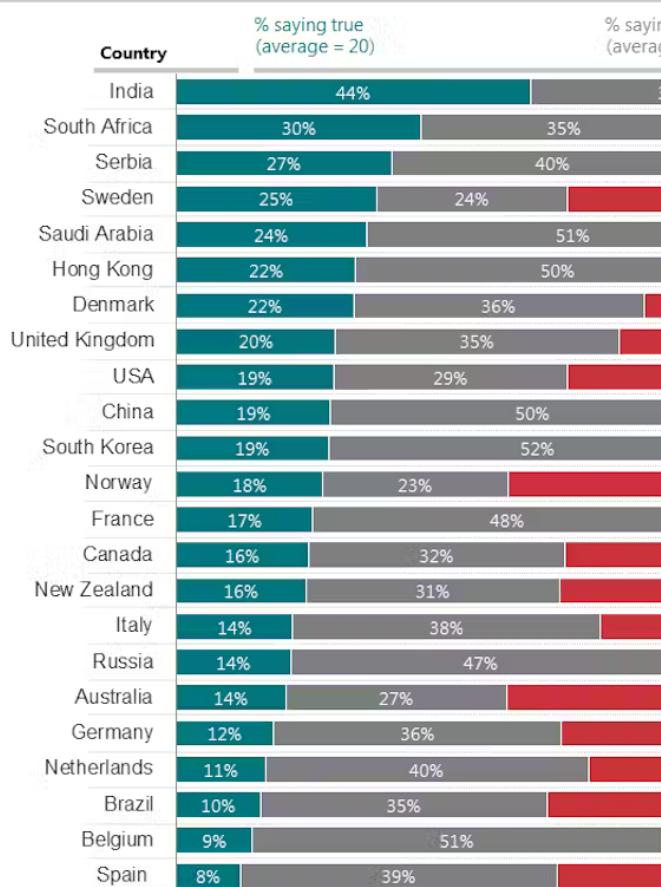
# Let's play



<https://etc.ch/TWnF>

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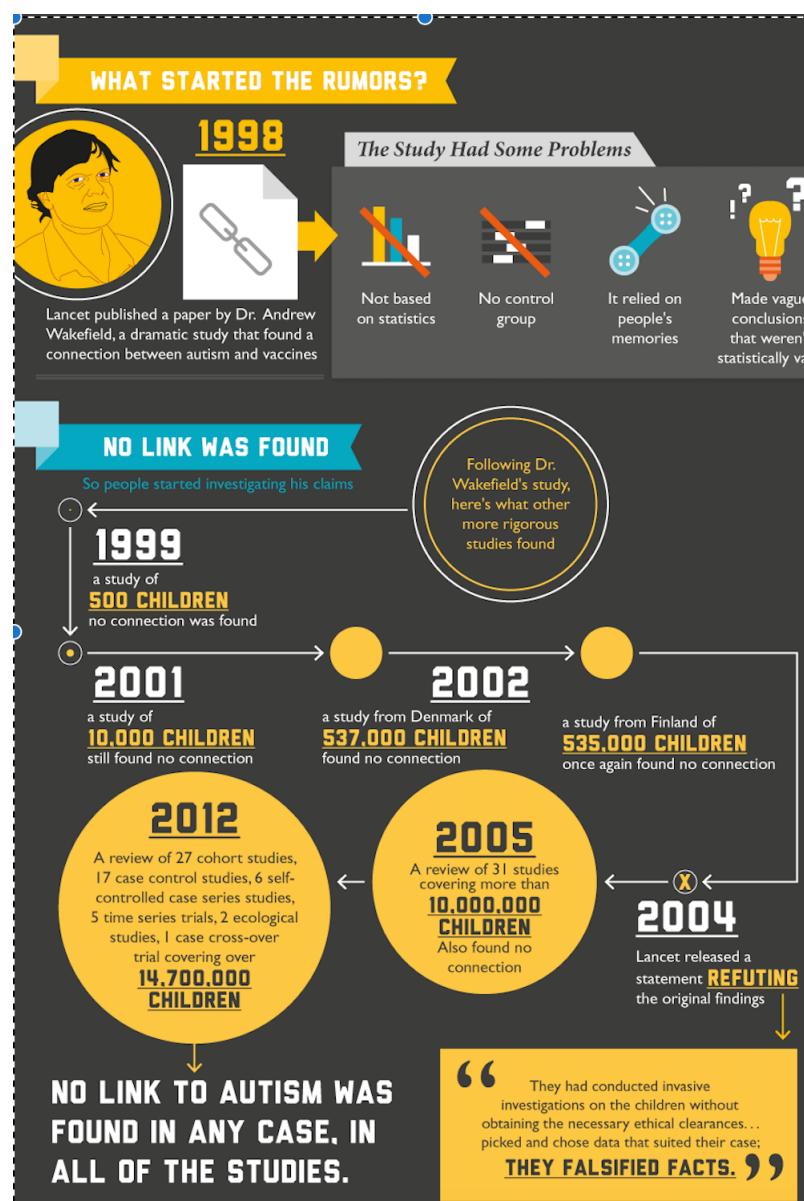
# At the global scale



Please see <http://perils.ipos.com/> for full details of all sources.

- more info: Davidson, 2017

# What started the rumors?



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# **Mis-information and meta**

## **Misinformation:**

- Spreads via confirmation bias, and misin studies.
- Harms public understanding and policy c

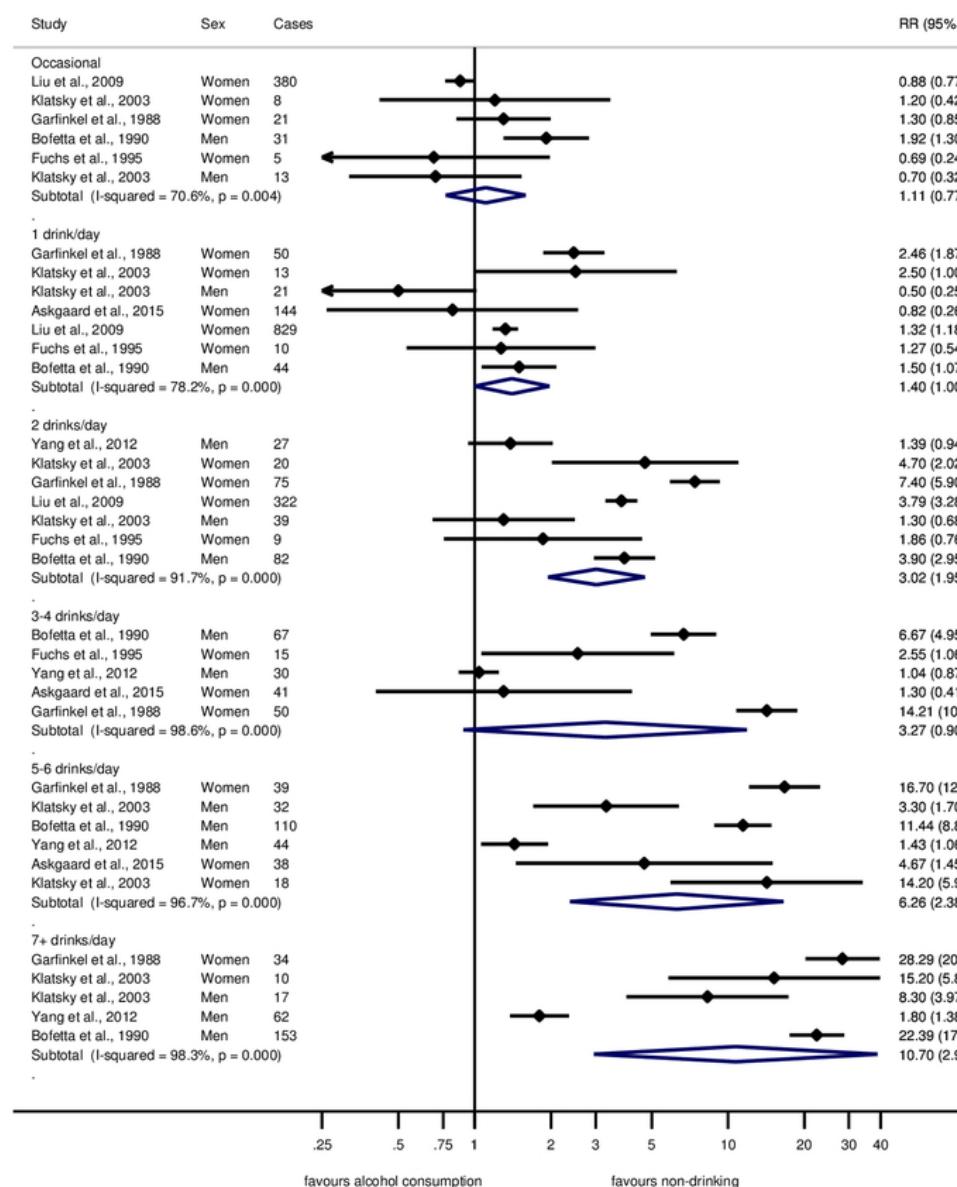
## **Meta-analyses and systematic reviews**

- Counters isolated, misleading findings.
- Strengthens scientific credibility.
- Informs public policy with solid evidence

# Let's play (again)



# State of the evidence



# **Contradictory evidence and analyses**

## **Contradictory evidence**

- Results from variations in study design, sample, methodology.
- Leads to uncertainty in scientific conclusions making.

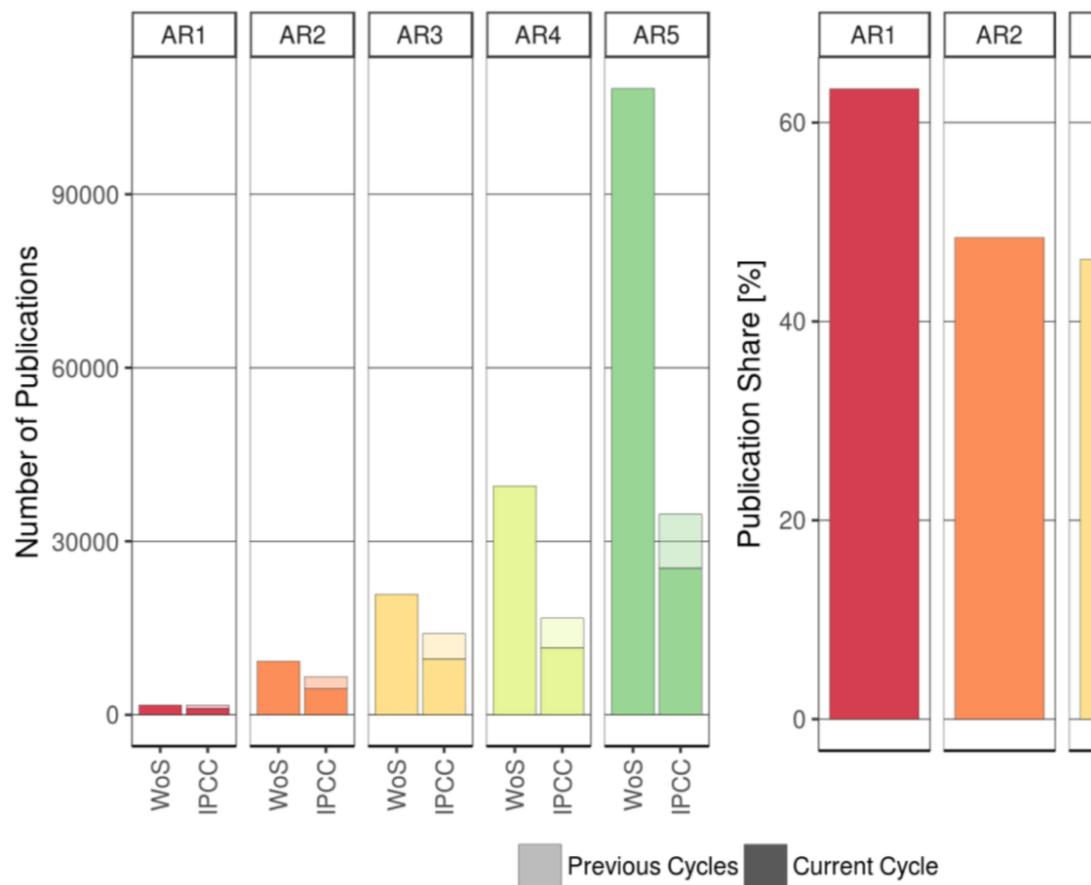
## **Meta-analyses and systematic reviews**

- based on the ‘means’ of many studies -> increased power

# Let's play (again?!)

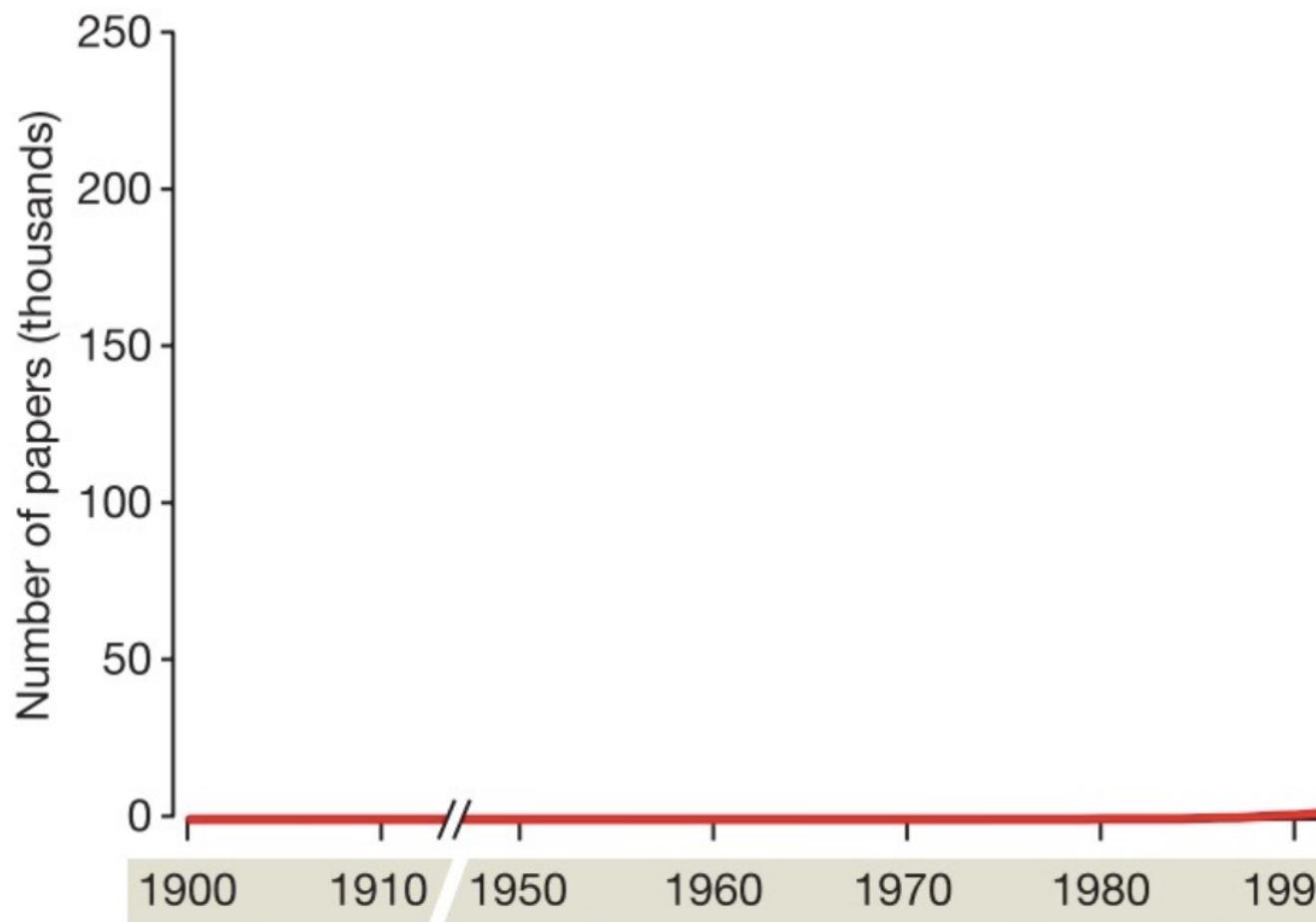


# Number of citations included in reports



source: Minx et al., 2017

# Number of papers in ecolo



source: [Gurevitch et al., 2018](#)

# **Number of papers and meta-analyses**

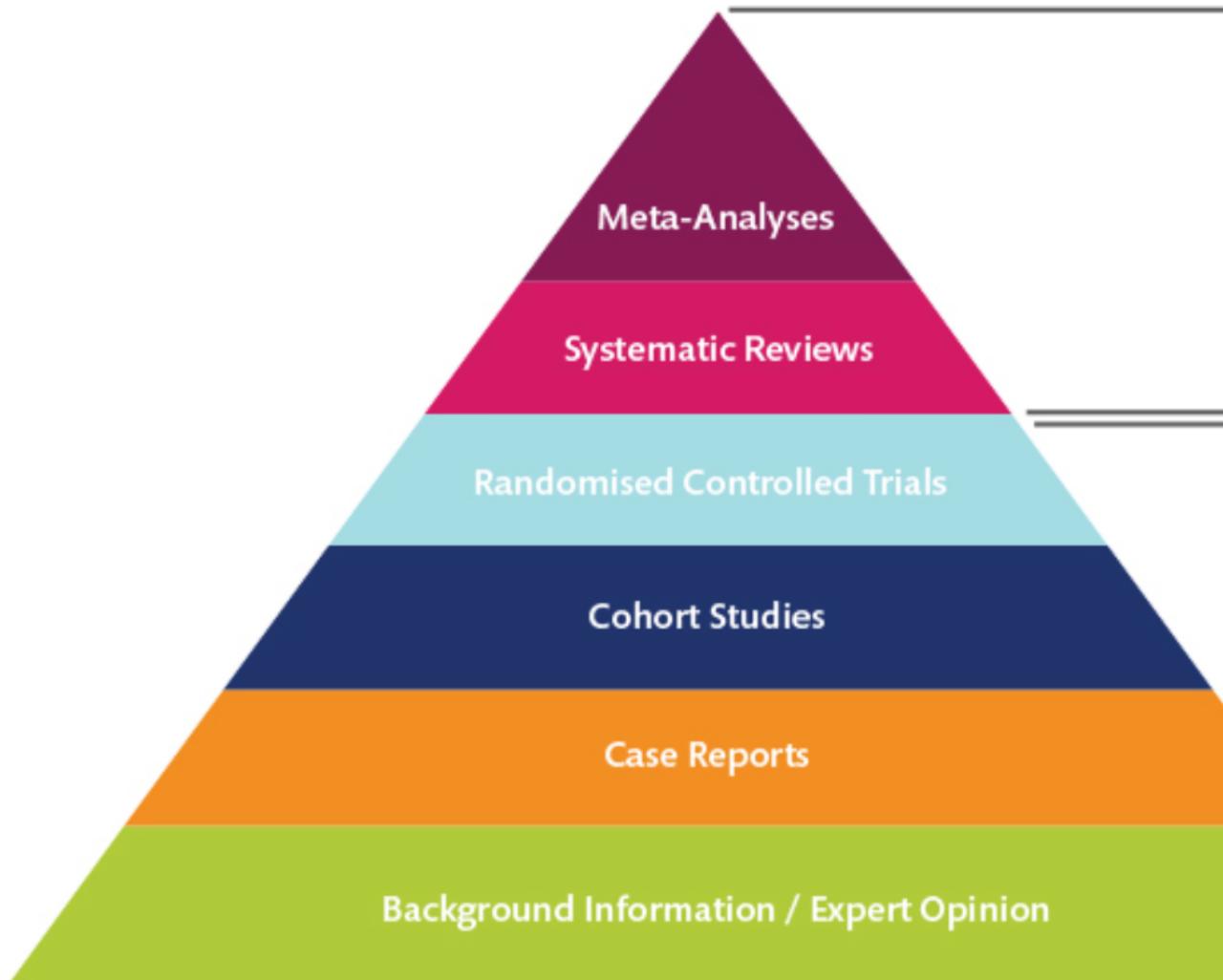
## **Number of papers**

- over 7M papers published each year

## **Meta-analyses and systematic reviews**

- Meta-analyses synthesized 2 to XXXX papers

# A need for robust evidence



# Some big projects/labs



German Centre for Integrative Biodiversity Research (iDiv)  
Halle-Jena-Leipzig

[About iDiv](#) | [Research](#) | [Groups and People](#) | [Science-Policy](#) | [sDiv Synthesis Centre](#) | [yDiv](#) |

## About iDiv

[History](#)

[Structure](#)

[Governance](#)

[Consortium](#)

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**German Centre for Integrative Biodiversity Research (iDiv)**

## Hotspot in Biodiversity Science

iDiv is a DFG research centre with more than 450 employees and members based primarily from 40 nations establish the scientific basis for the sustainable management of our planet's

Biodiversity refers to the diversity of life – not only species diversity but also genetic diversity ecosystems. We know that our actions dramatically change this diversity: species become e

# Some big projects/labs



ABOUT THE FOUNDATION

THE FRB IN ACTION

BIODI

## CESAB

CESAB – Centre for the Synthesis and Analysis of Biodiversity – is a key program of the FRB (Foundation for Research on Biodiversity) and is an original, innovative and internationally recognized tool that offers researchers a place and time to synthesize and analyze already existing data and information in the field of biodiversity research.



With the major crisis facing biodiversity, the need to synthesize scientific data in ecology has never been greater. An unprecedented work has been initiated by international experts within IPBES to assess the current status of biodiversity and its contribution to human societies. These reports are based on studies already published in scientific journals and databases already compiled. When pooled, existing data can be used to address new issues, significantly advance knowledge and provide recommendations for decision-makers.

# Some big projects/labs

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## The PREDICTS project

PREDICTS - Projecting Responses of Ecological Diversity In Changing Terrestrial Systems - is a collaborative project aiming to use a meta-analytic approach to investigate how local biodiversity typically responds to human pressures such as land-use change, pollution, invasive species and infrastructure, and ultimately improve our ability to predict future biodiversity changes.

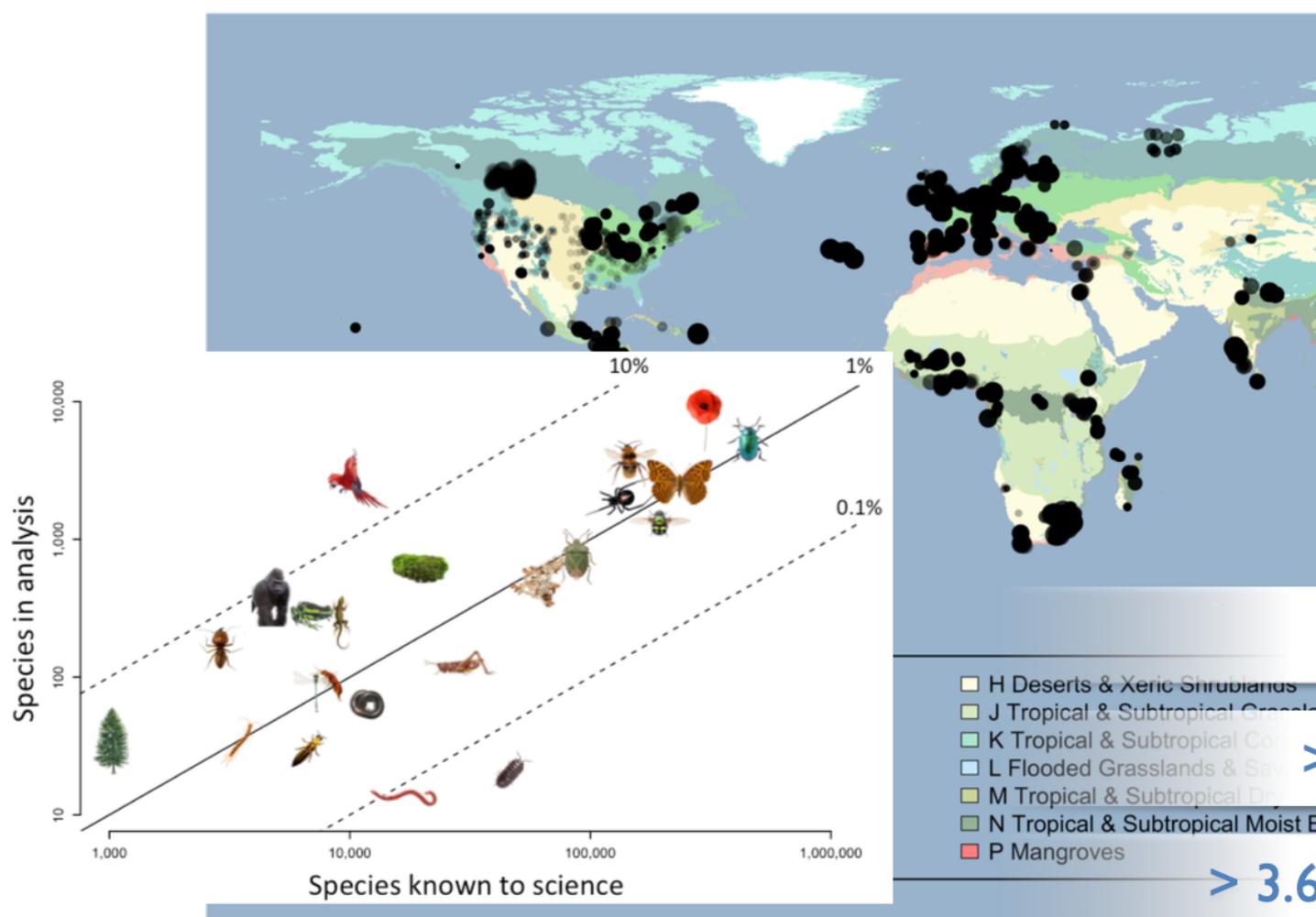
Human activities are causing major changes in biological communities worldwide, and these changes can harm biodiversity and ecosystem function. Ecosystem function is important in supporting plant and animal communities, as well as ensuring the long-term survival of human populations. Understanding how human pressures influence global biodiversity at a local scale can help us make predictions of future changes, and can inform conservation policy at national and global levels.

Read more about [conservation and global biodiversity declines](#).

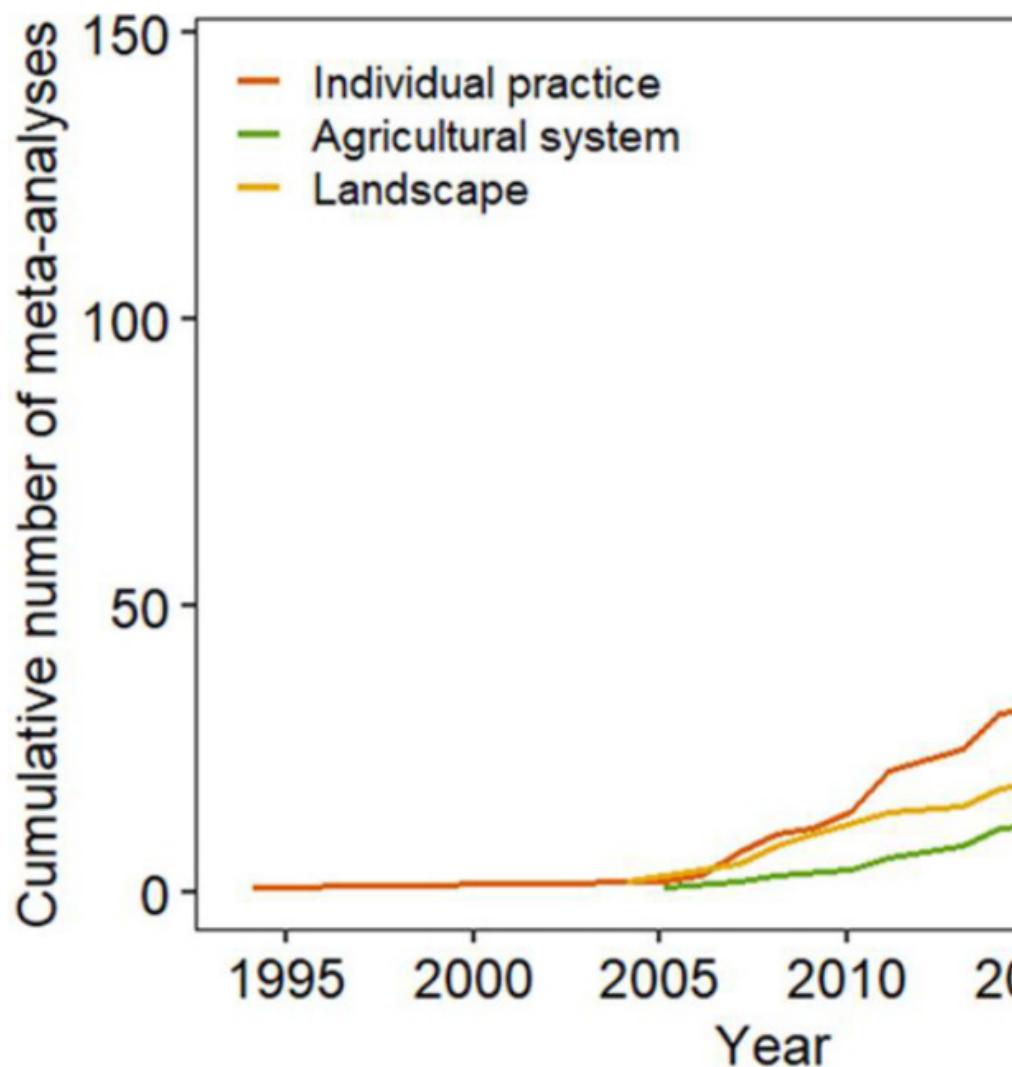
## We need more data!

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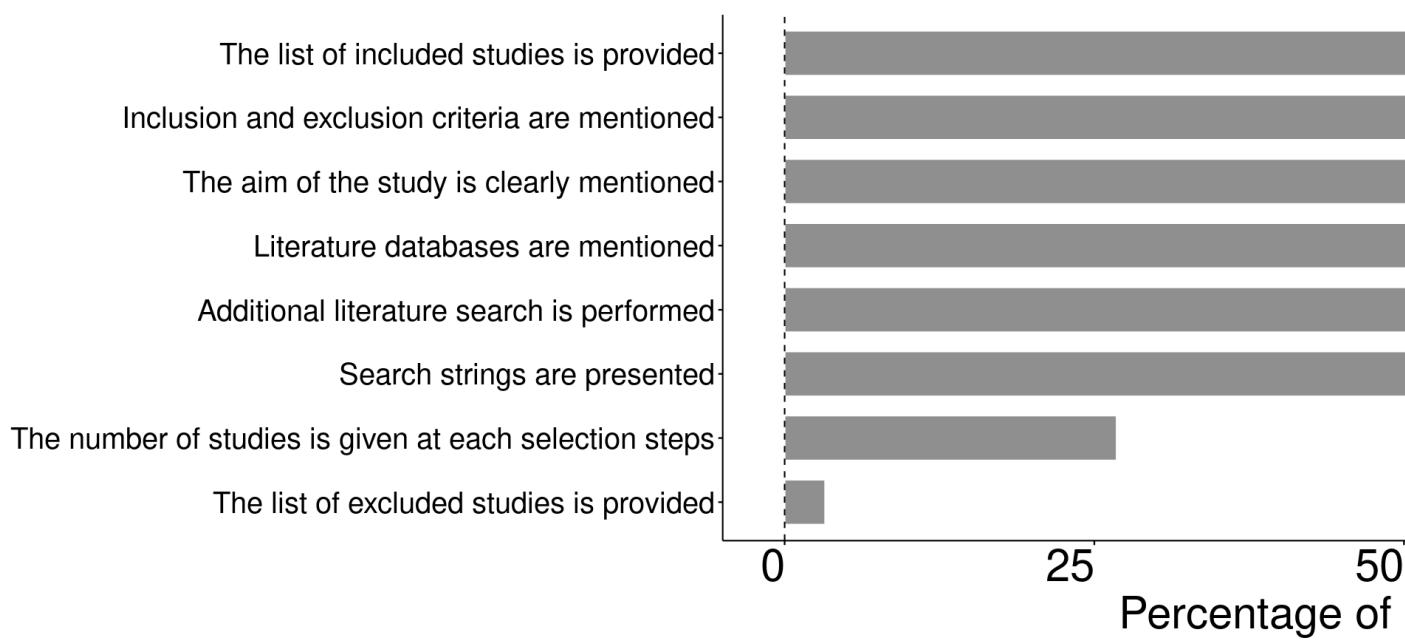
# Some big projects/labs



# Results: Increase in meta-analyses



# But of variable quality



more info: [shinyApp](#)

# **A lot of confusion in terms methods to synthesized da**

- Expert consultation, focus group, ...
- Rapid evidence assessment, non-systematic
- Systematic maps
- meta-analyses
- ....

# A typology of methods

*Aim of the study*

*Describe*

***Effort to search the documents***

*Low*

*Narrative review*

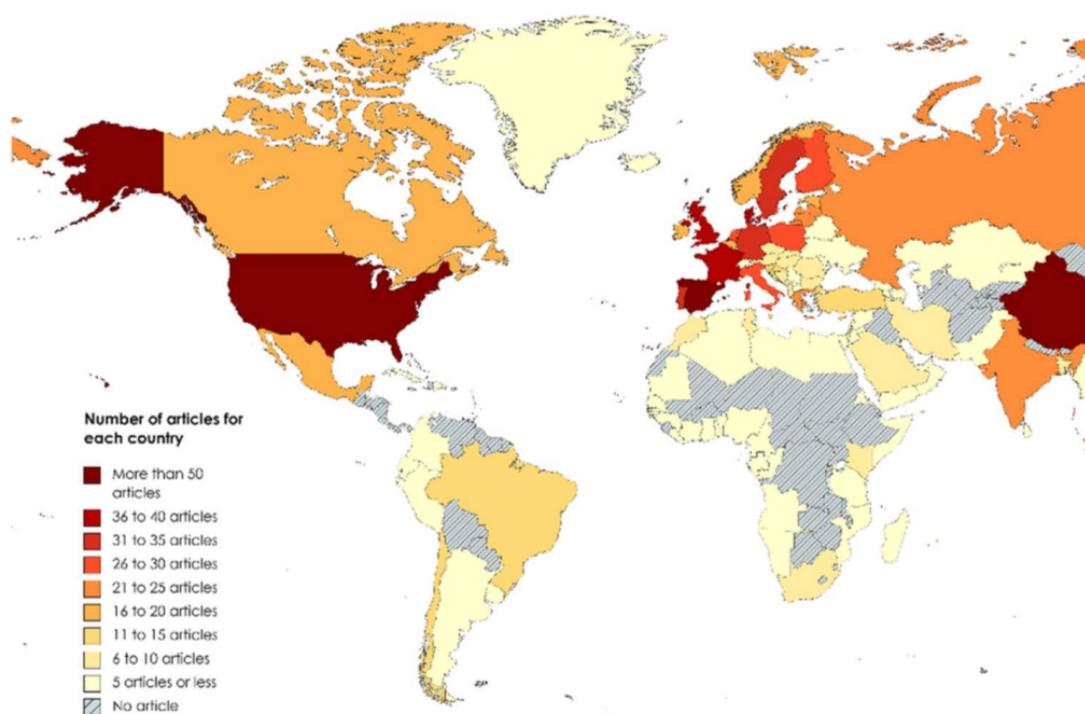
*Rapid review*

*High*

*Evidence maps*

# Systematic (evidence) map

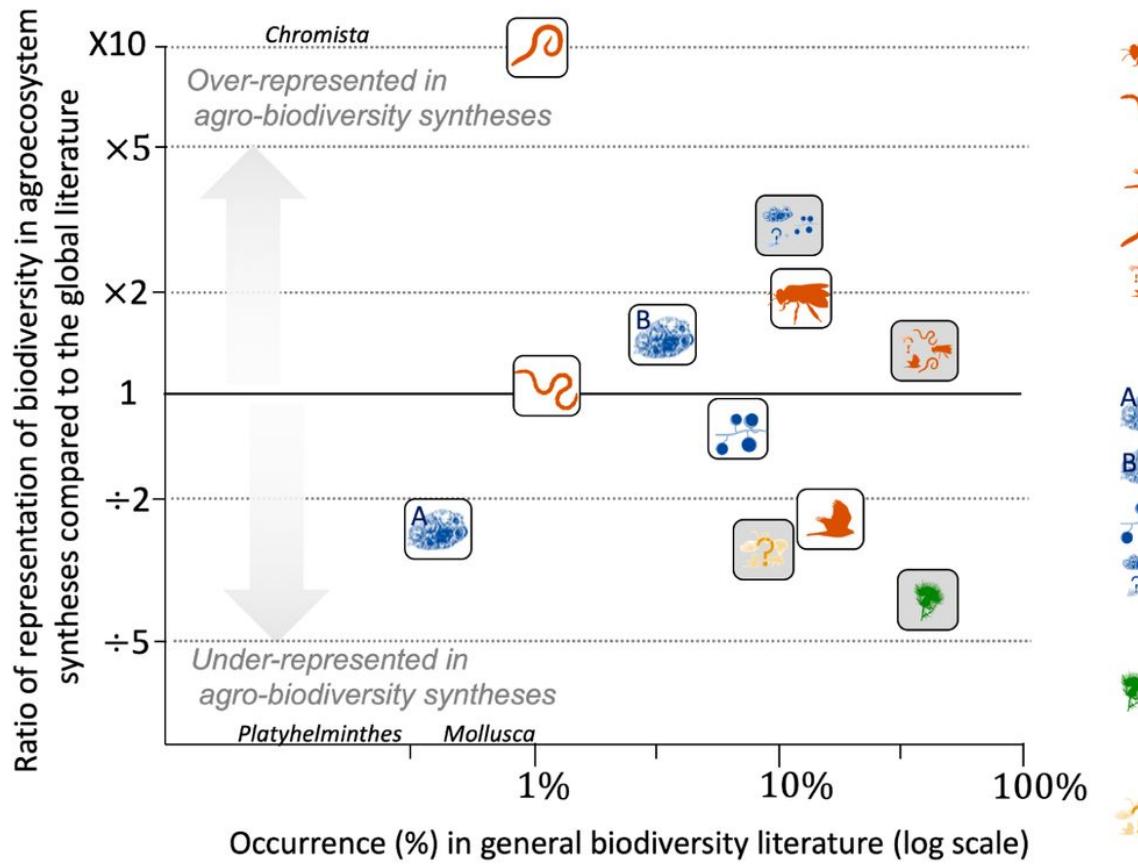
- Purpose: Provide an overview or 'landscape' on a given issue



**Fig. 3** Spatial distribution of the number of articles per country

# Systematic (evidence) maps

- Purpose: Provide an overview or 'landscape' on a given issue



# Strengths of evidence maps

- 1. Visual representation of the knowledge available**  
*(i.e. no need to read hundreds of primary studies)*
- 2. Typology/categorization of the research**  
*(often term and definition varies a lot to represent different phenomena/practice )*
- 3. Offer a foundation for further, more focused synthesis**  
*(a first step for a new meta-analysis)*
- 4. Political/scientific agenda for future research**

# Weakness of evidence map

**1. Only descriptive - no analyses**

*(i.e. do not inform on the effectiveness of the*

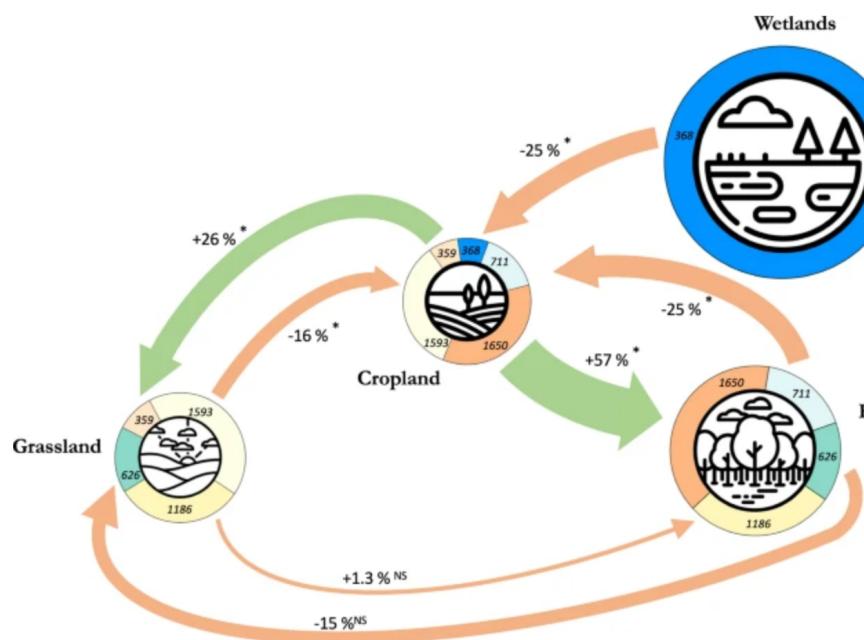
**2. The results could be presented in meta-analyses**

*(sometimes)*

# Meta-analyses

- Purpose: Provide an estimate of an effect size, test for heterogeneity, rank the moderators of the effect size

Fig. 2: Percentage change in soil organic carbon (SOC) due to land-use change



The arrows represent the effect of a land-use change on SOC, with the final land-use on the side. The arrow sizes are proportional to the magnitude of the SOC change in reference to the initial land-use, with negative effects highlighted in orange and positive effects highlighted in green. Significant mean SOC changes are noted alongside the arrows. An asterisk indicates a significant effect.

# Strengths of meta-analyses

## 1. See the forest for the trees

(i.e. see effect/relationships that might not be individual studies!)

## 2. Synthesize knowledge on controversial issues

(find average effect while trying to minimize heterogeneity)

## 3. Can compare apples and oranges (to some degree)

(meta-analyses are specifically designed to detect heterogeneity)

## 4. Examine reasons for variation

(to some degree)

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# Weakness of meta-analyses

**1. See the forest for the trees**

(i.e. mask specific pattern/local effect?)

**2. Can not overcome bias**

(e.g. publication bias)

**3. Can compare apple and oranges (to some extent)**

(combine things that should not be combined)

**4. Not representative**

(study population  $\neq$  population of interest)

**5. Not able to examine causality**

# What you will do this week



# What you will do this week

A training based on international golden standards

The Cochrane Collaboration: Working together to provide the best evidence for health care. Home | About us | Cochrane Reviews | News & Events | Training | Multimedia | Contact | Intranet. Latest: Madrid Colloquium: Registration is now open! evidence aid. Resources for Japanese earthquake and tsunami. Collections of resources for flooding- and earthquake-related injuries.

JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH. Evidence-Based Toxicology Collaboration. ABOUT US | CURRENT PROJECTS | NEWS | PUBLICATIONS | CONTACT. ebtc. Evidence-Based Toxicology Collaboration. EBTC was founded in 2011 at Johns Hopkins Bloomberg School of Public Health with the vision to make evidence-based methodologies the standard that is used to ensure public health, a healthy environment and a sustainable future.

The Collaboration for Environmental Evidence. Serving Environmental Management In The Public Interest. An open community of stakeholders working towards a sustainable global environment and the conservation of biodiversity. CEE seeks to promote and deliver evidence syntheses on issues of greatest concern to environmental policy and practice as a public service.

EE Journal | EE Library | Guidelines | Latest News

Campbell Collaboration. Better evidence for a better world. Global Funds | Better Evidence | Campbell Library | For Re. Crime and Justice. The Campbell Library. Campbell Coordination Groups.

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