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Place: Tirana

Knowledge FOR Resilient soCiEty

Impacts of Sustainability and Resilience Research on Risk Governance, Management and Education

Aalborg University



AALBORG UNIVERSITY
DENMARK

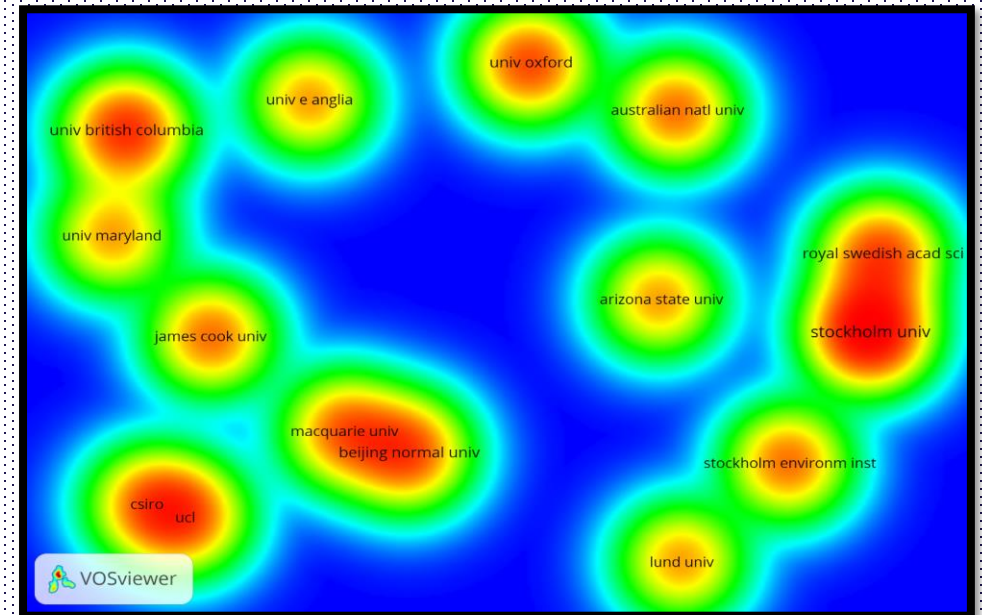
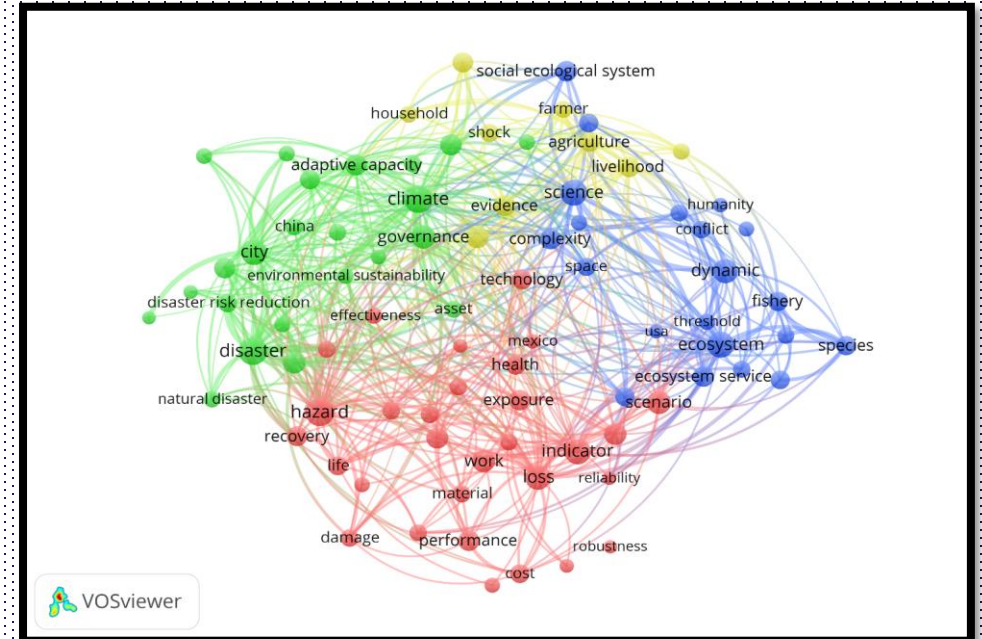
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 - Selected results from bibliographic coupling analysis
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Introduction: Aim & Scope

Problem Context

- Need to understand implications and **define future strategic directions for risk education** in view of **exponential increase** in research on **sustainability** and **resilience** over the past 3 decades
- Part of **baseline assessment** to support the development of a **blueprint for learning design** in risk-informed decision support

Research questions

- How large is the scientific community researching resilience and sustainability in comparison to research in risk and what is the evolutionary trajectory of these knowledge domains for the period 1990-2017?
- What are the characteristics of the scientific literature on risk, sustainability and resilience (1990-2017) in terms of different disciplinary contributions, authors, countries and organizations producing research?
- To what extent are resilience and sustainability research integrated into research on risk-informed decision support and how is their influence shaping the development of the risk knowledge domain with respect to risk governance, risk management and risk education?





Methodology

Steps

- I. Identification of search terms relevant for risk, sustainability and resilience based on expert discussion between the authors;
- II. Data collection;
- III. Bibliometric networks construction;
- IV. Data results and analysis

Data

- 442,171 records extracted from the Web of Science (WoS)
- Only journal articles and book chapters included
- Records categorized as part of medical (physical and psychological) research on risk as this very large sub-domain of risk excluded
- Min. number of co-occurrence of terms adapted according to the volume of records for each search term.



Methodology

	Search Term	Search Term	Search Term	Search Term	Search Term	Search Term	Search Term	Search Term	Search Term
Group 1	Risk 1990-2000	Risk 2001-2010	Risk 2011-2017	Sustainability	Resilience	Risk AND Sustainability	Risk AND Resilience	Risk AND Sustainability AND Resilience	
Group 2	Ecological Resilience	Spatial Resilience	Engineering Resilience	Infrastructure Resilience	Robustness	Disaster Resilience	Community Resilience	Urban Resilience	(economic) Development Resilience
Group 3	Planetary Boundaries	Natural Capital and Eco-services	Circular Economy	Social OR Urban Metabolism	Inclusive Economy OR Inclusive Wealth OR Inclusive Growth	Degrowth	Adaptive Governance	Social Cohesion	Social Ecological Systems





Methodology

What is term co-occurrence?

- Data mining clustering technique based on an algorithm for solving an optimization problem
- VOSviewer text mining software, which performs part-of-speech tagging and uses a filter to identify noun phrases (terms), for which a relevance score is calculated (van Eck and Waltman 2014)
- Terms are derived from the titles and abstracts of the records from WoS

Legend

Relevance score - low relevance score indicates that a term co-occurs with other terms more or less randomly; high relevance score is attributed to noun phrases that co-occur mainly with a limited set of other noun phrases

Label & Circle - Terms are represented by their label and a circle, whose size depends on the number of publications that contain the term in the title or abstract

Links & Link strength - connections or relations between two terms. The strength depends on the number of publications in which two terms occur together; the stronger the link, the thicker the line

Cluster & Density - a set of terms strongly linked together. Terms that co-occur often are located closer to each other; terms that have no or almost no co-occurrence are located further apart





Methodology

What is bibliographic coupling?

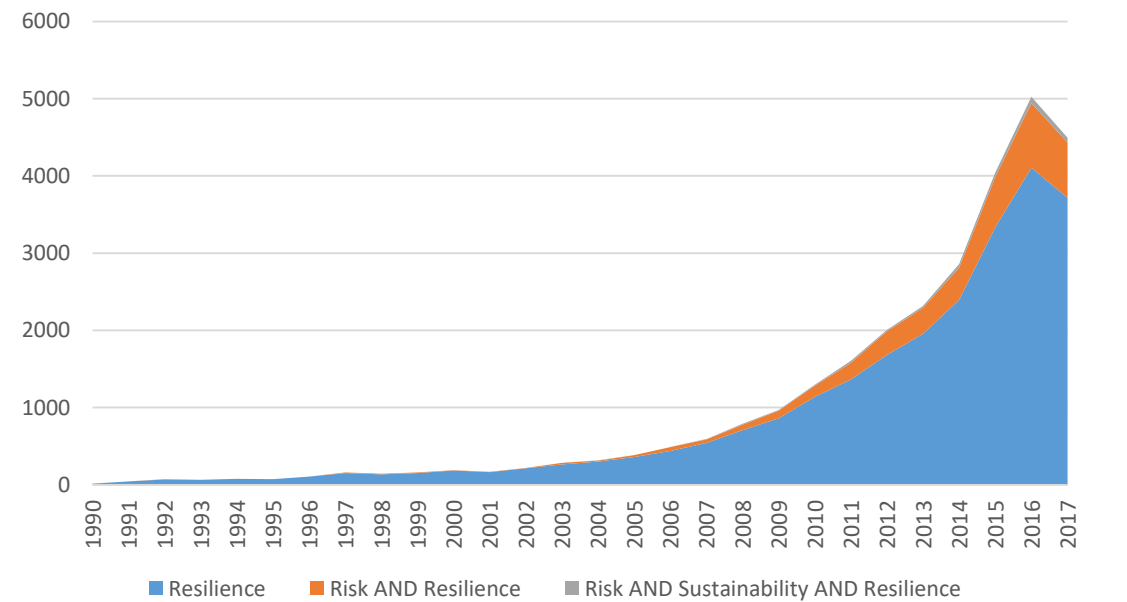
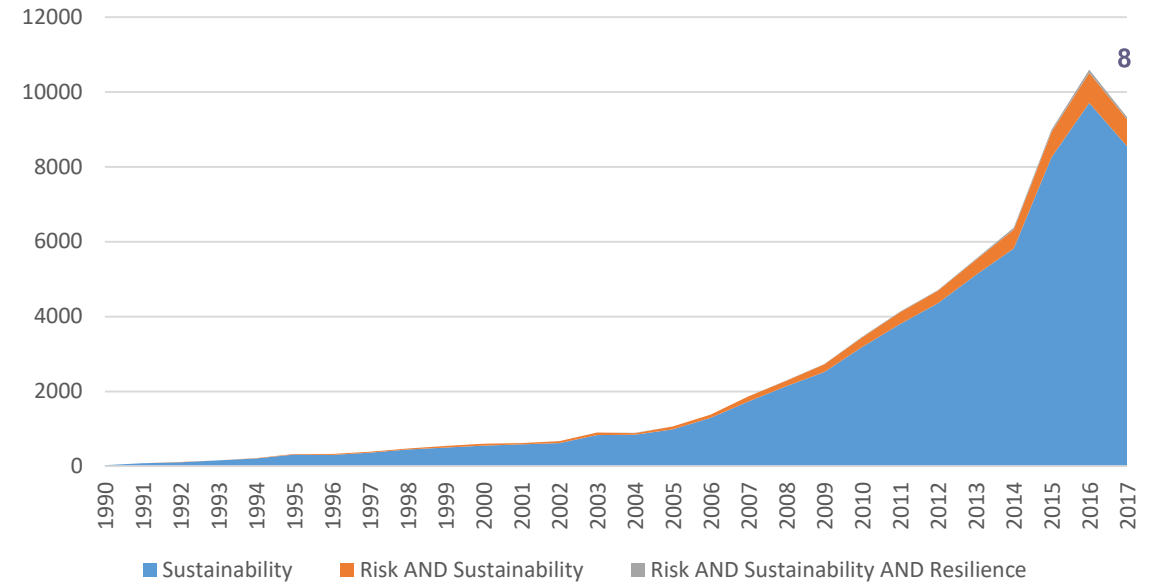
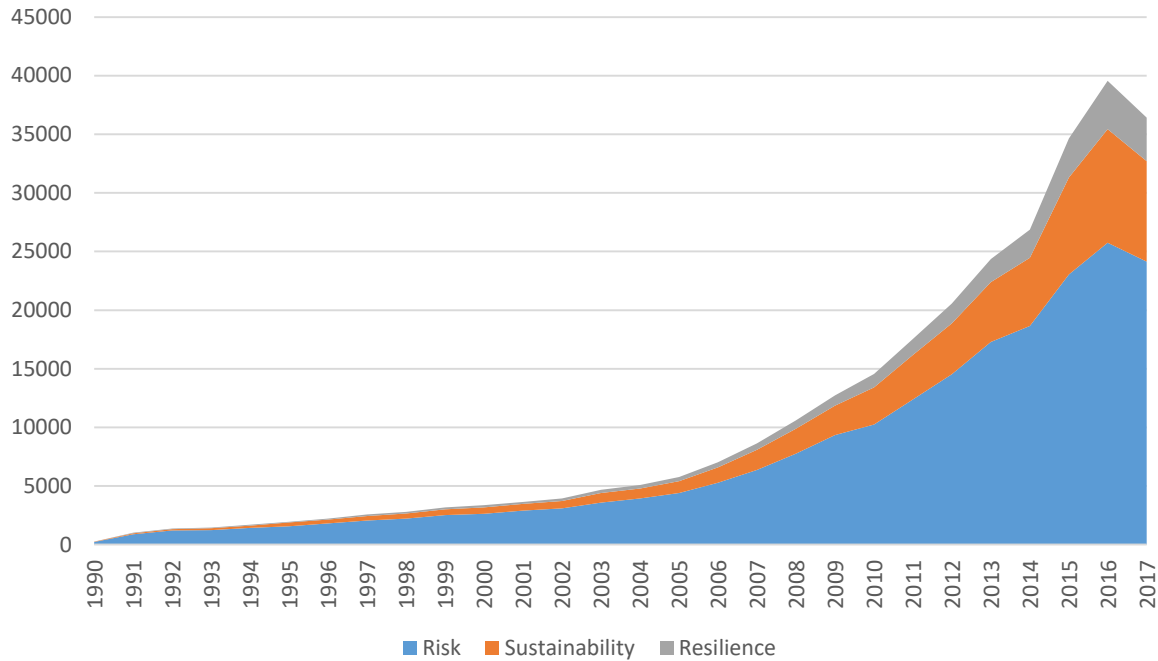
- In a bibliographic coupling analysis the relatedness of items is based on the number of references they share: the larger the number of shared references, the stronger the bibliographic coupling is between them.
 - Two publications are said to be bibliographically coupled if there is a third publication that is cited by both publications (Kessler 1963 and Van Eck and Waltman 2014).
-

Some specifications:

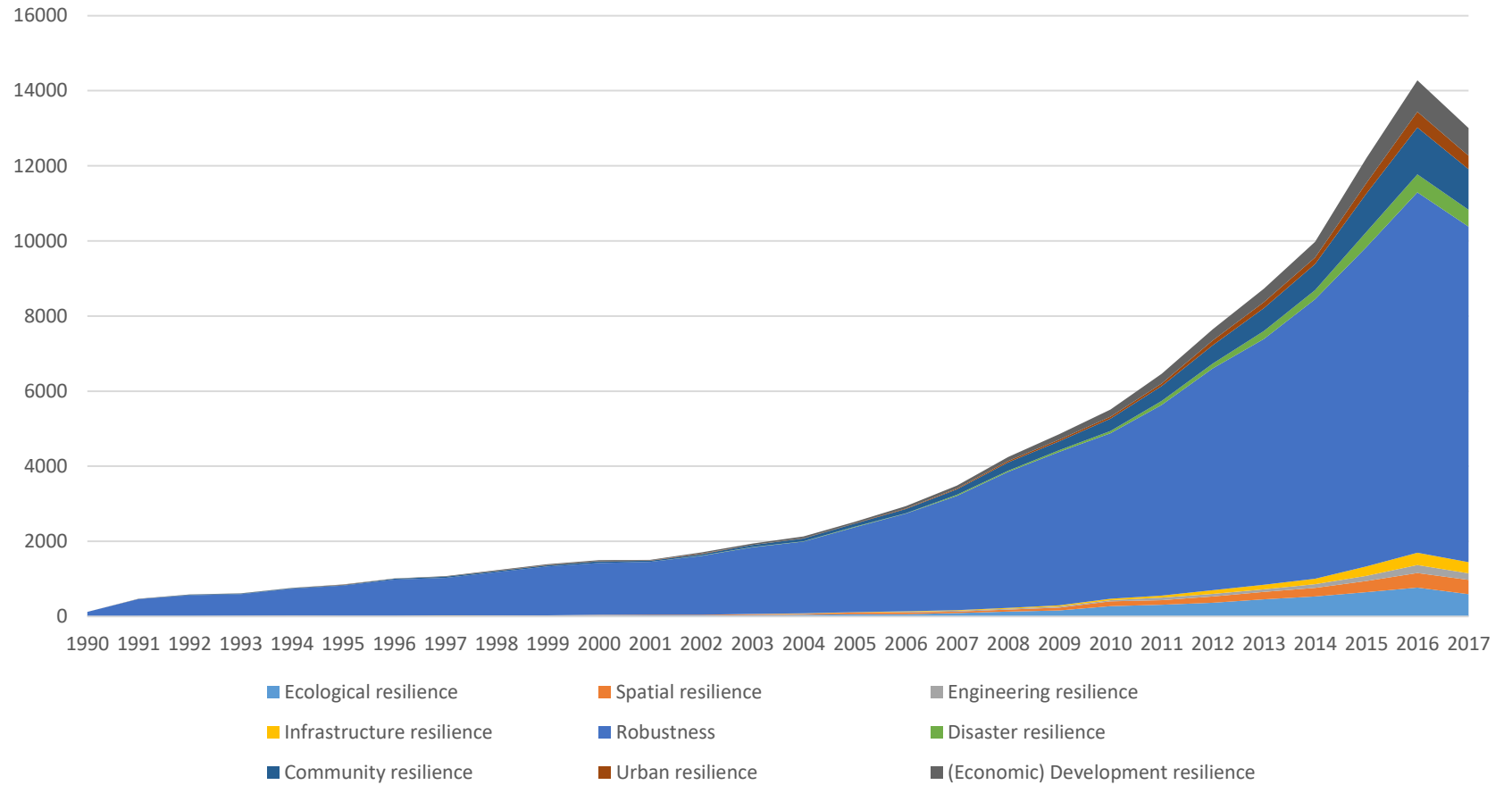
- We represent the relatedness of three items: authors, countries and organizations, using density visualization format for authors and organizations and network visualization format for countries.
- We use the fractional counting method b/c it purposefully diminishes the importance of highly cited publications, which allows us to be inclusive of perspectives that are not bound by what passes as “significant” research based on citation numbers.



Evolution of research

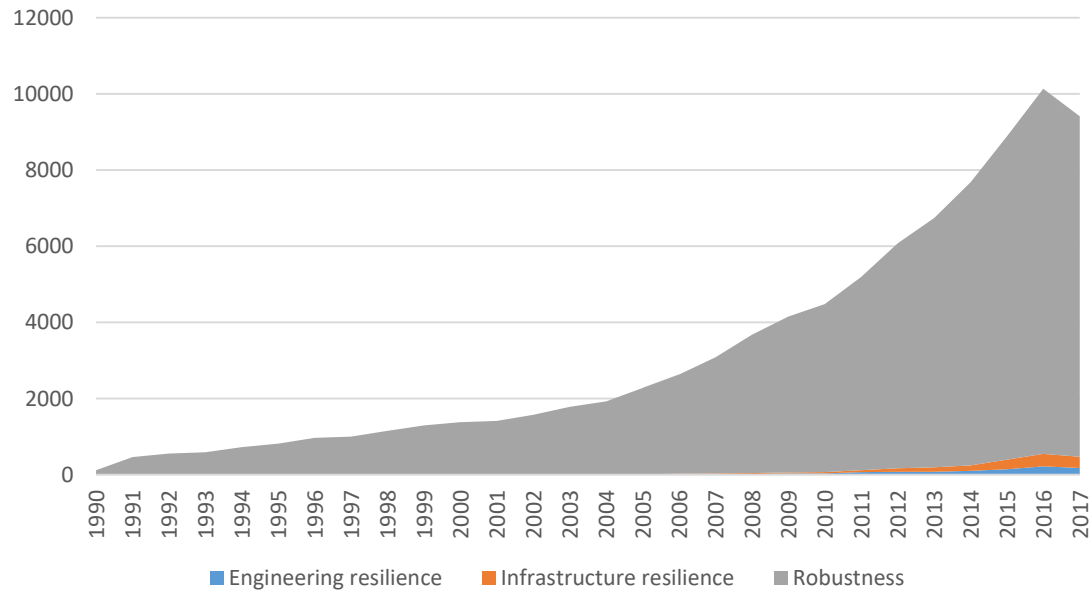


Evolution of research

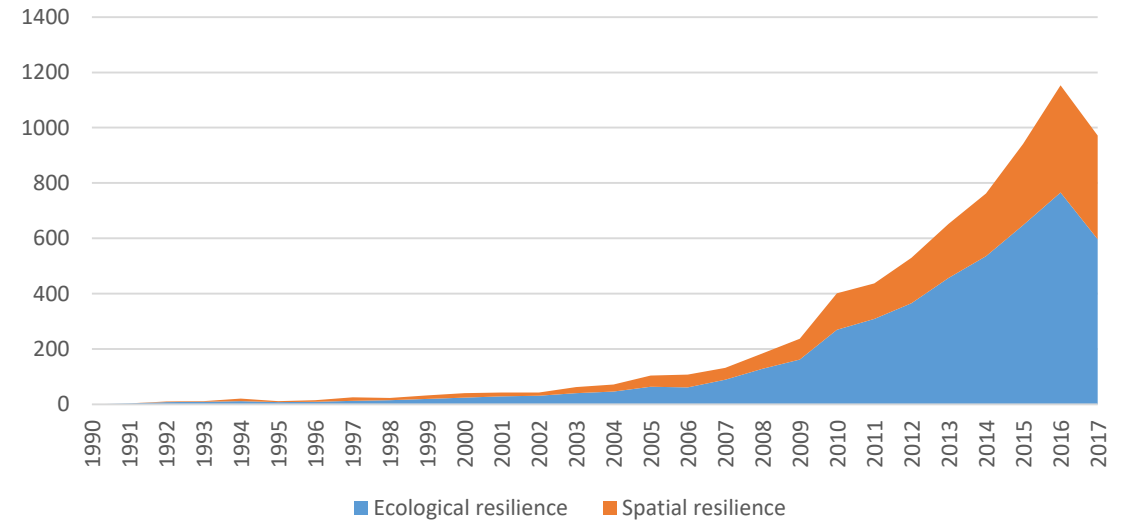


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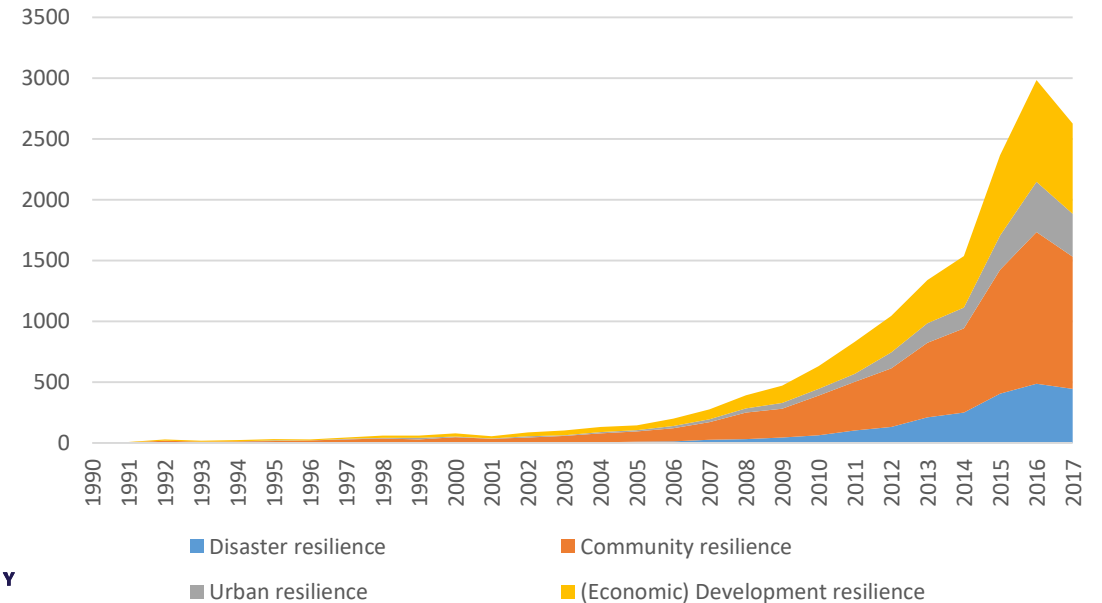
Engineered systems



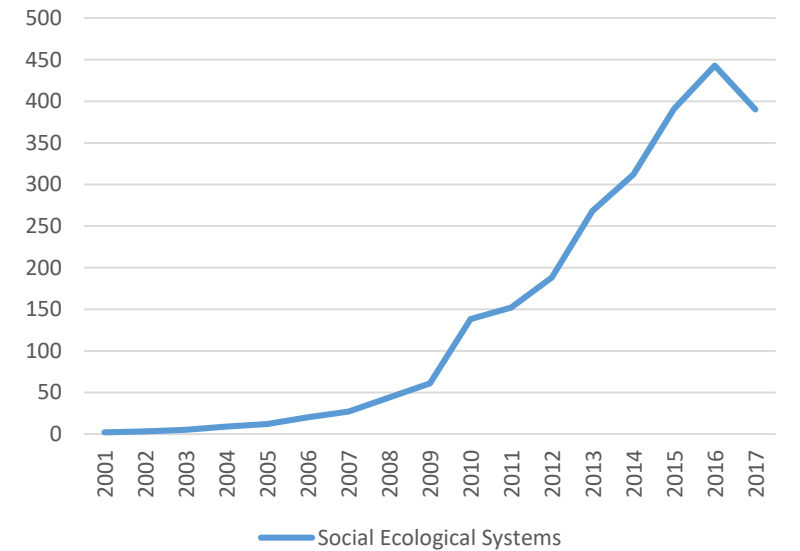
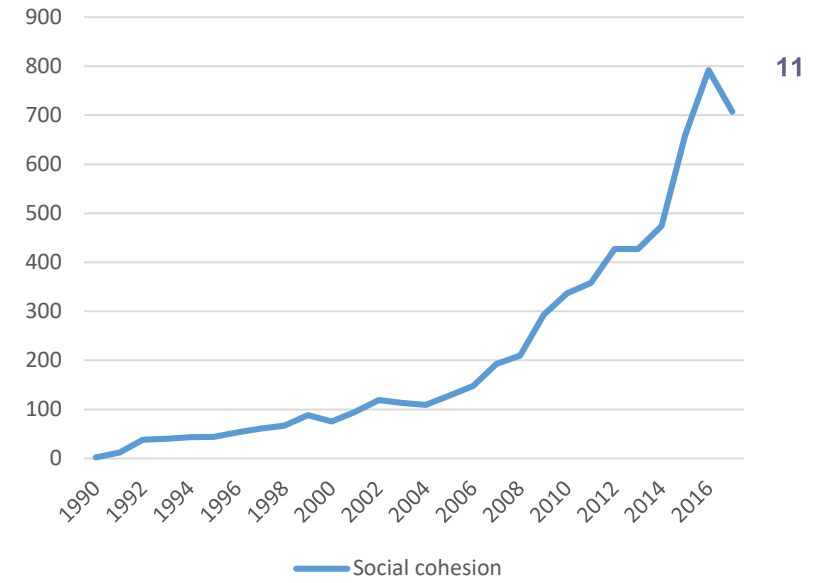
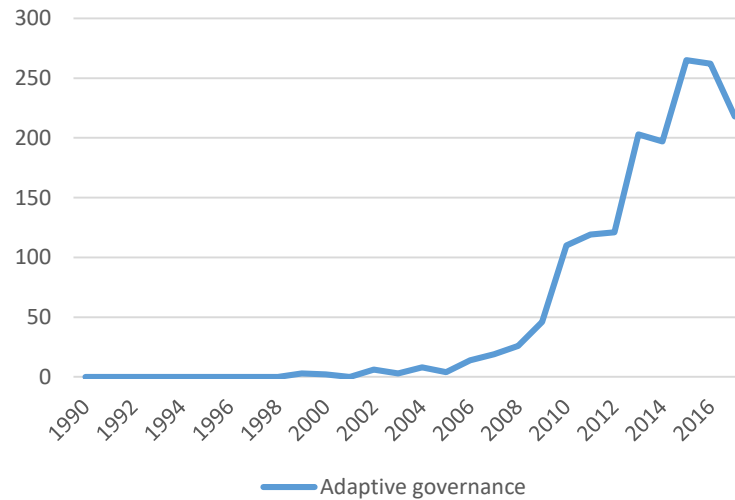
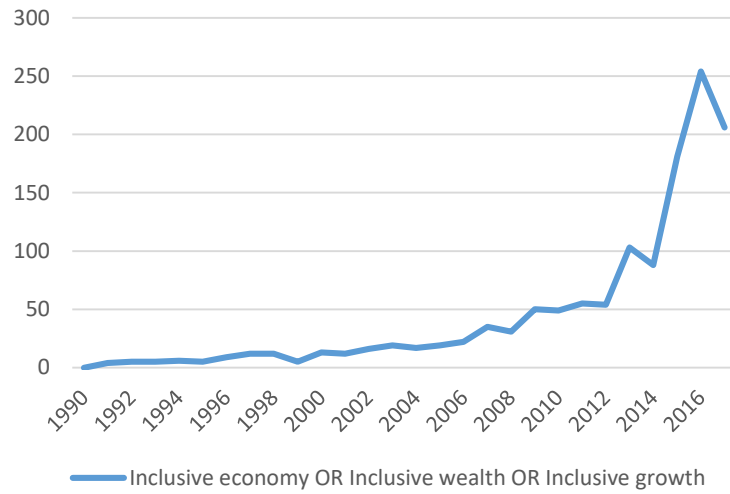
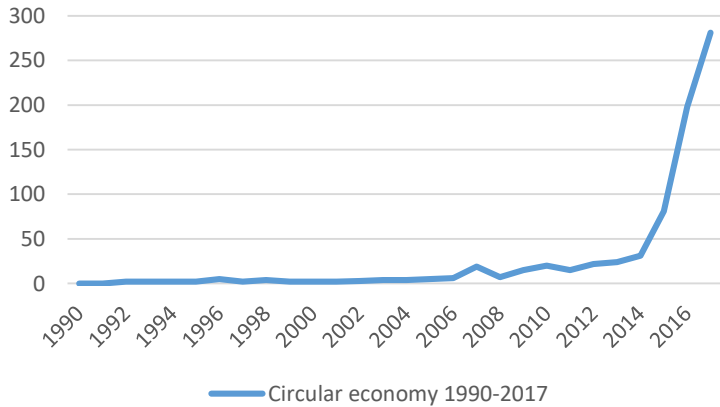
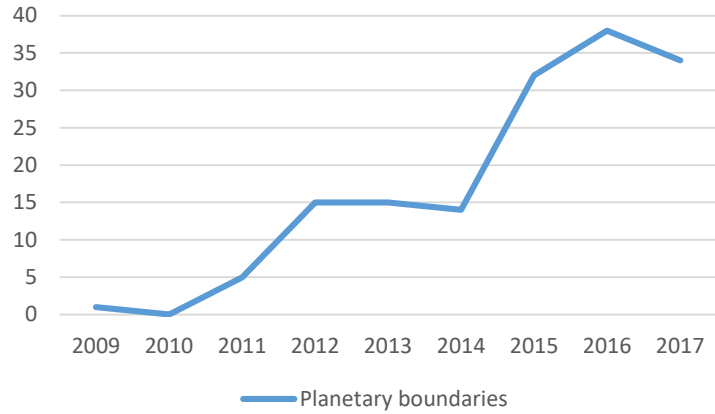
Ecological systems



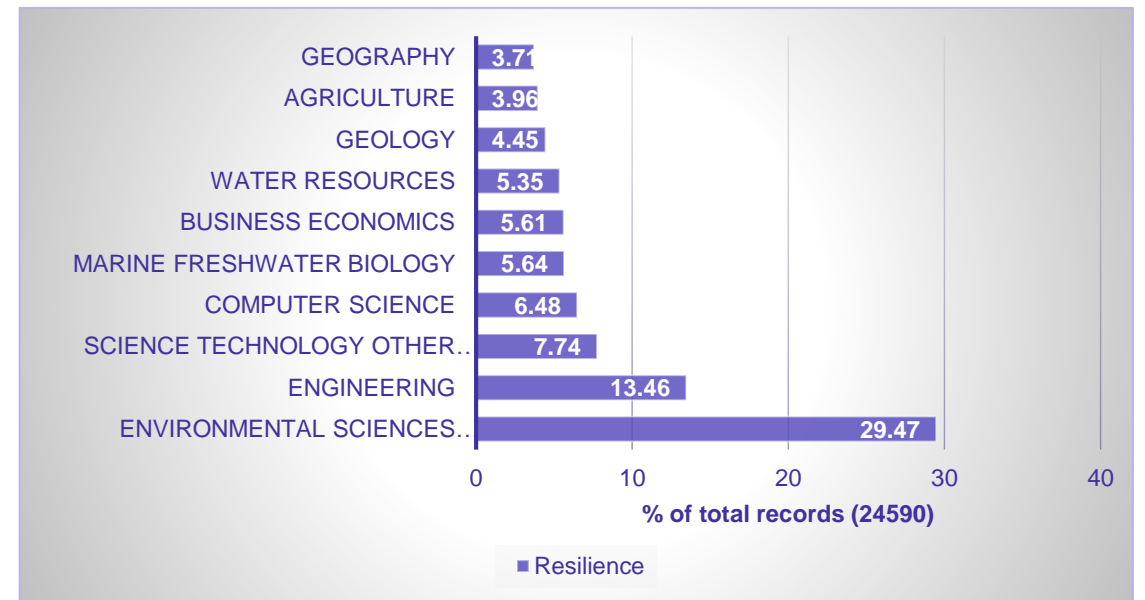
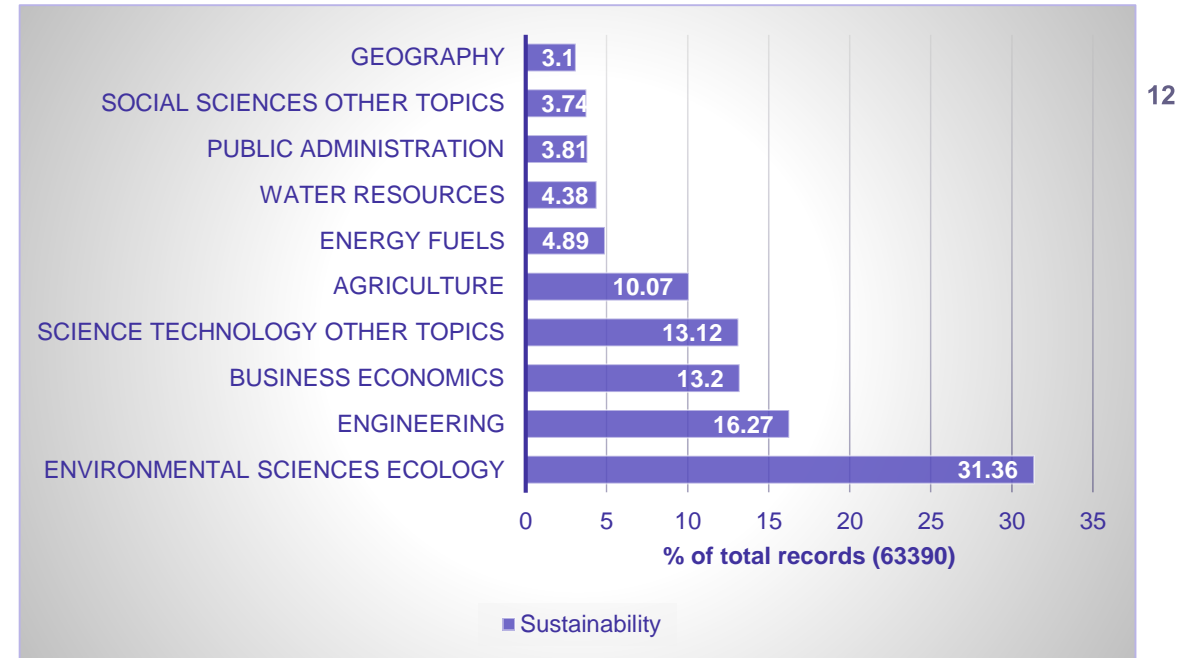
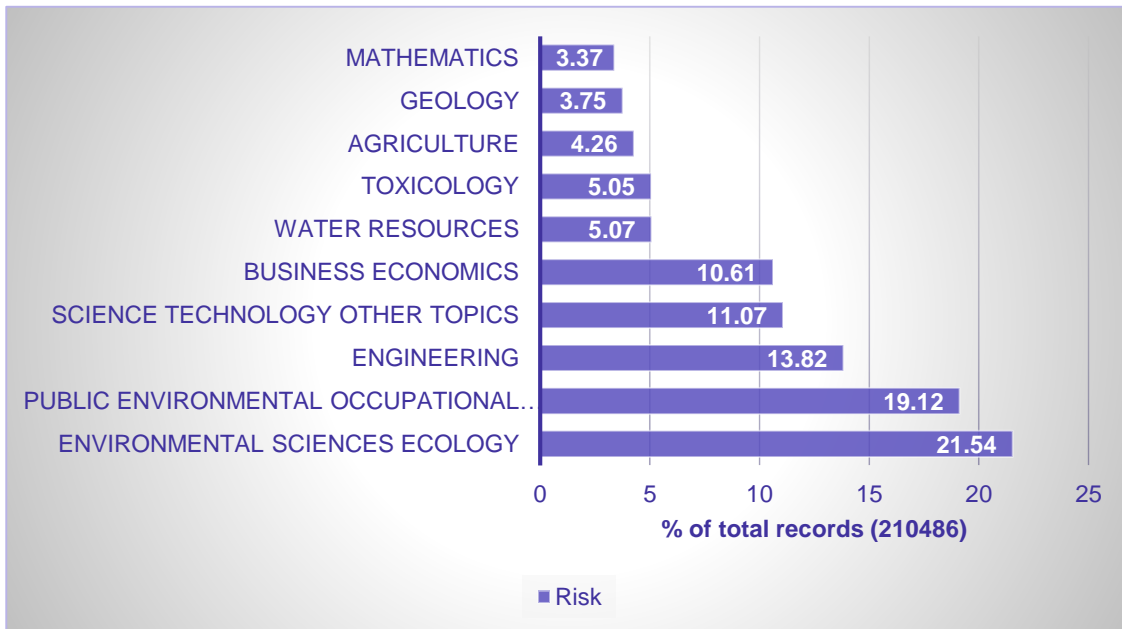
Social systems



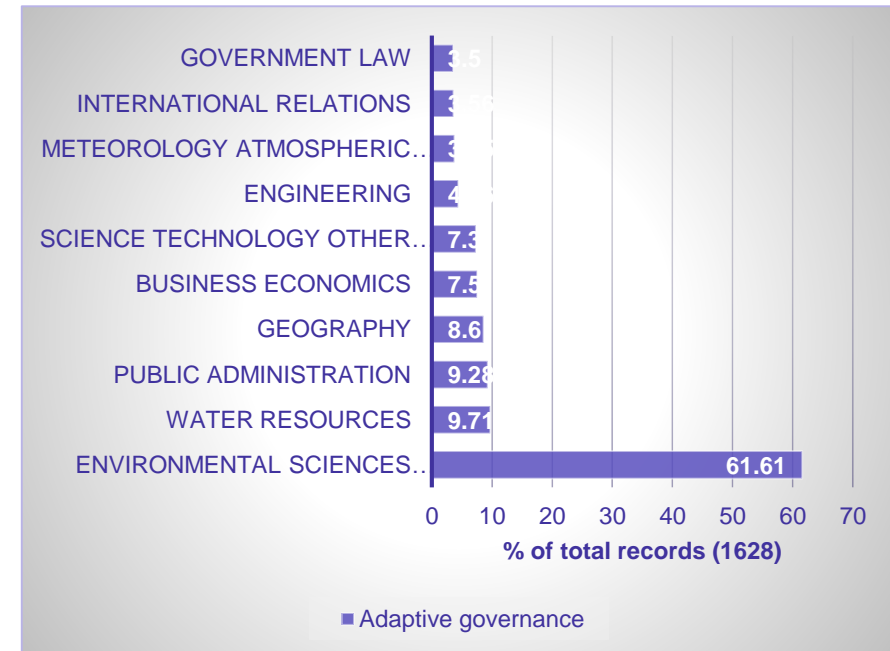
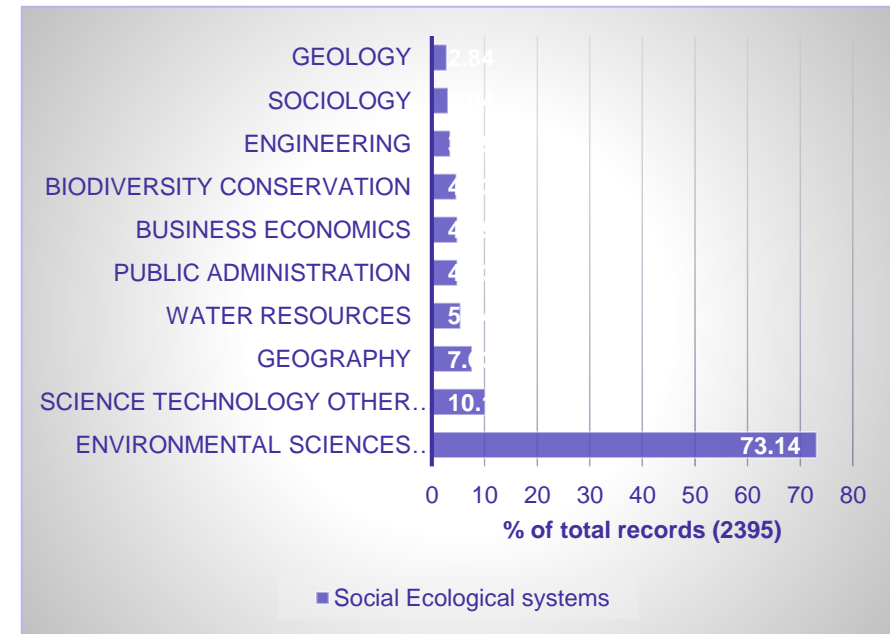
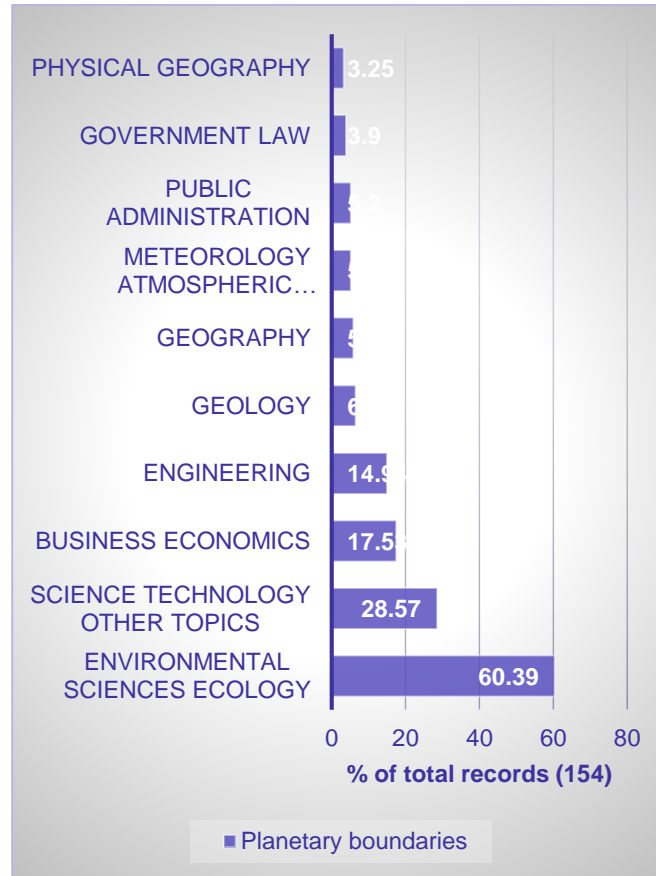
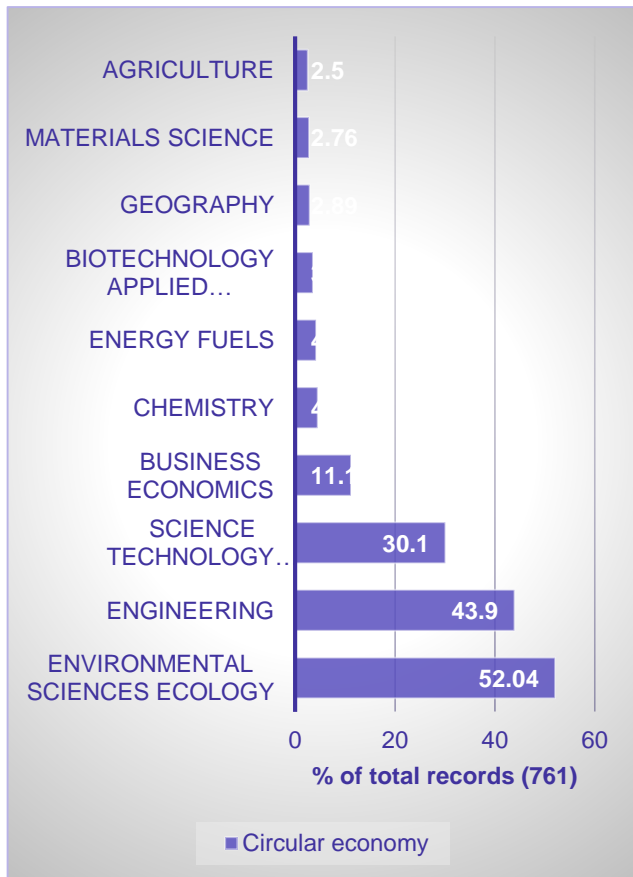
Evolution of research



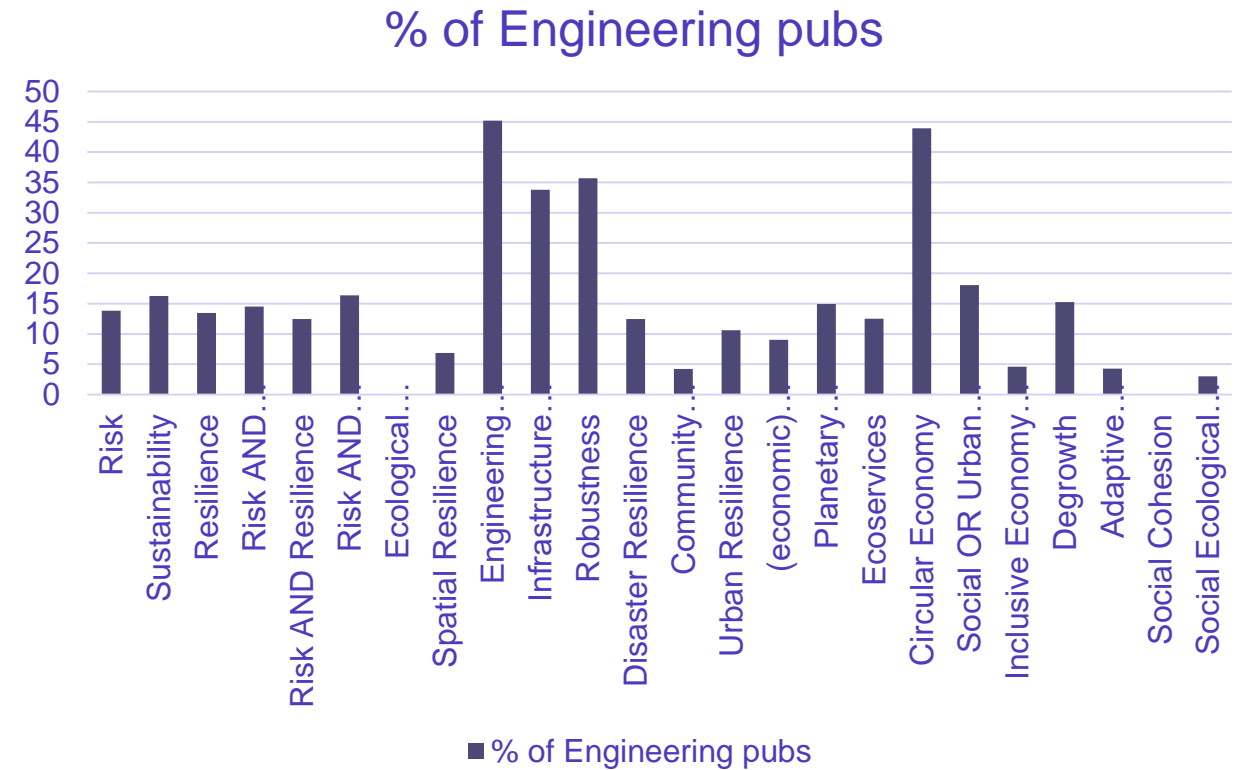
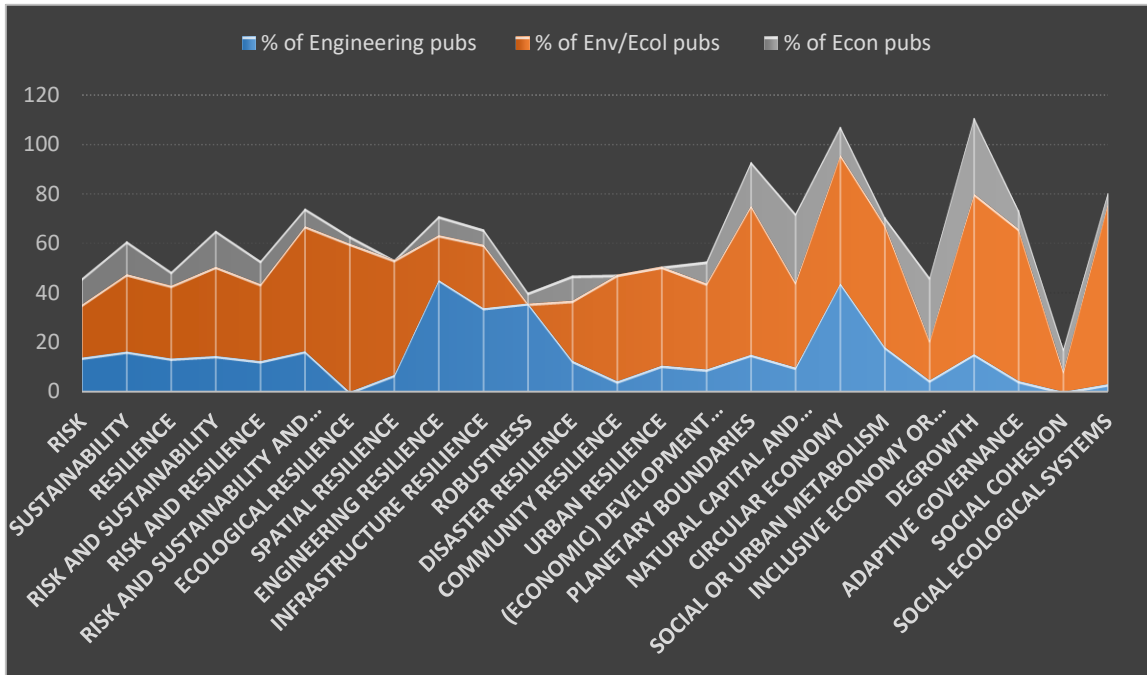
Composition of research



Composition of research



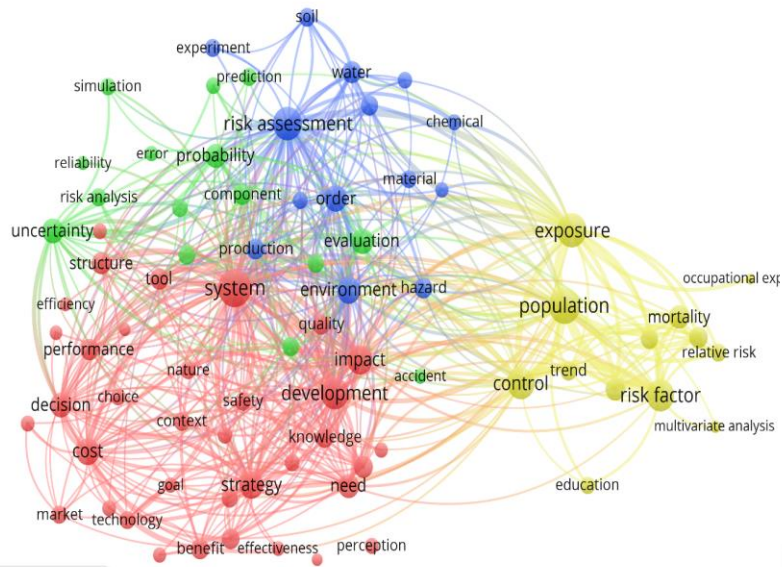
Composition of research



Term Co-occurrence

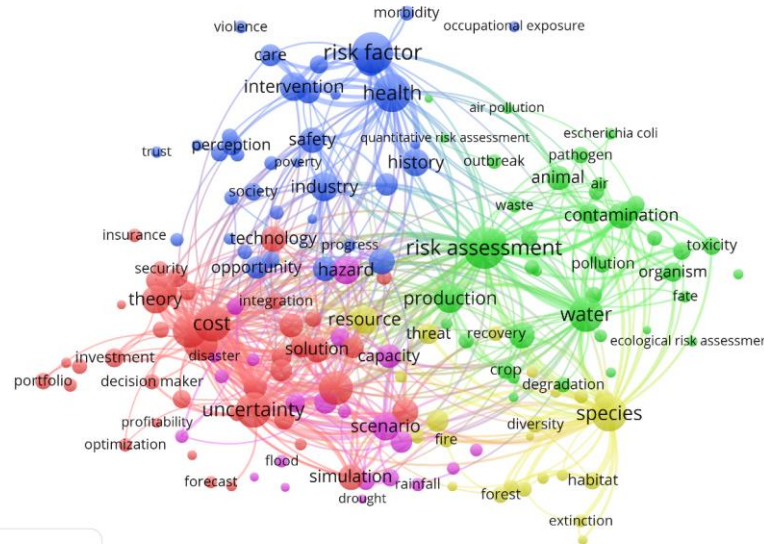
Risk 1990-2017

1990-2000



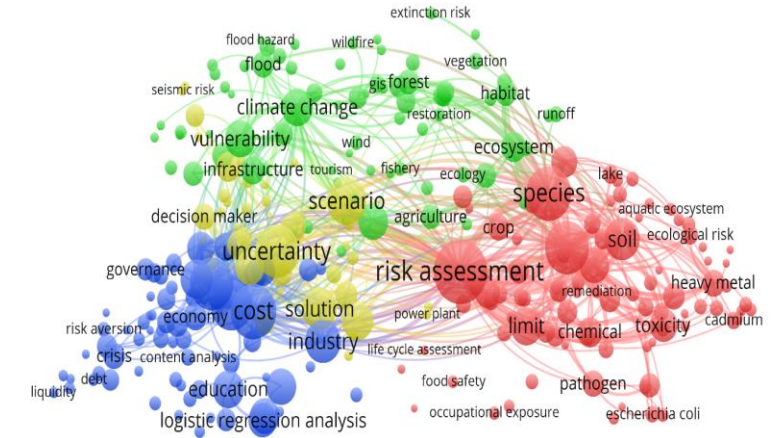
Total nr. records: 17,729
 Min. occurrence: 200
 Nr. terms selected: 78 (of 349)

2001-2010



Total nr. records: 56,622
 Min. occurrence: 200
 Nr. terms selected: 165 (of 1144)

2011-2017

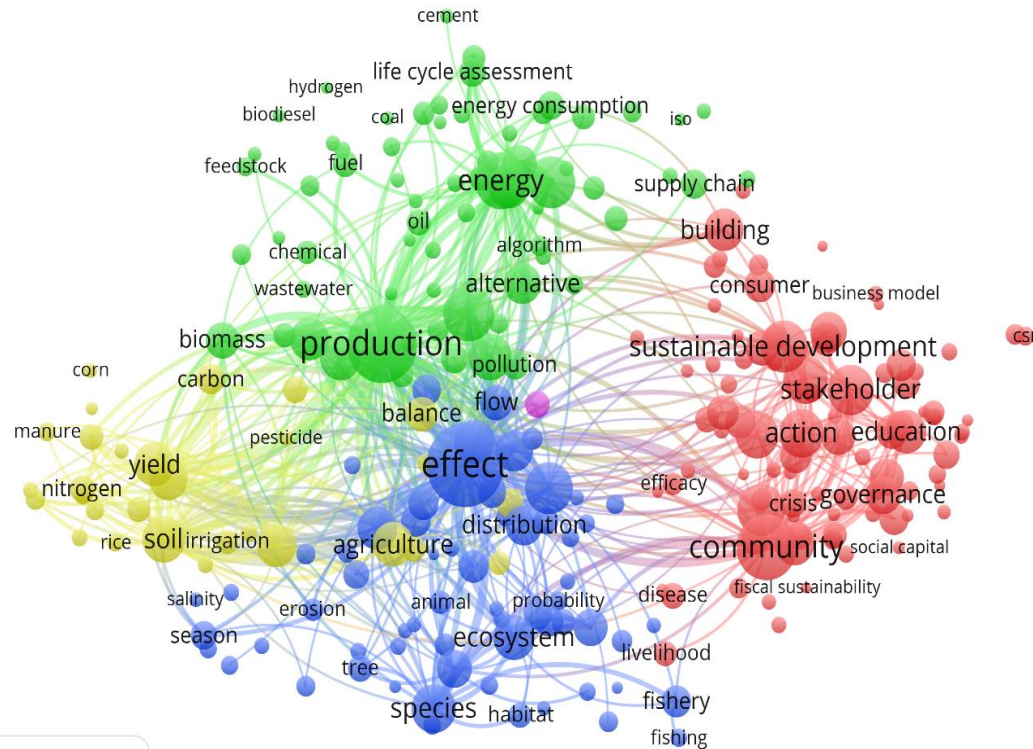


Total nr. records: 143,825
 Min. occurrence: 200
 Nr. terms selected: 277 (of 2752)



Term Co-occurrence

Sustainability &Risk AND Sustainability



VOSviewer

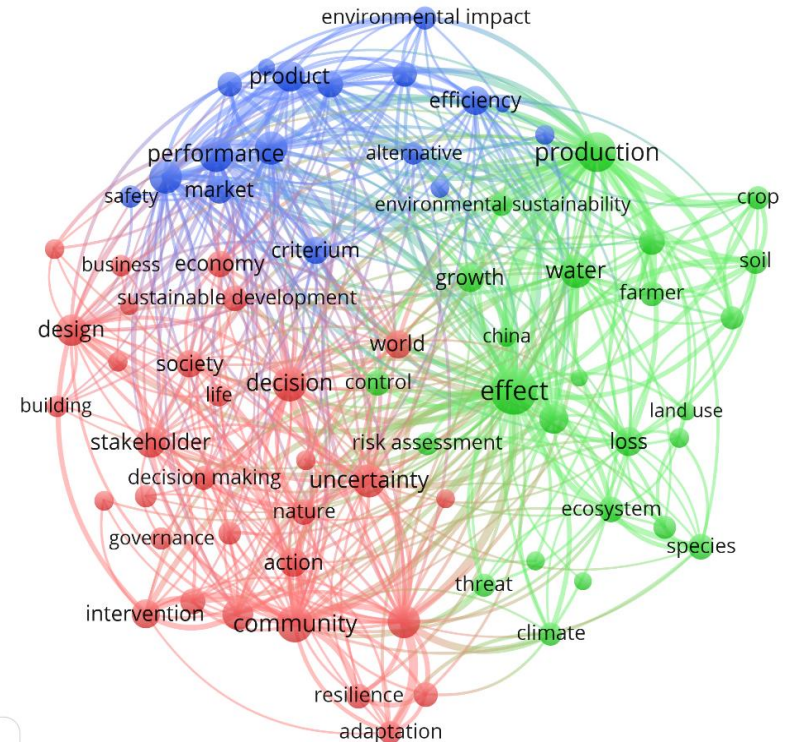
Sustainability

Total nr. of records: 63,390

Min. Occurrence: 200

Nr. terms selected: 253 (of 1318)

csr



VOSviewer

Risk AND Sustainability

Total nr.of records: 5052

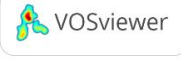
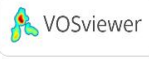
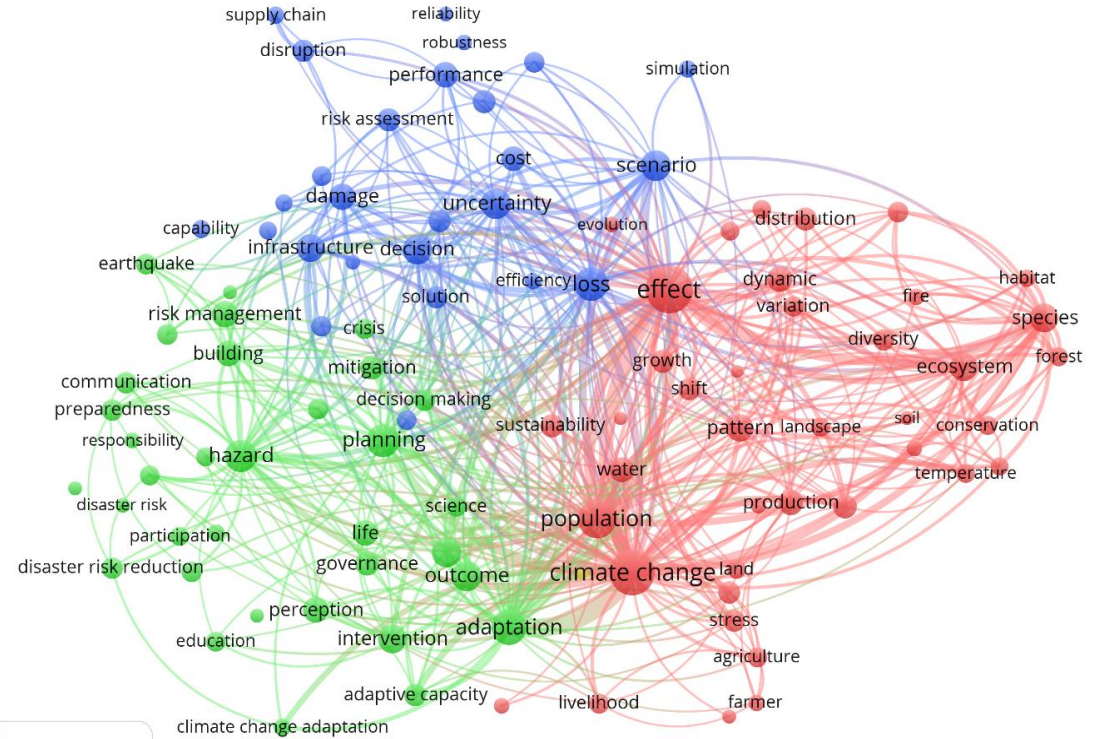
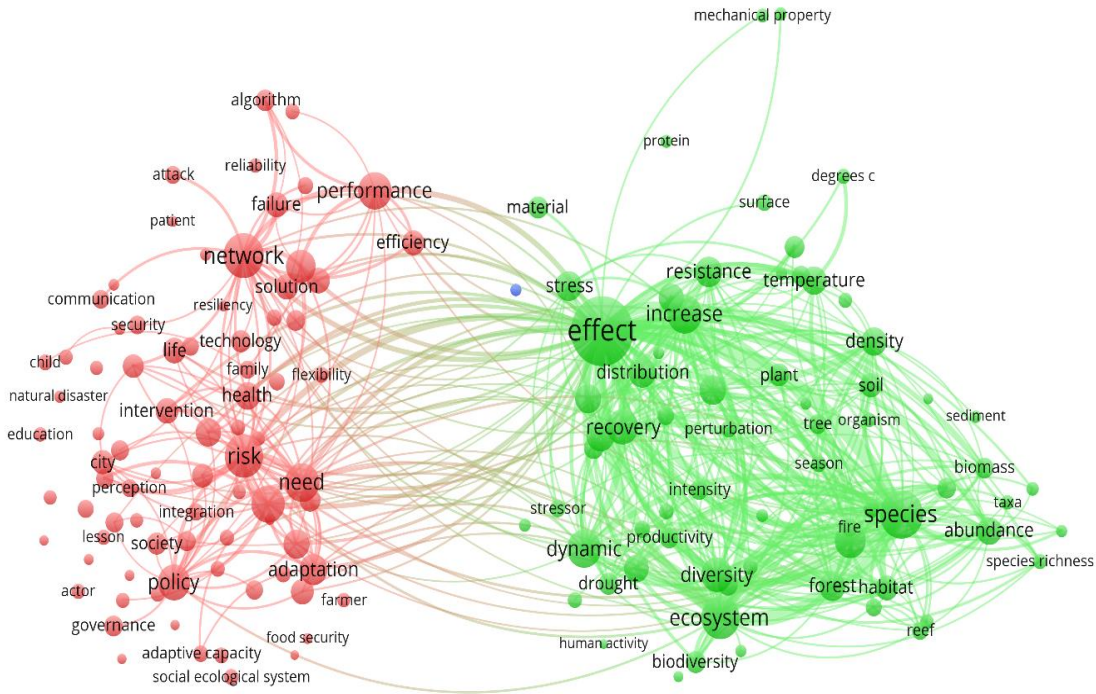
Min. Occurrence: 100

Nr. terms selected: 73 (of 276)



Term Co-occurrence

Resilience & Risk AND Resilience



Resilience

Total nr. of records: 24, 533
 Min. occurrence: 200
 Nr. terms selected: 152 (of 544)

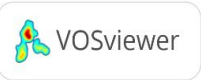
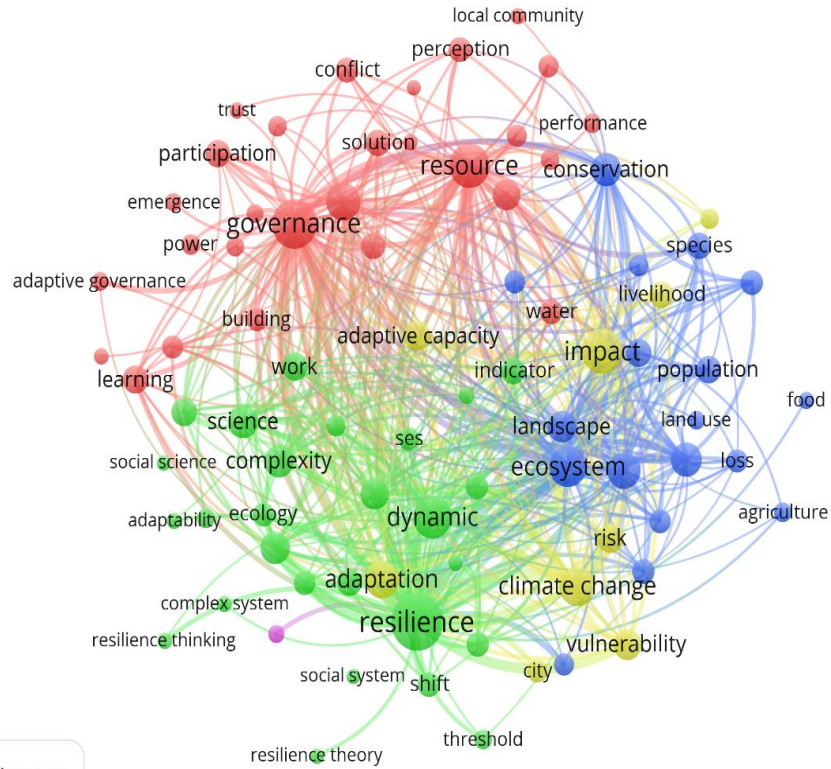
Risk AND Resilience

Total nr. of records: 3993
 Min. occurrence: 50
 Nr. terms selected: 101 (of 391)



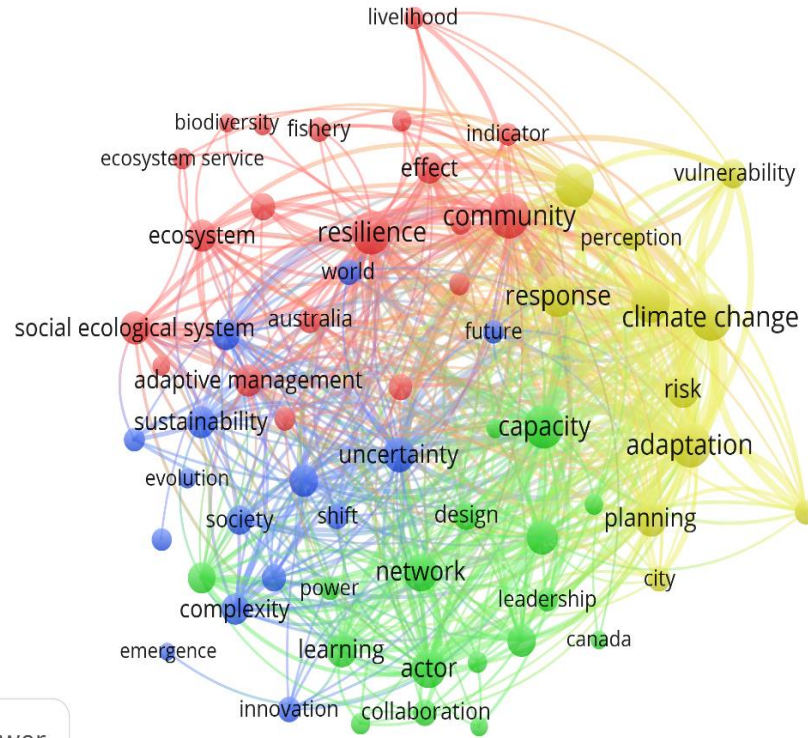
Term Co-occurrence

Social-Ecological Systems & Adaptive Governance



Social-Ecological Systems

Total nr. records: 2395
Min. occurrence: 50
Nr. terms selected: 83 (of 294)



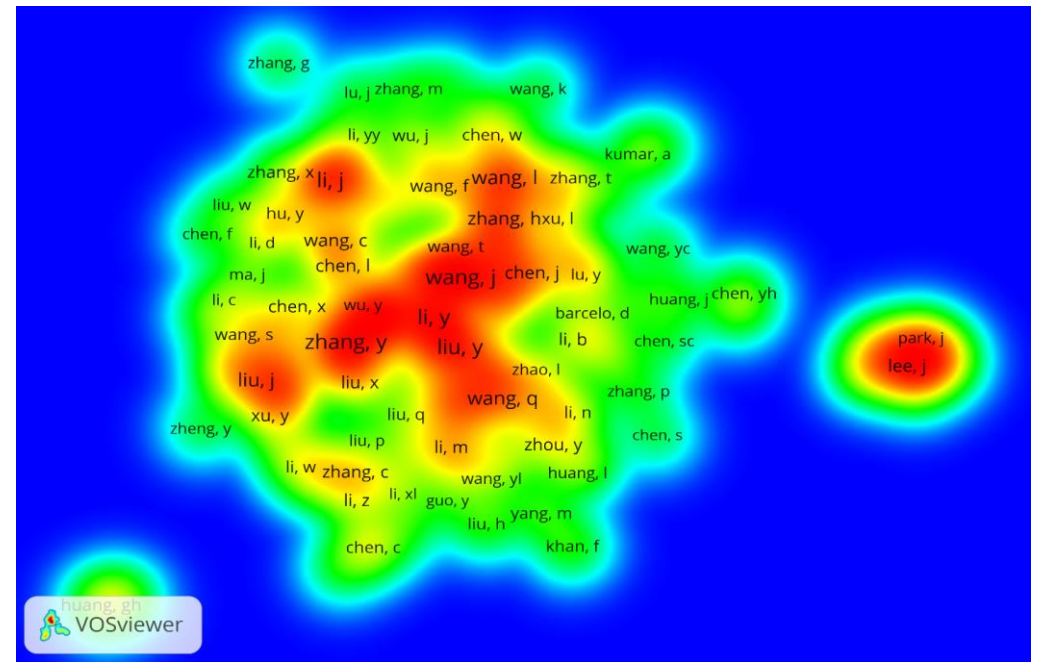
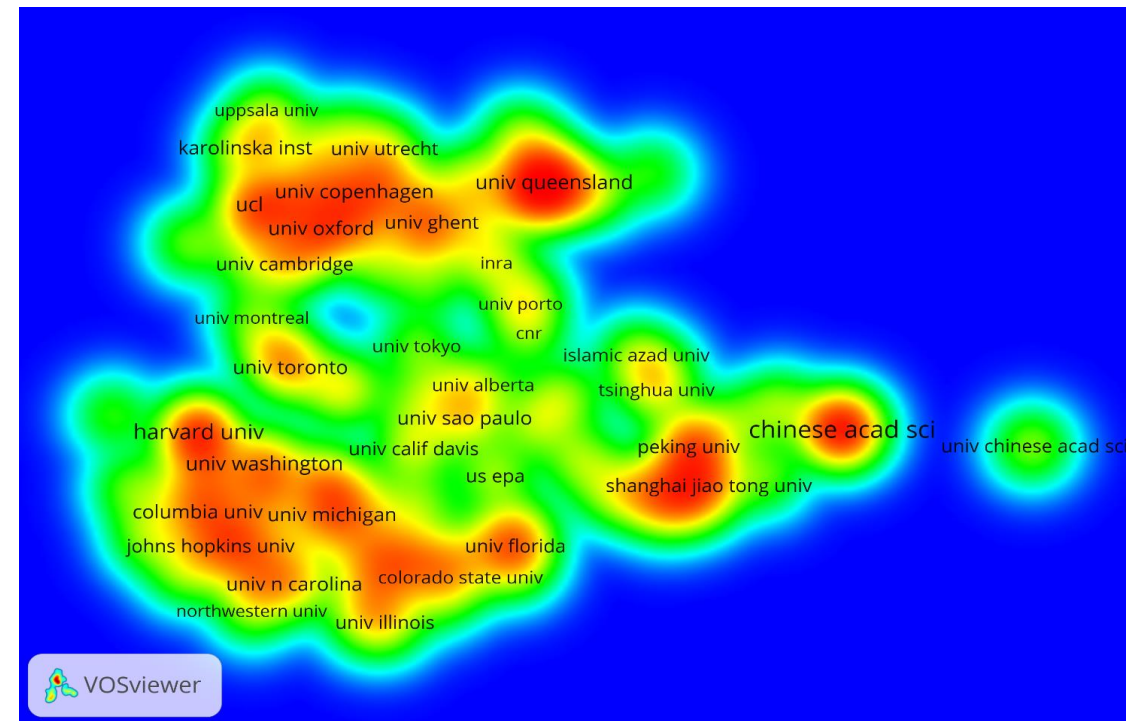
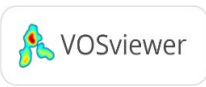
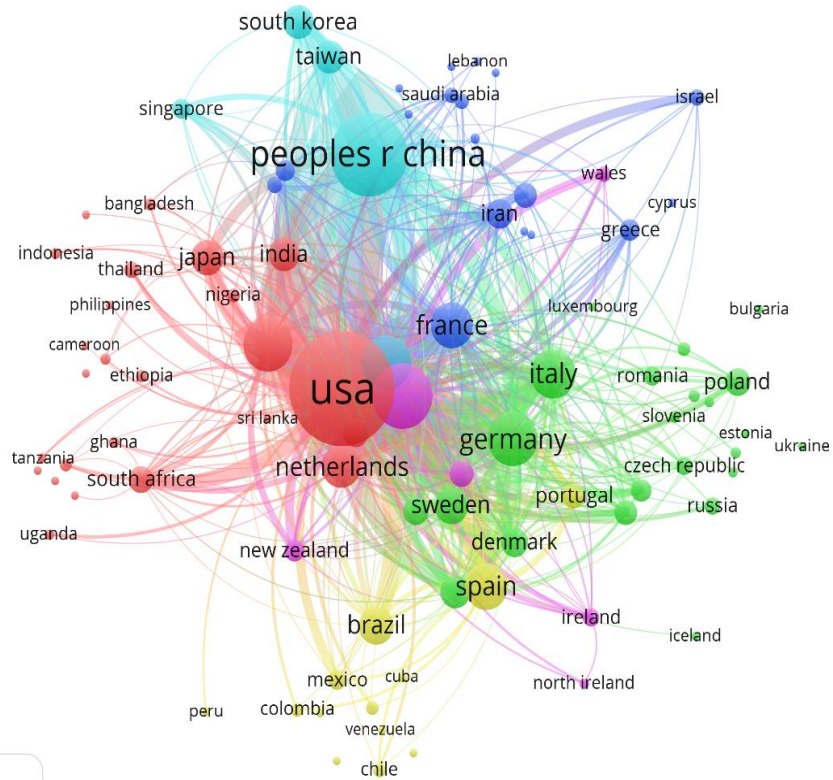
Adaptive Governance

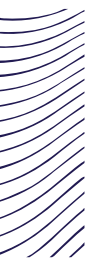
Total nr. records: 1623
Min. occurrence: 50
Nr. terms selected: 63 (of 195)



Bibliographic Coupling

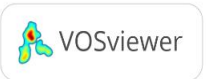
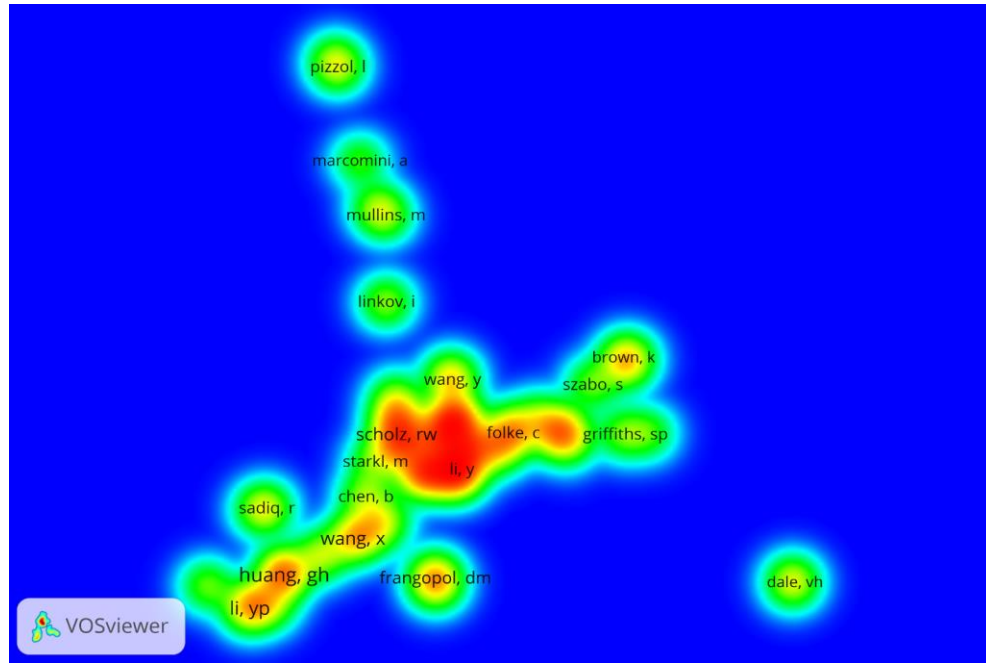
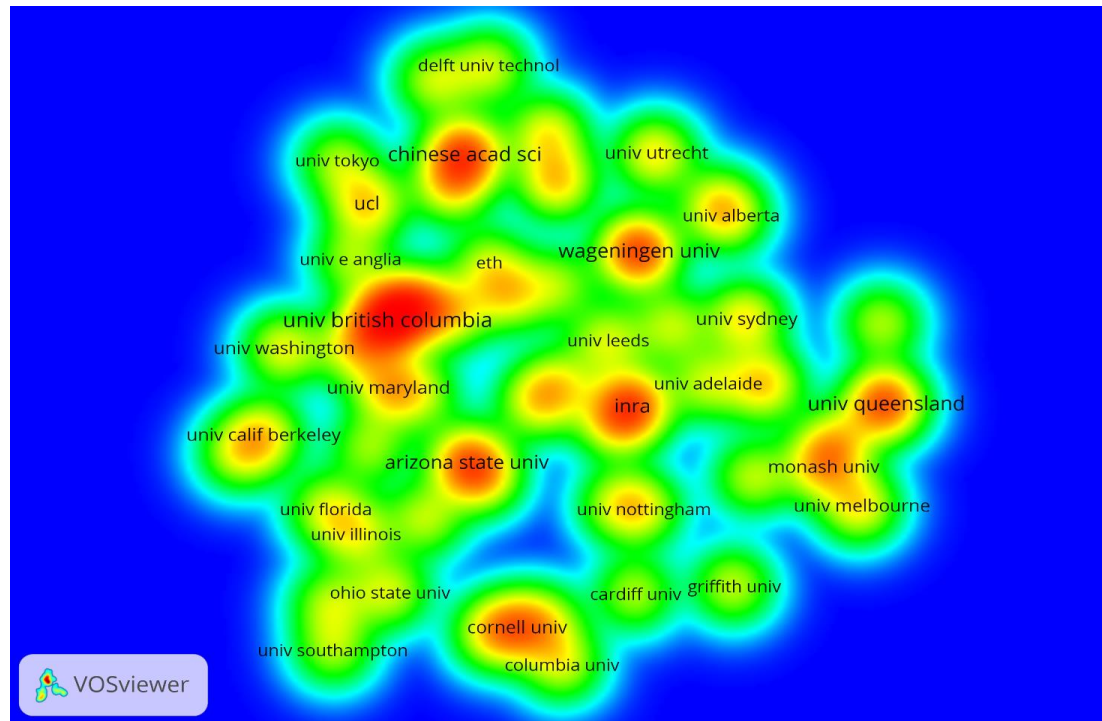
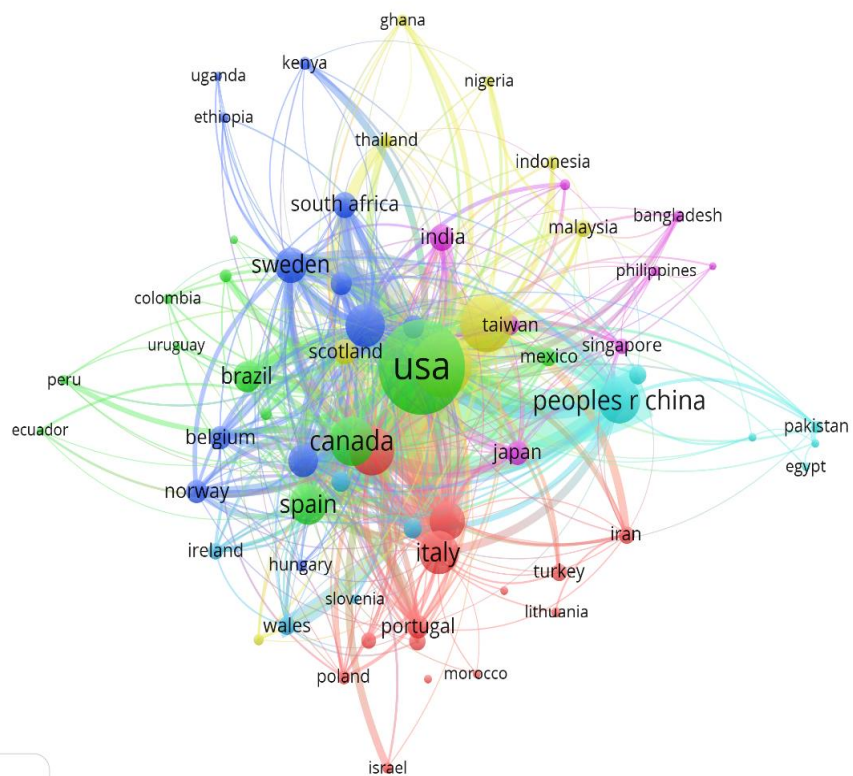
Risk 2011-2017





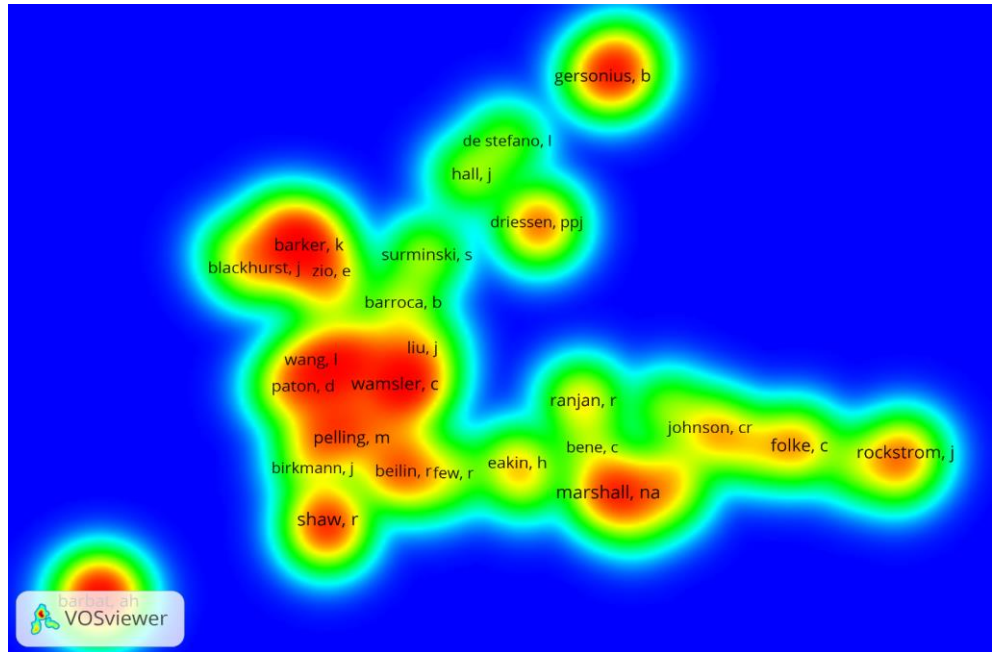
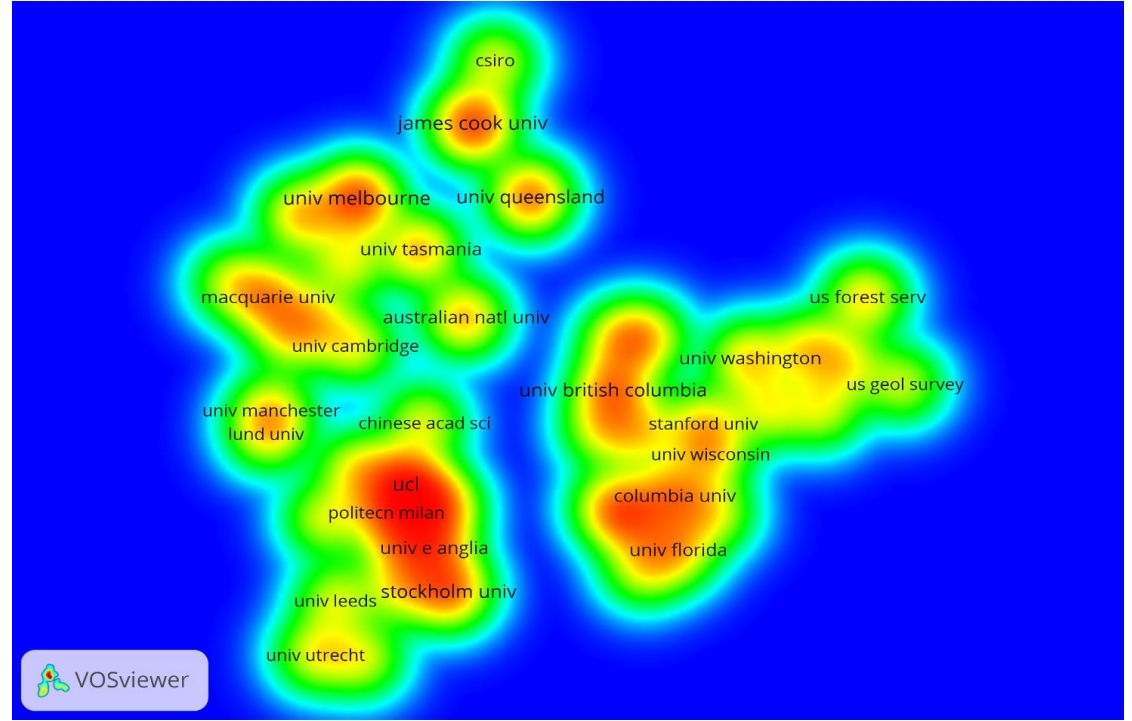
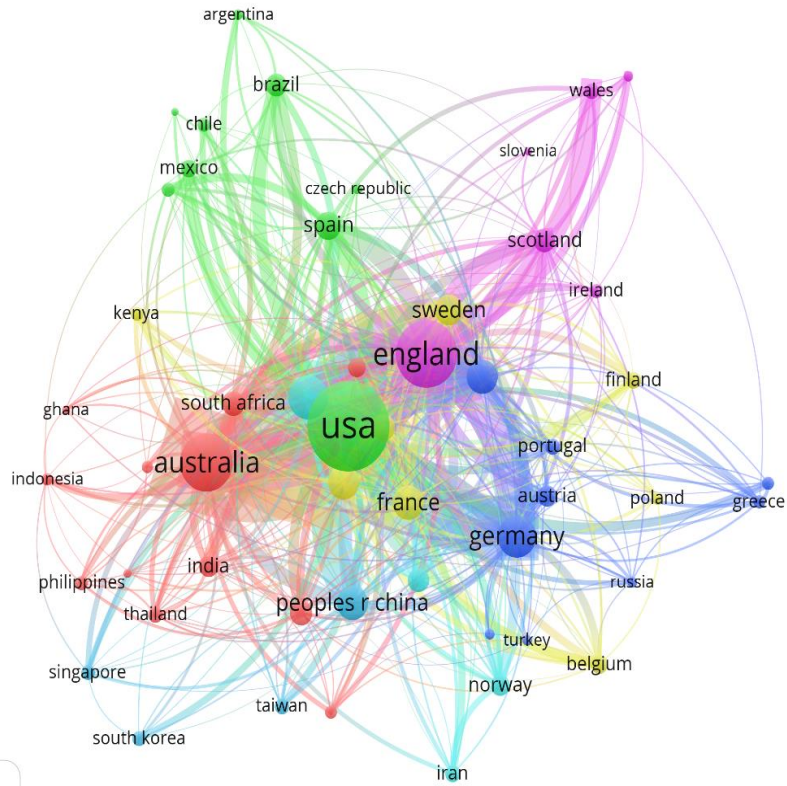
Bibliographic Coupling

Risk AND Sustainability



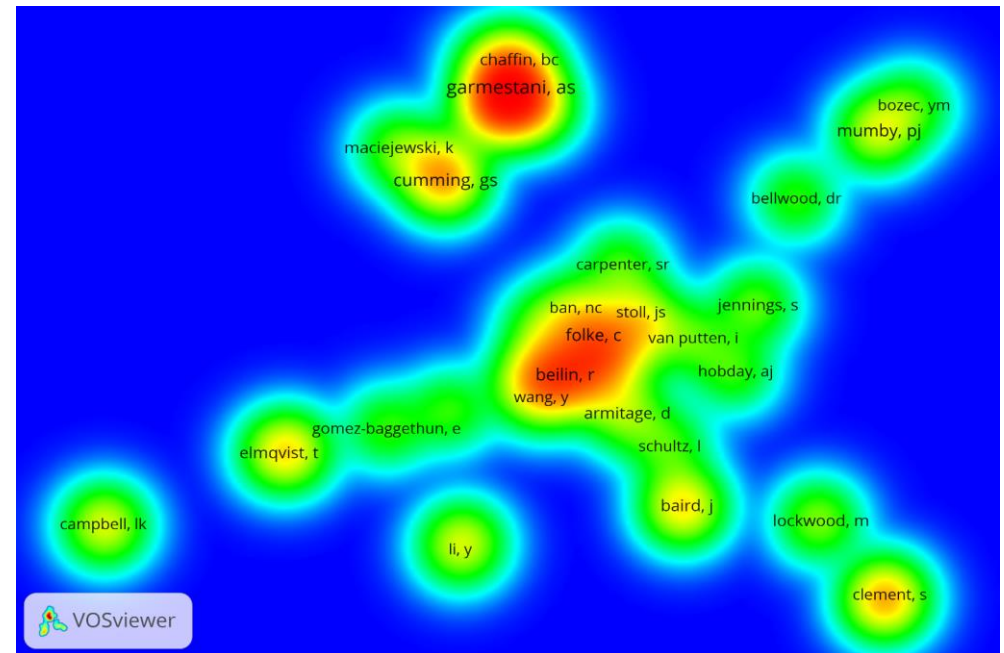
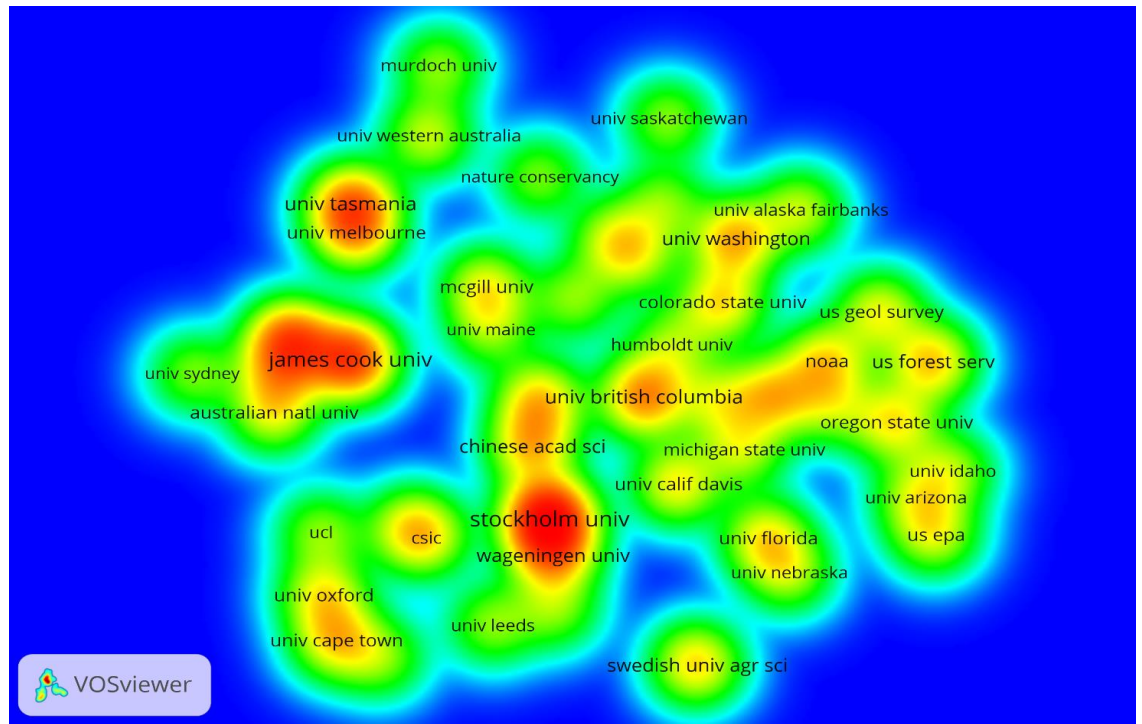
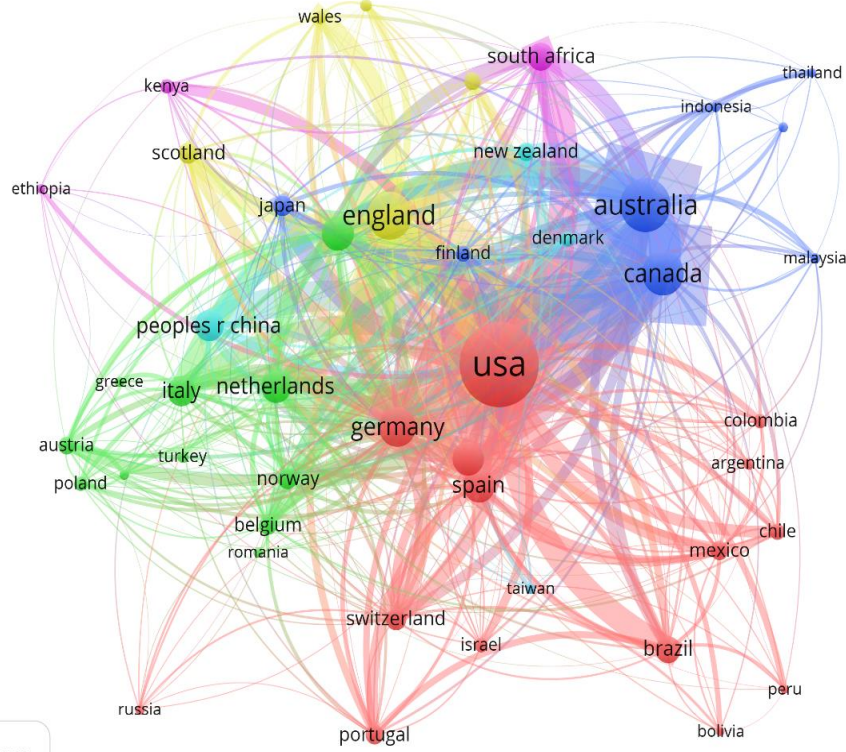
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Risk AND Resilience



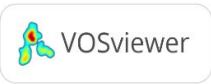
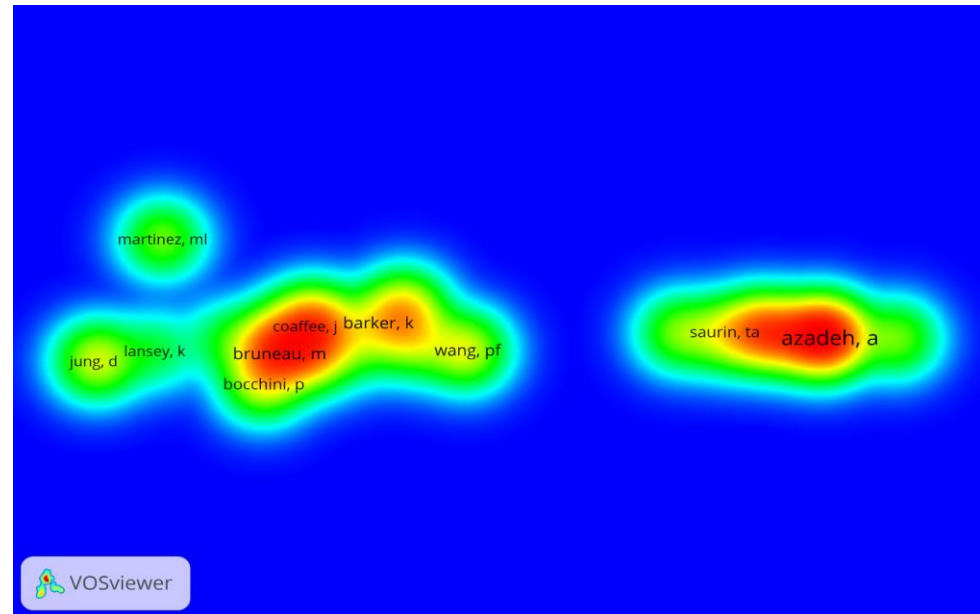
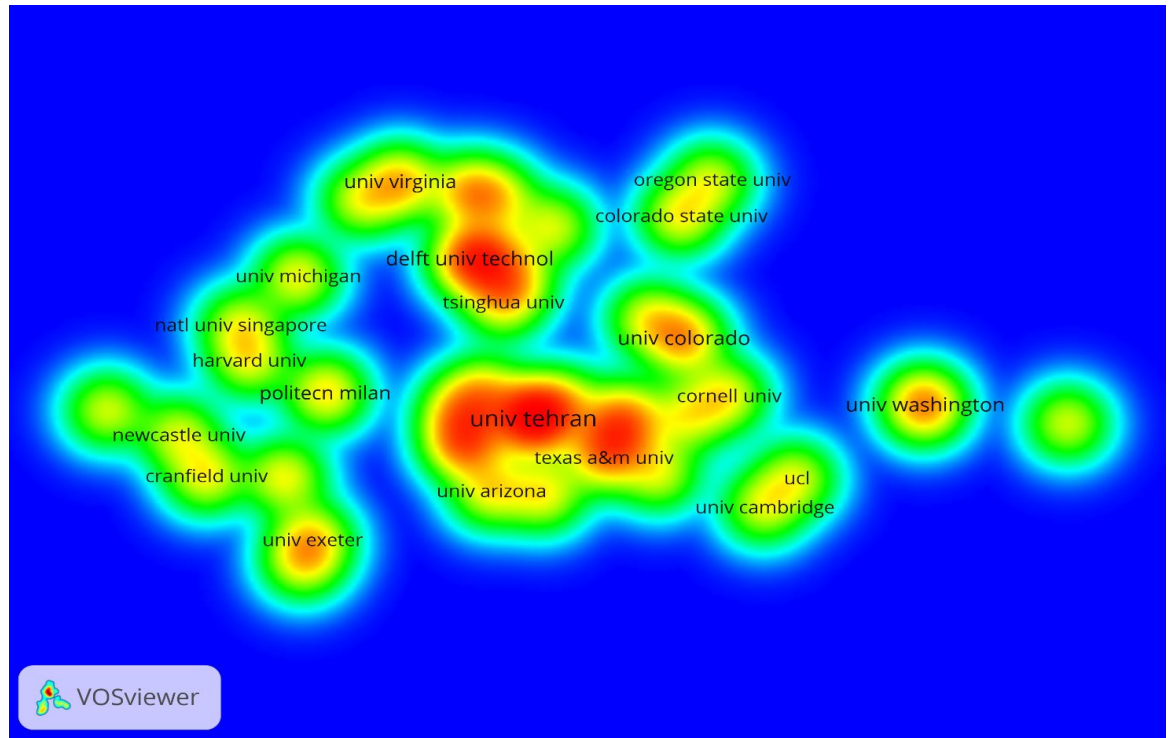
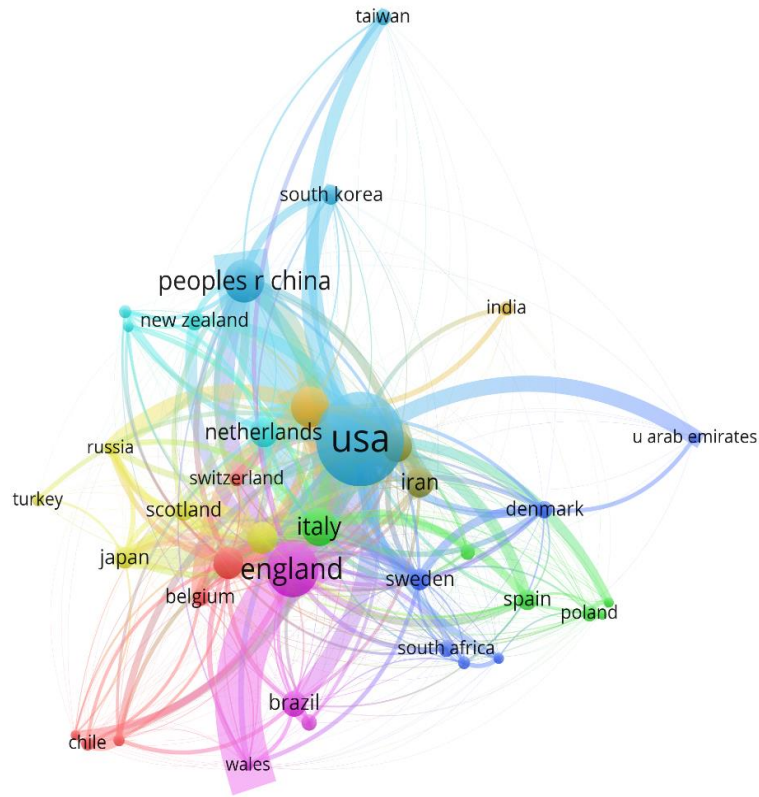
Bibliographic Coupling

Ecological resilience



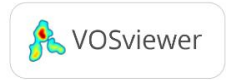
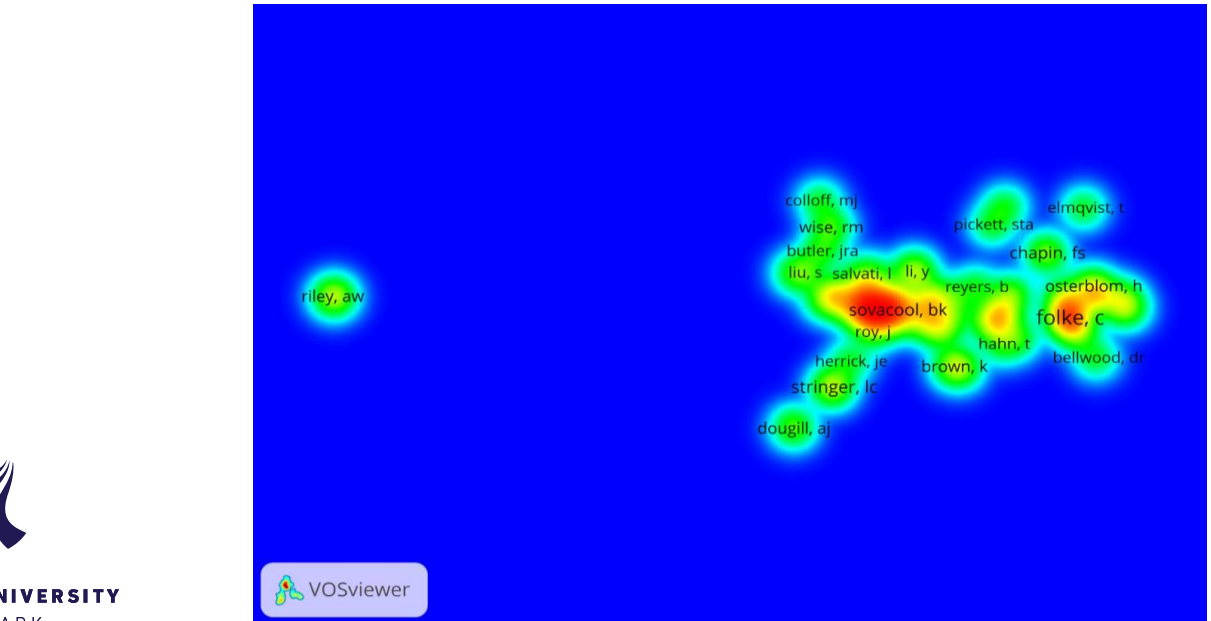
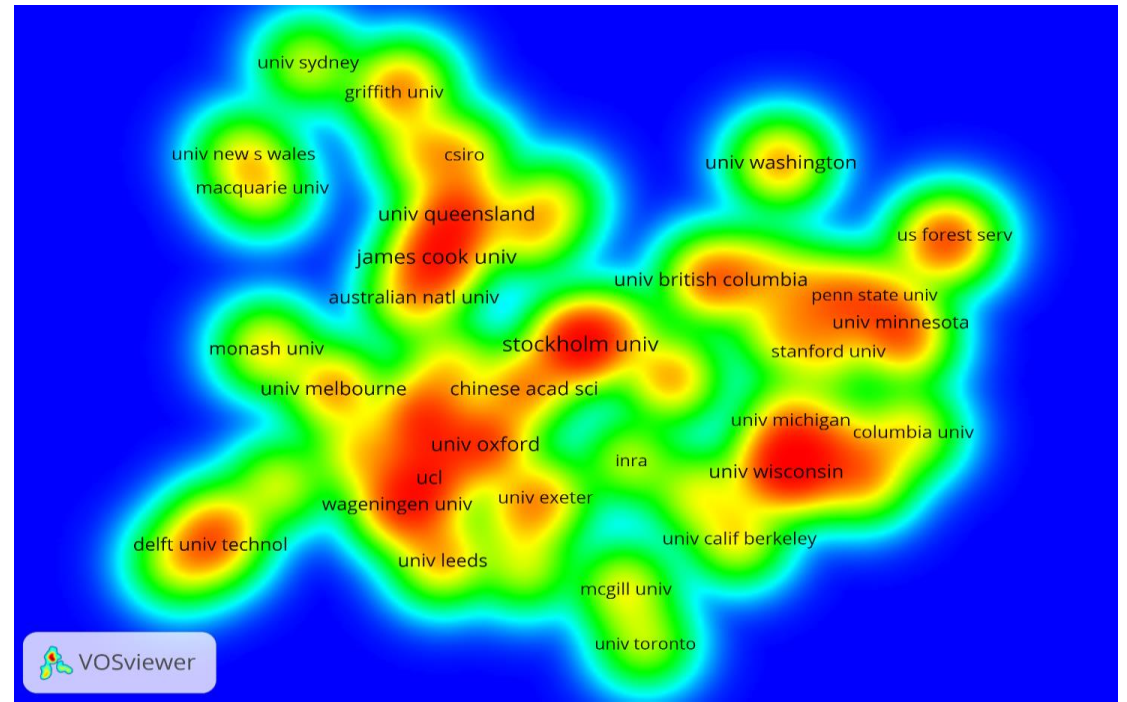
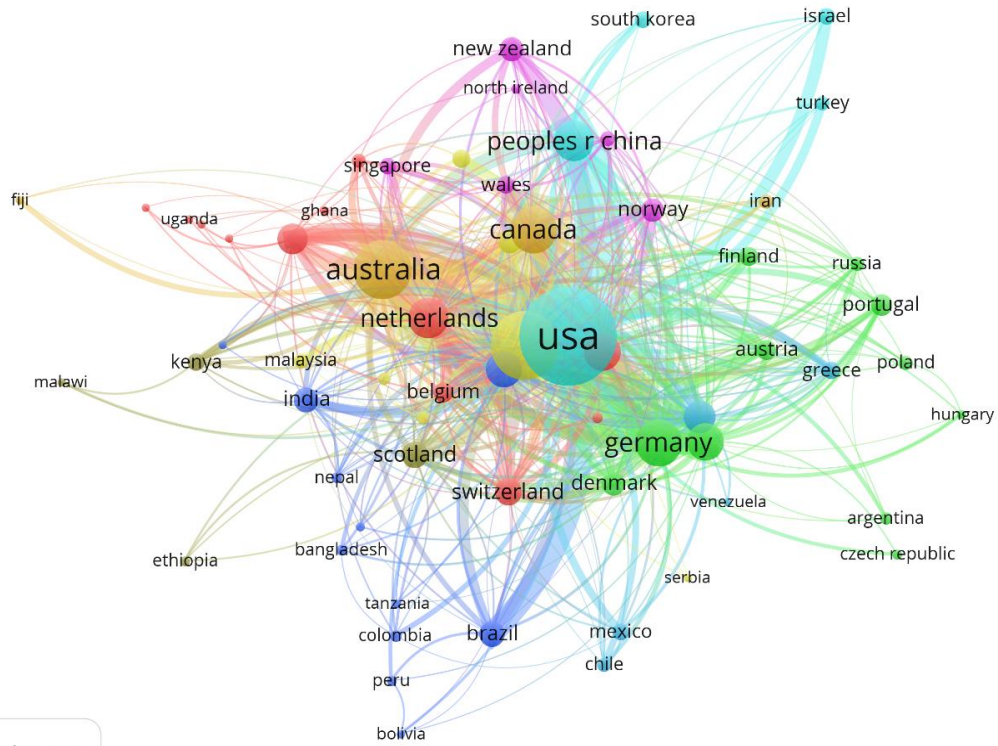
Bibliographic Coupling

Engineering resilience



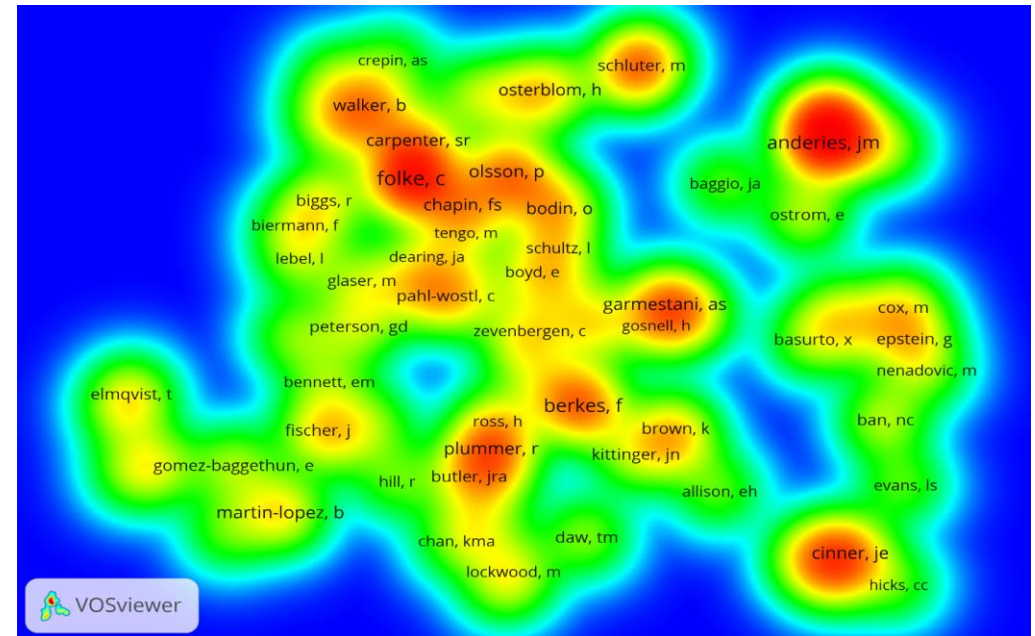
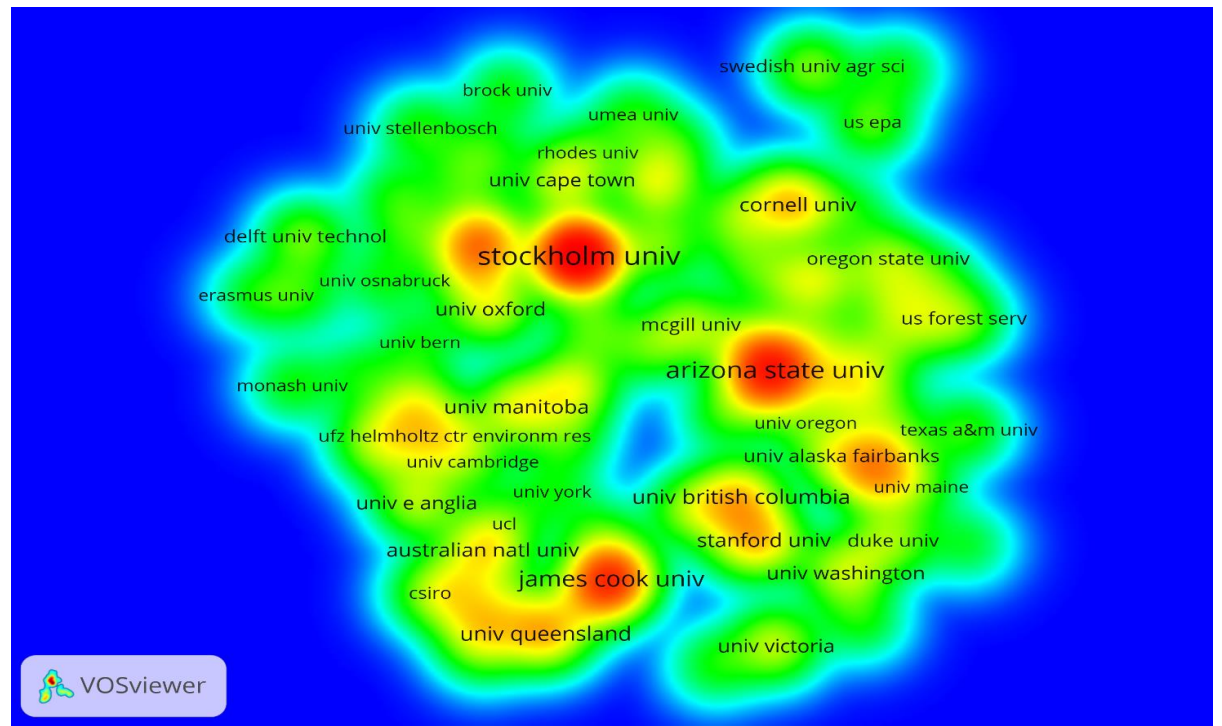
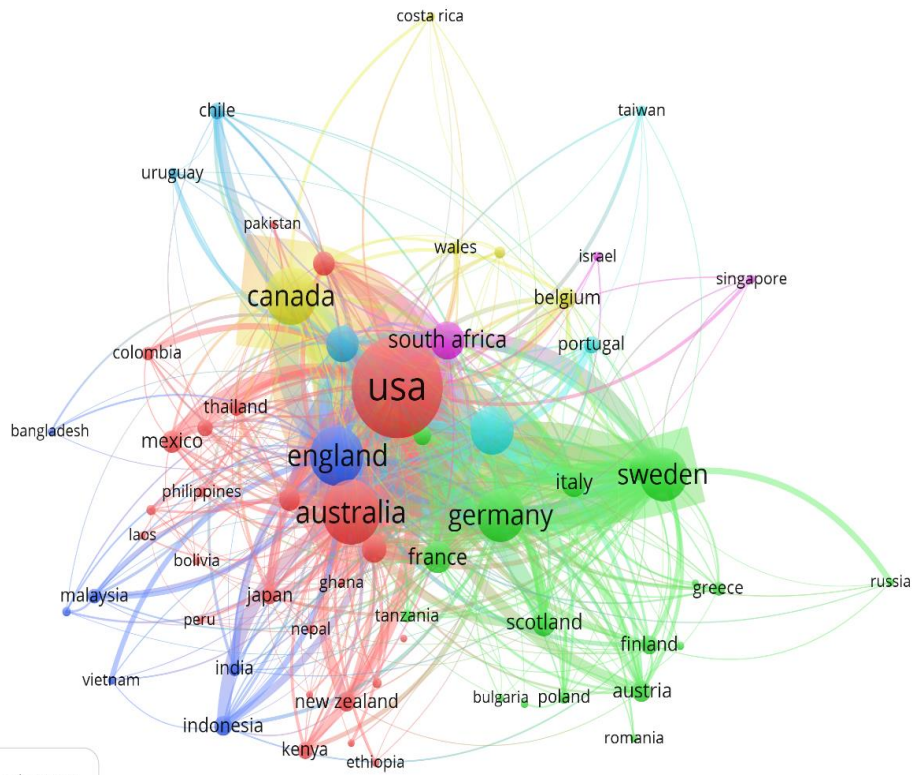
Bibliographic Coupling

(economic) Development resilience



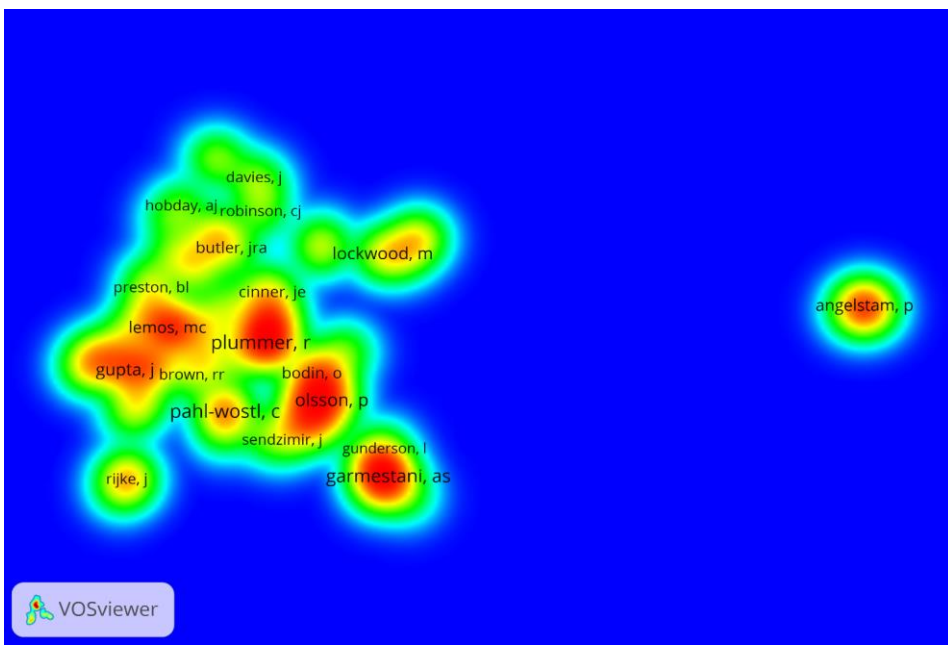
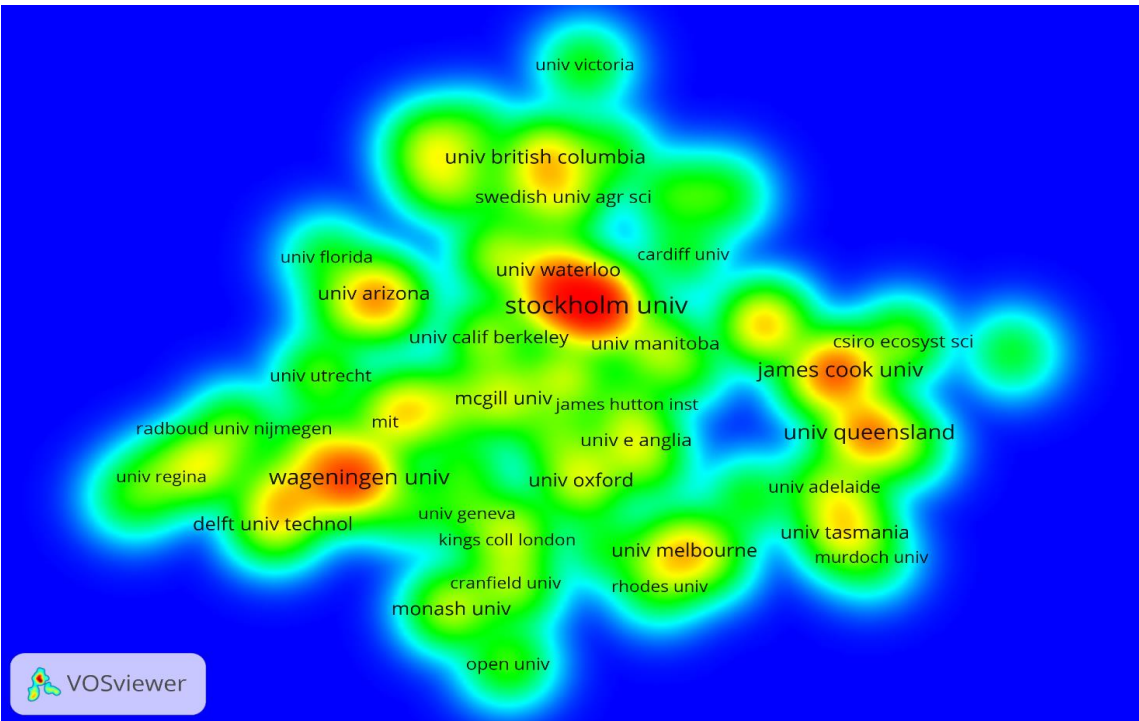
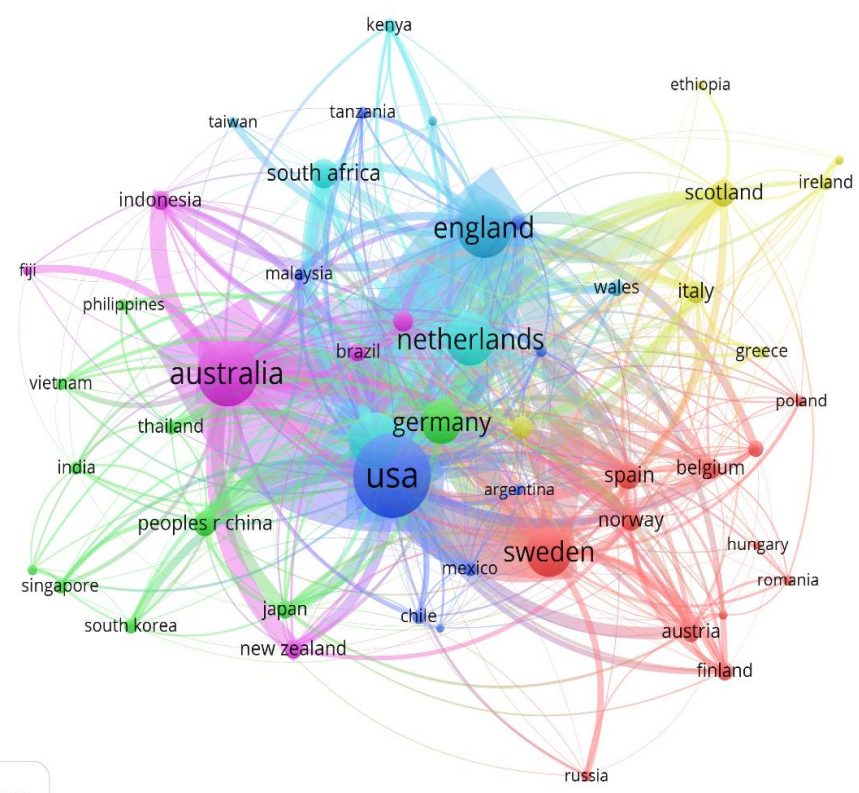
Bibliographic Coupling

Social-Ecological Systems



Bibliographic Coupling

Adaptive Governance



Summary of Conclusions

- All 3 domains – risk, sustainability and resilience show an upward trend in the production of research. Risk is the dominant field. There is some integration between risk and sustainability and between risk and resilience. Research combining all three is in its infancy.
- The top 3 contributing disciplines across risk, sustainability and resilience research are: Environmental sciences/Ecology, Engineering, and Economics representing respectively natural, engineered and social systems.
- Risk research over the last 30 years has undergone a transformation from a predominantly decision theoretical/civil engineering perspective toward an Env/Ecological one. Traditional Engineering area of OHS has been strongly marginalized. New areas of research have gained importance: Climate Change, Natural Hazards, Food Safety.
- Research in risk, sustainability and resilience is dominated by the highly developed "Western" countries (USA, UK, Canada, Australia, Sweden). China is a major contributor to Sustainability and Circular Economy research.
- Despite lower output in comparison with Env/Ecology, the centrality of Engineering in the network representations could be seen as a potentially unifying role – a meeting place for both social and ecological systems. The success criteria would be the integration of risk, resilience and sustainability into joint strategic, operational and tactical frameworks for assessment, management and education.

Implications for Risk Education

Blueprint for Learning Design of Risk, Sustainability and Resilience Science

- Survey of 125 + master level programs currently offered in various aspects of Risk
- Findings presented here on the evolution, trends and composition of research in risk, sustainability and resilience
- A joint framework for the assessment of risk, resilience and sustainability (Faber 2018)
- Thorough critical review of the theories and methods available for the joint assessment of human, technical and natural systems
- An operational systems framework for the management of such education
- Learning philosophy based on Threshold Concepts and Transformational Learning

