uture of Water:

Results of a Text Mining Study

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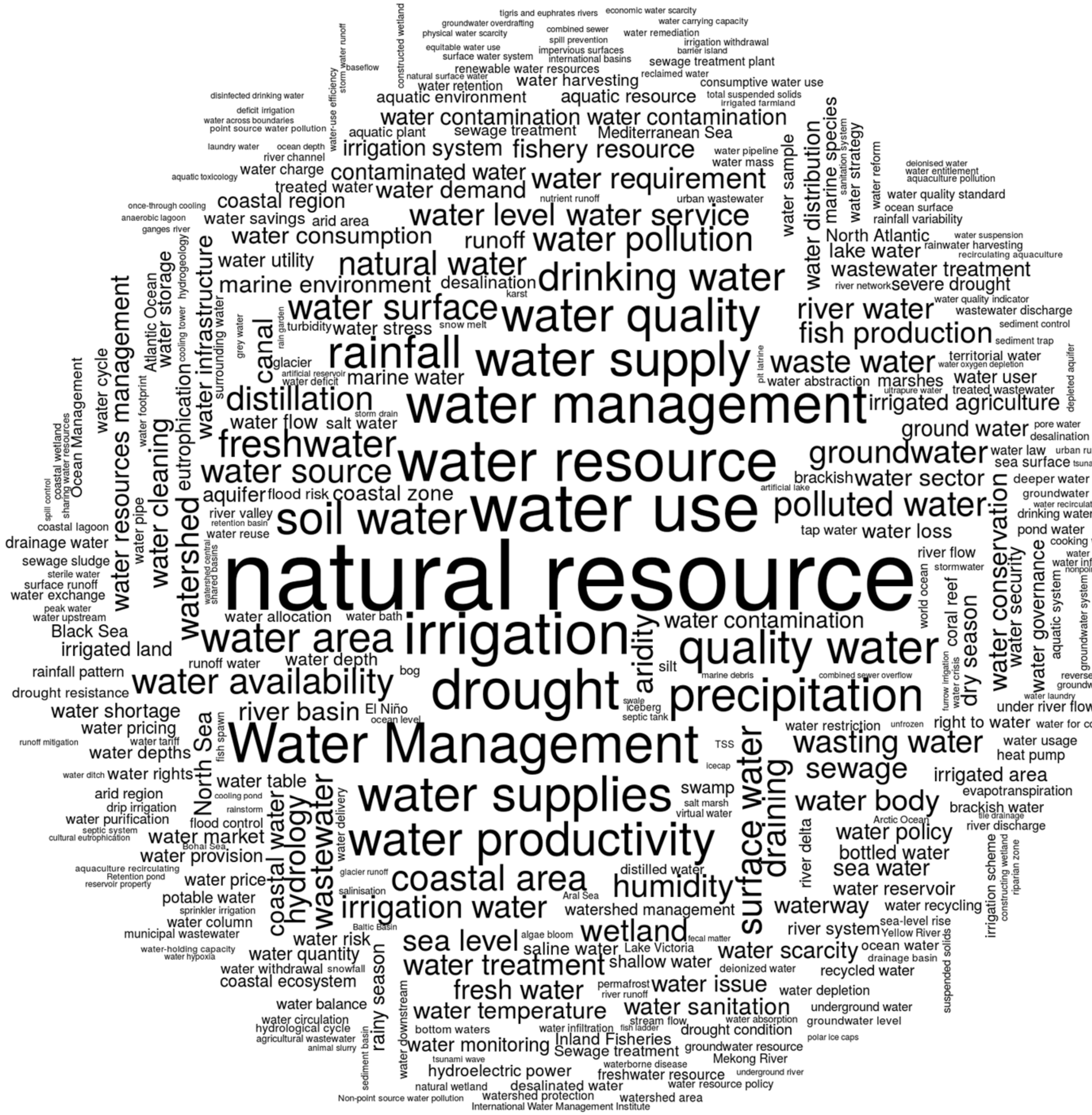
Institute for Statistical Studies and Economics of Knowledge

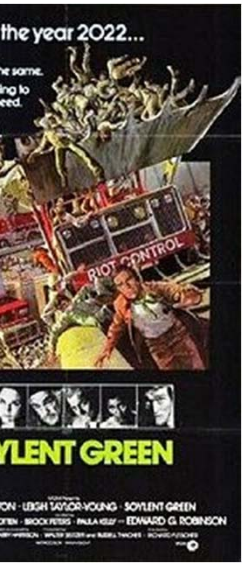


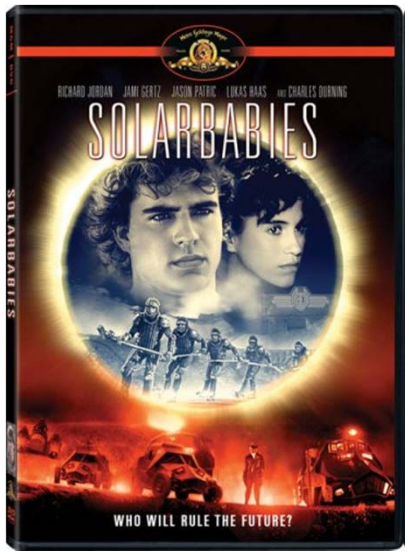
* Future of water wordcloud: analytic reports

** Source: NRU HSE GTMS system

oomy Future of Water: Is There an Alternative?

only scientists fear the future world suffering from
ution, depleted resources, poverty, dying
ans, and the dire greenhouse effects





er scarcity, water pollution, water ecosystems
radation, devastating climate change effects on
er resources have long become common features of
popular culture. **Everyone fears water scarcity**

In many places, including the developed countries, the nightmares already comes

Outline

Grounds, scope, methodology and sources of the study

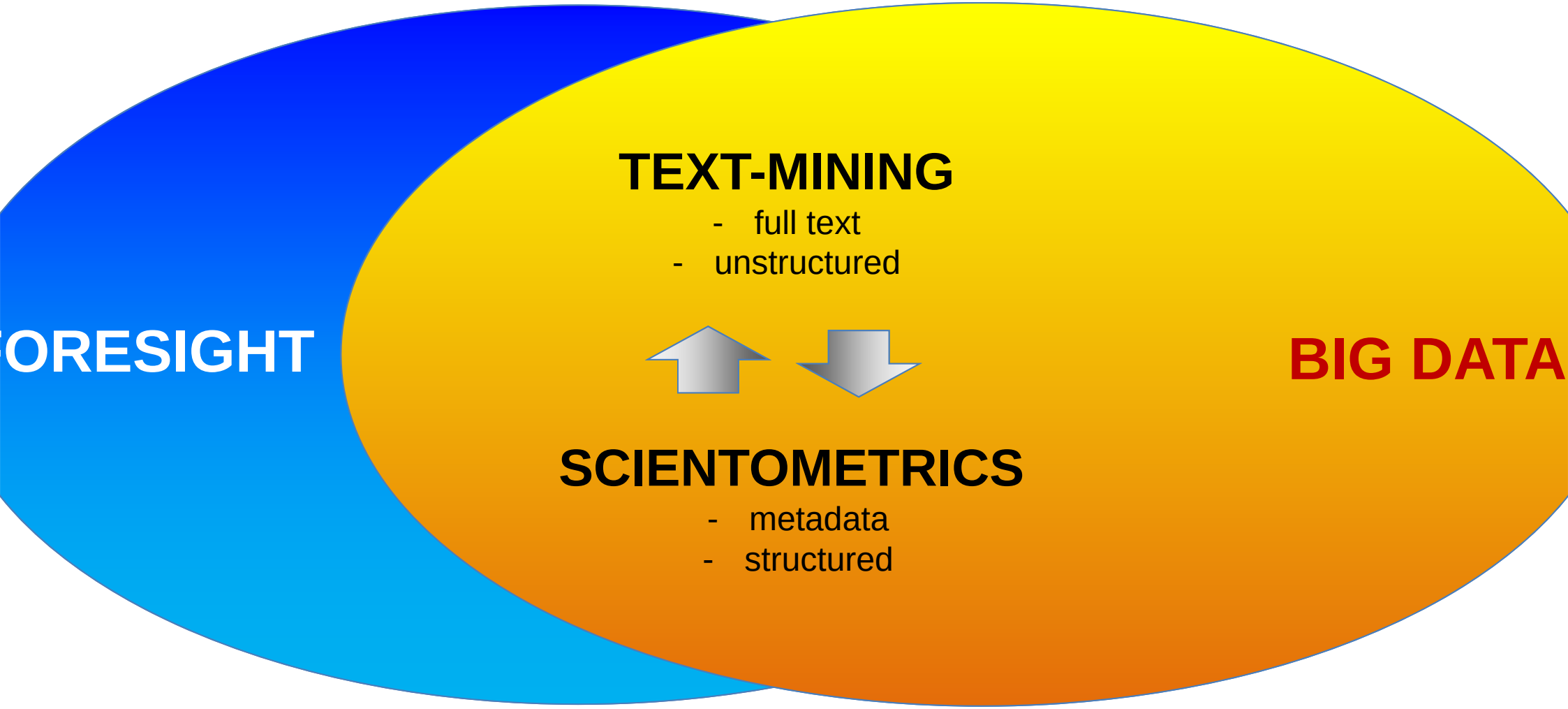
Place of water-related problems in environmental studies

Mapping the water management innovation landscape

R&D vs media – coverage of water-related topics

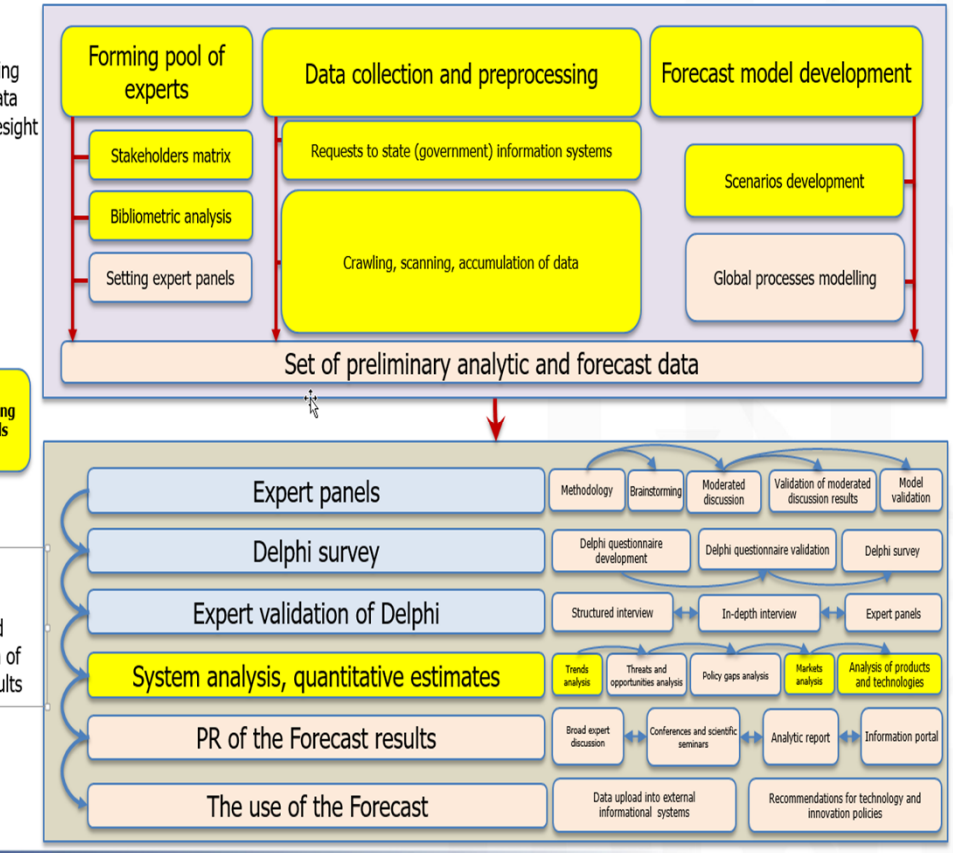
Case study: future of water purification

In the era of the Big Data revolution, data mining & text mining
become an integral part of any scientifically sound foresight stu

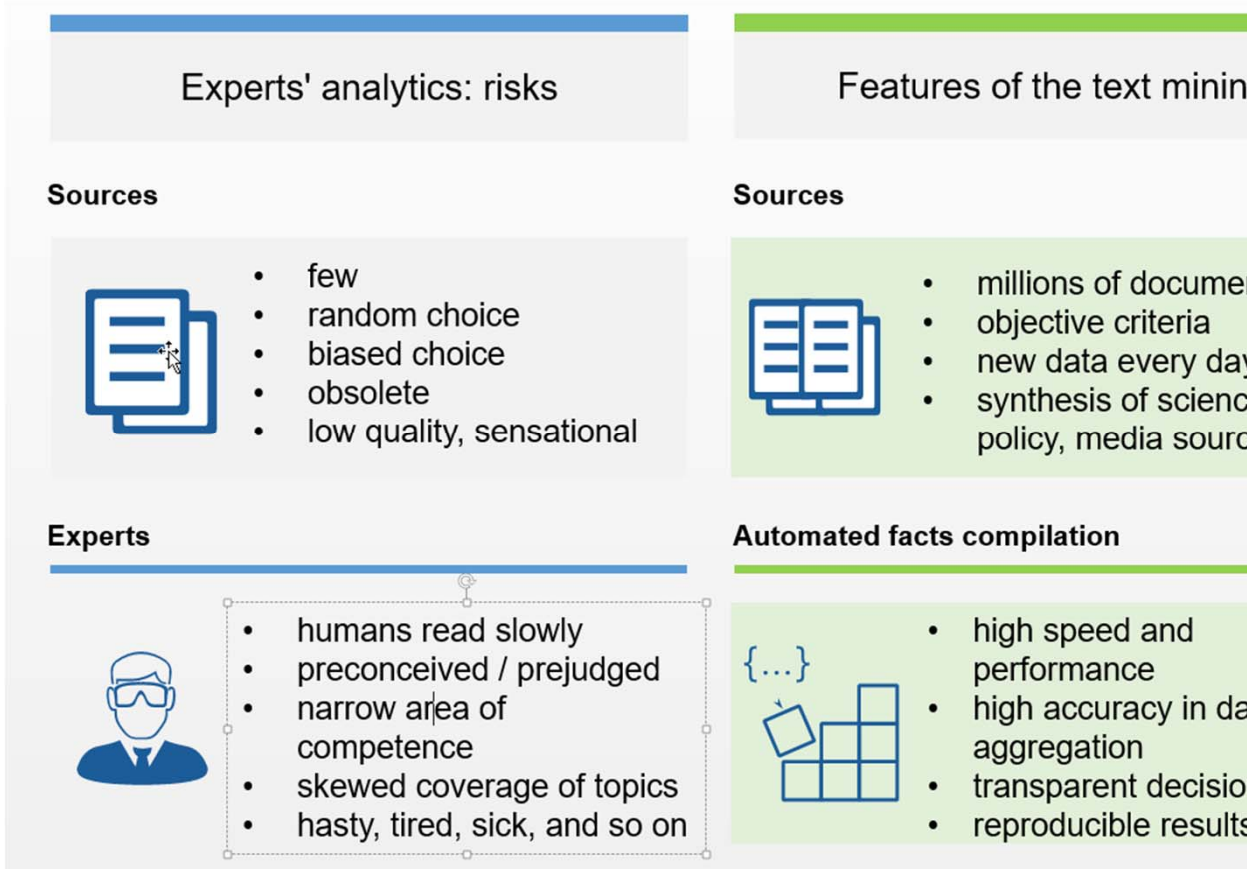


Importance of semantic analysis, knowledge discovery and concept landscape mapping will only increase in the future

t mining methods are of use in many
ponents of typical foresight pipeline ...



... because they can significantly improve objec
and eliminate gaps in expert desk researc



We have implemented a data mining of over 1 000 000 full-text posts fr leading science, technology and innovation news aggregators

Most important technology and innovation journalists and bloggers

Most important media data sources

SOURCE	NUMBER OF
Business Insider	1
techcrunch.com	1
huffingtonpost.com	1
New Scientist	
venturebeat.com	
Ars Technica	
time.com	
wired.com	
The Verge	
engadget	
Gizmodo	
Gizmag	
scientific 2.0	
Scientific American	
popularmechanics.com	
agriculture.com	
Gigaom.com	
zdnet.com	

Source: NRU HSE GTMS system

Also, we have analyzed 200 000 of international analytic and forecast reports by hundreds of global and national organization

Source: NRU HSE GTMS system

Top publishers of analytic reports
MarketLine
OECD
IEA
Springer
Elsevier
EU
Wolters Kluwer
ITF
World Bank
EFMN
ECMT
European Biotechnology Network
US
John Wiley & Sons
FAO
Oxford University Press
BMJ
Lancet
McKinsey
Asian Development Bank
Emerald
...

Number of useful snippets (contexts) by publisher	
OECD	2
Elsevier	2
FAO	2
Springer	
IEA	
MarketLine	
World Bank	
Zhejiang University	
EU	
Cambridge University Press	
African Highlands Initiative	
ECMT	
UNEP	
Eurostat	
National Intelligence Council	
NSW EPA	
IDRC	
ITF	
IPCC	
OPEC	
U.S. Environmental Protection Agency	
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We processed 1 800 000 of open-access research papers' abstracts as we

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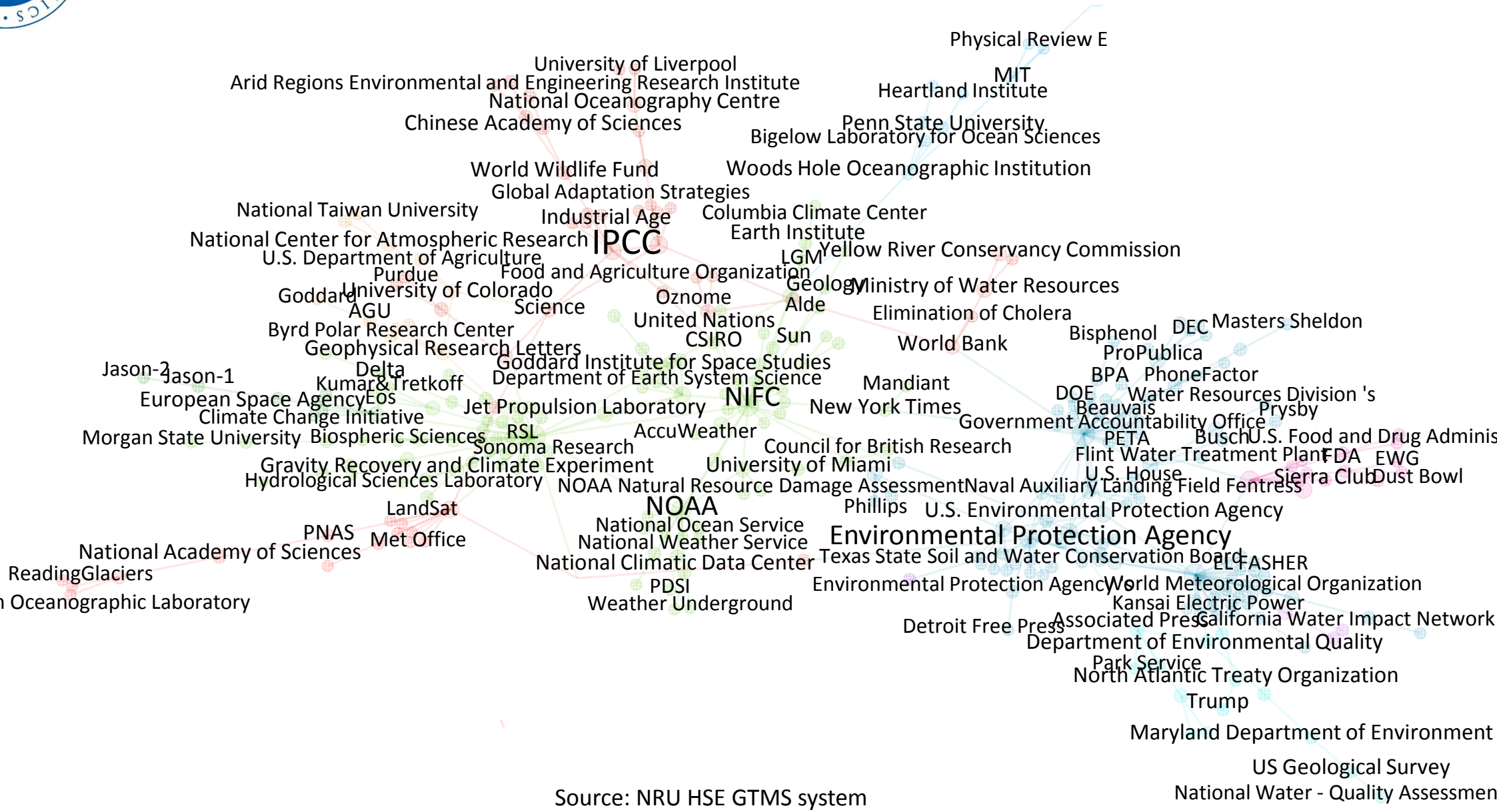
rogen Energy

Number of relevant abstracts by journal	
Journal Of Hazardous Materials	2917
Water Research	2795
Bioresource Technology	2295
Chemical Engineering Journal	1741
Journal Of Hydrology	1598
Journal Of Membrane Science	1561
Science Of The Total Environment	1484
Chemosphere	1467
Desalination	1268
Palaeogeography Palaeoclimatology Palaeoecology	1133
Proceedings Of The National Academy Of Sciences Of The United States Of America	1054
Marine Ecology Progress Series	1048
Global Change Biology	973
Remote Sensing Of Environment	916
Earth And Planetary Science Letters	886
Sensors And Actuators B-Chemical	818
Journal Of Chromatography A	799
Applied Catalysis B-Environmental	790
Marine Pollution Bulletin	725
Geomorphology	688
Environmental Pollution	641
Hydrological Processes	640
Journal Of Alloys And Compounds	625
Estuarine Coastal And Shelf Science	622
Food Chemistry	616
Separation And Purification Technology	613
Deep-Sea Research Part II -Topical Studies In Oceanography	583
...	...

Wordcloud of scientific journals relevan water resources

Source: NRU HSE GTMS system

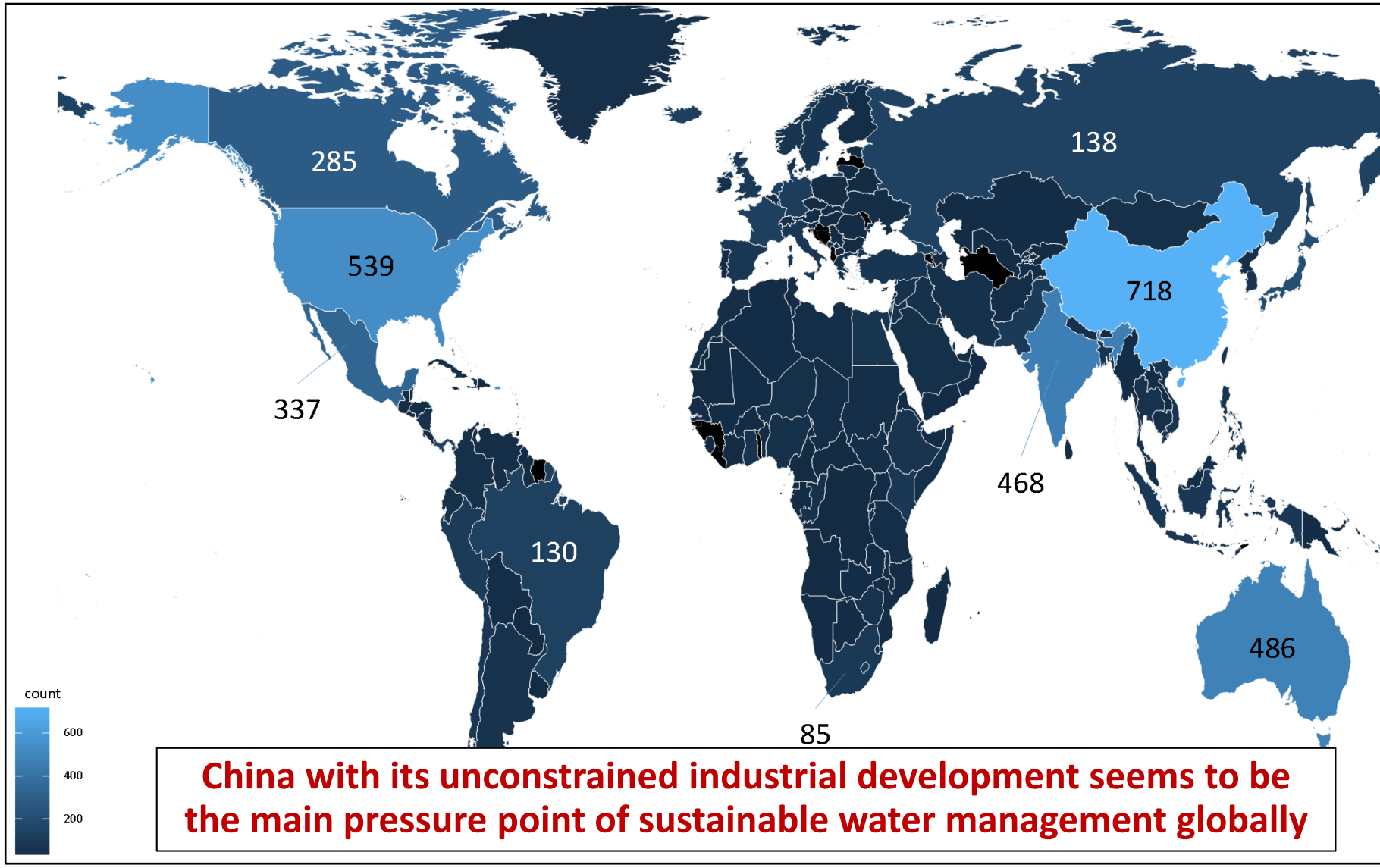
We found thousands information on hundreds of organizations - global centers of competence in the area of water management innovations



Source: NRU HSE GTMS system

We built an automatic map of how frequently are world countries mention in the context of water resources management

rtunately, Africa its dire water city conditions scussed by ntists and nology neers far less the problems rgest loped and key loping tries with dry ate on part of territories



China with its unconstrained industrial development seems to be the main pressure point of sustainable water management globally

Source: NRU HSE GTMS system

We built a map of cities mentioned in the context of water management, water technologies, and water innovation

he **developed**
untries, these cities
mostly the global
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untries - they are
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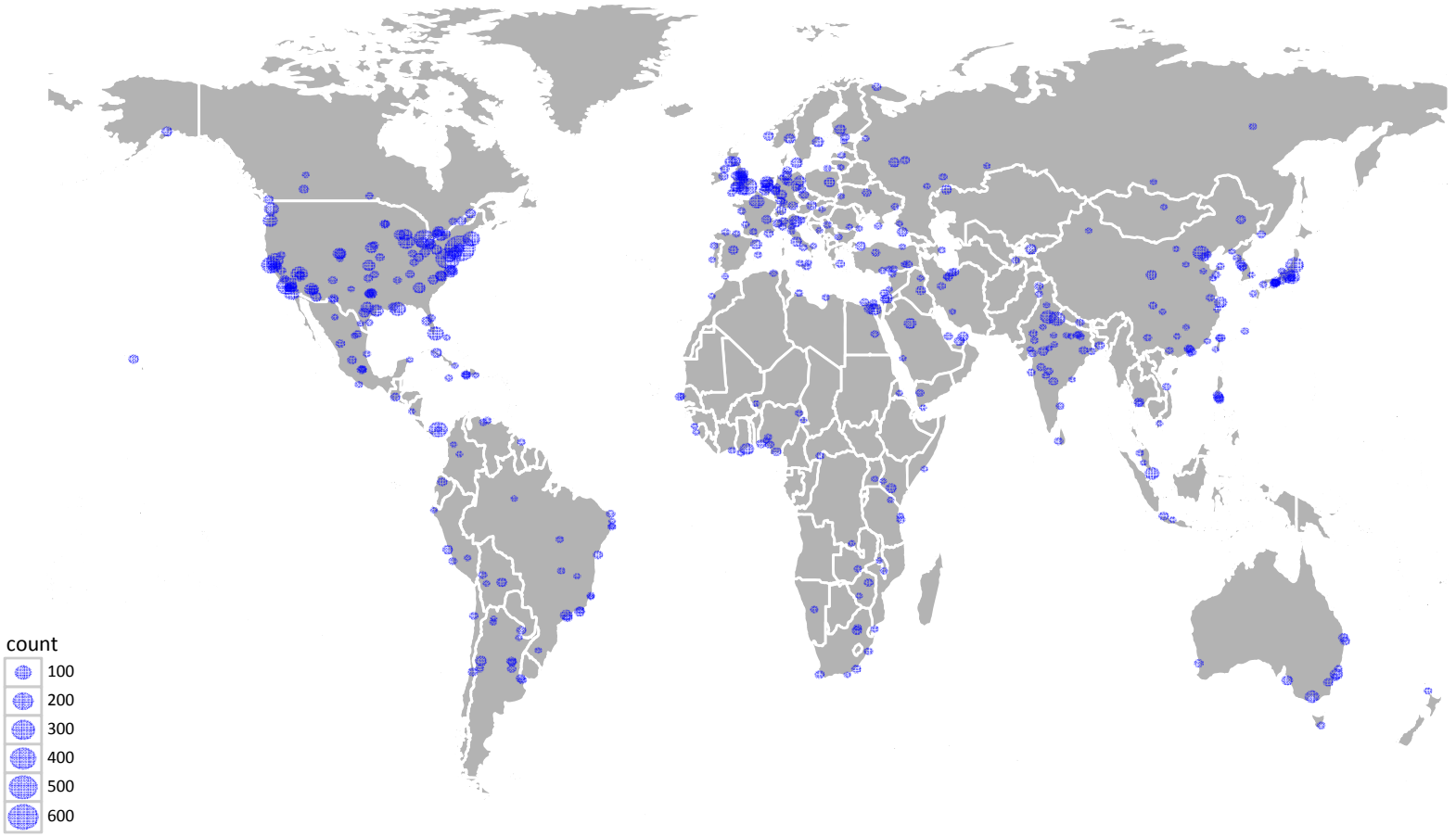
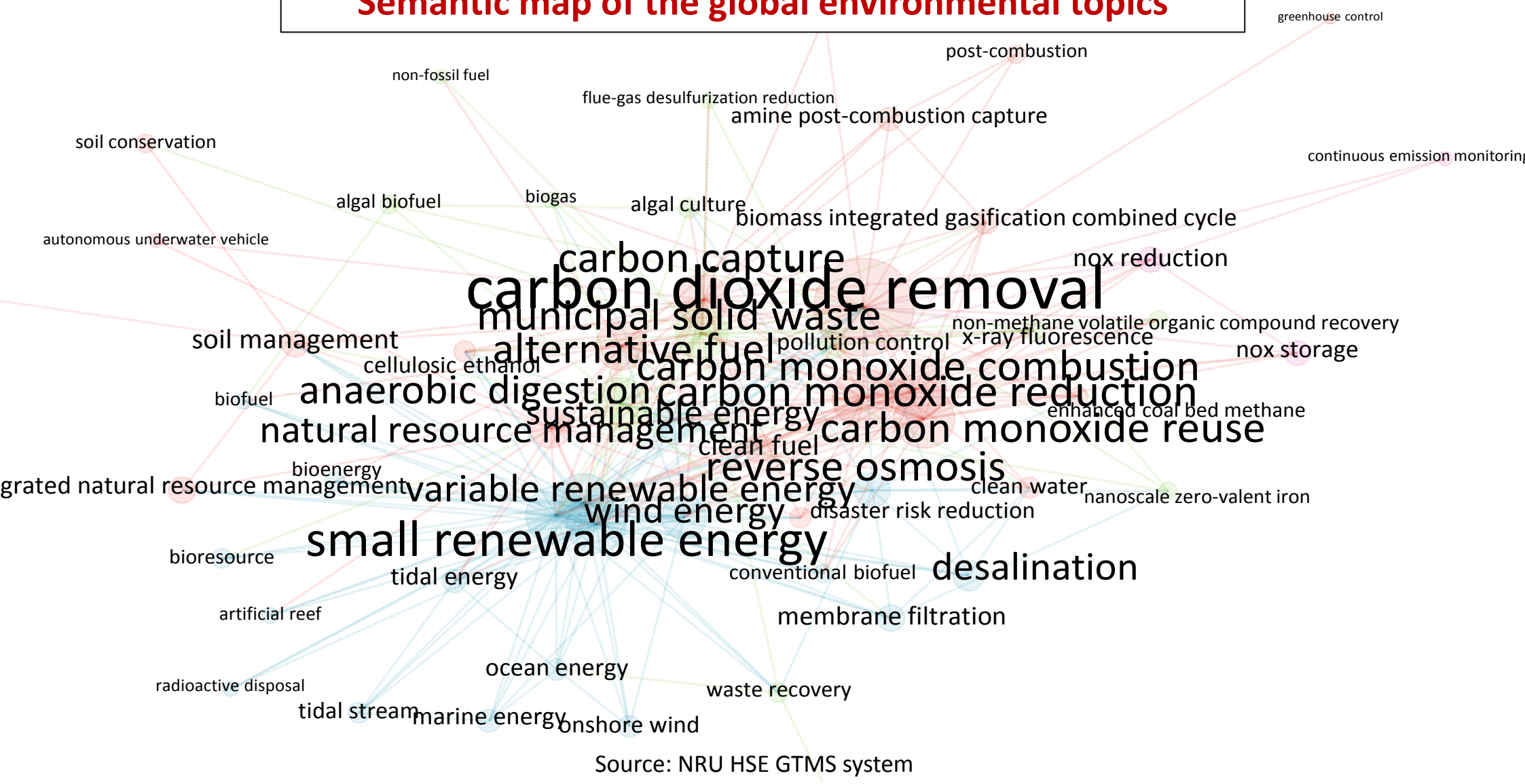
ter inefficiencies



Source: NRU HSE GTMS system

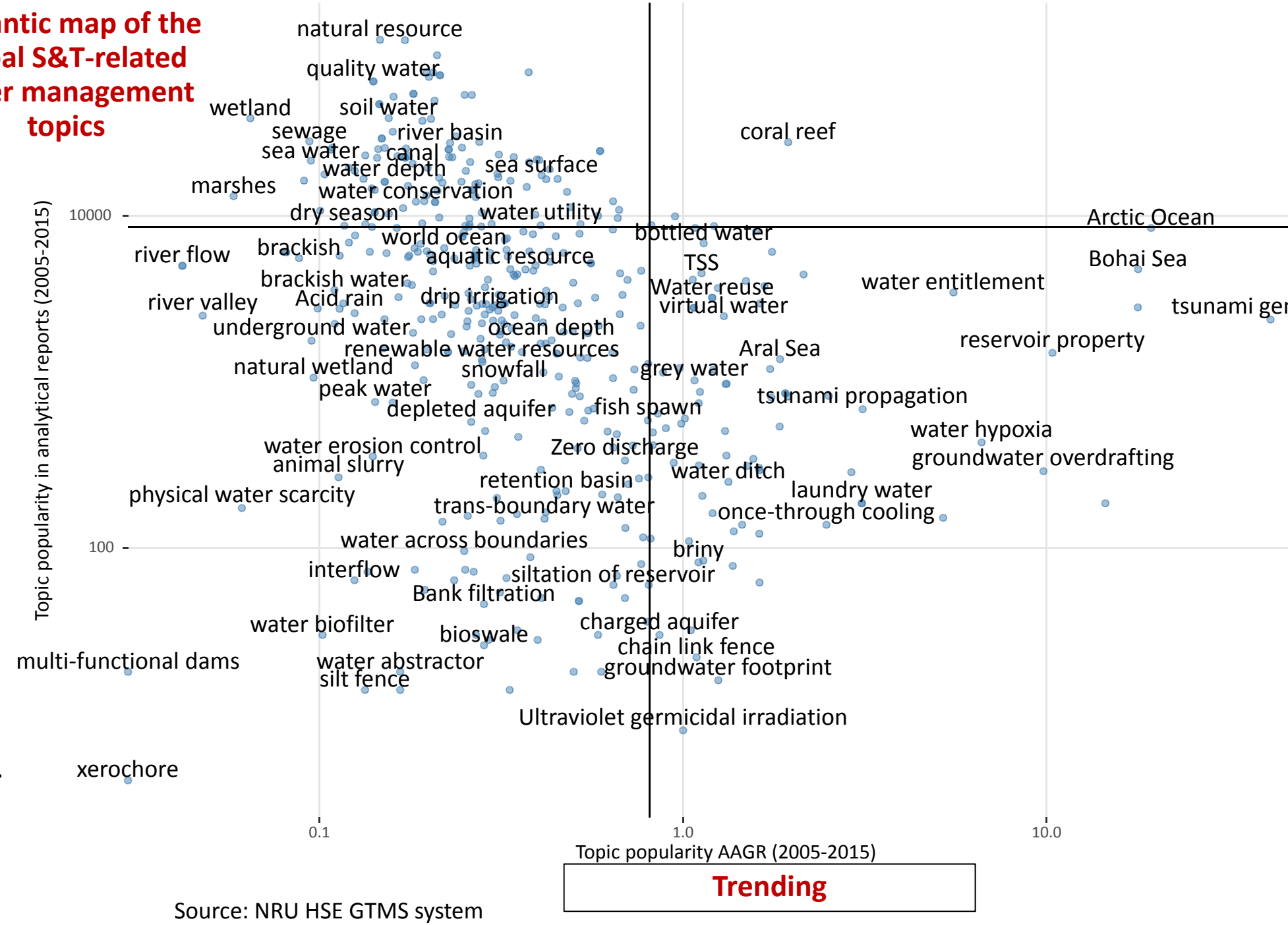
Water related topics are discussed in approximately 22% of highly cited publications about environment

Semantic map of the global environmental topics



Source: NRU HSE GTMS system

Semantic map of the global S&T-related water management topics



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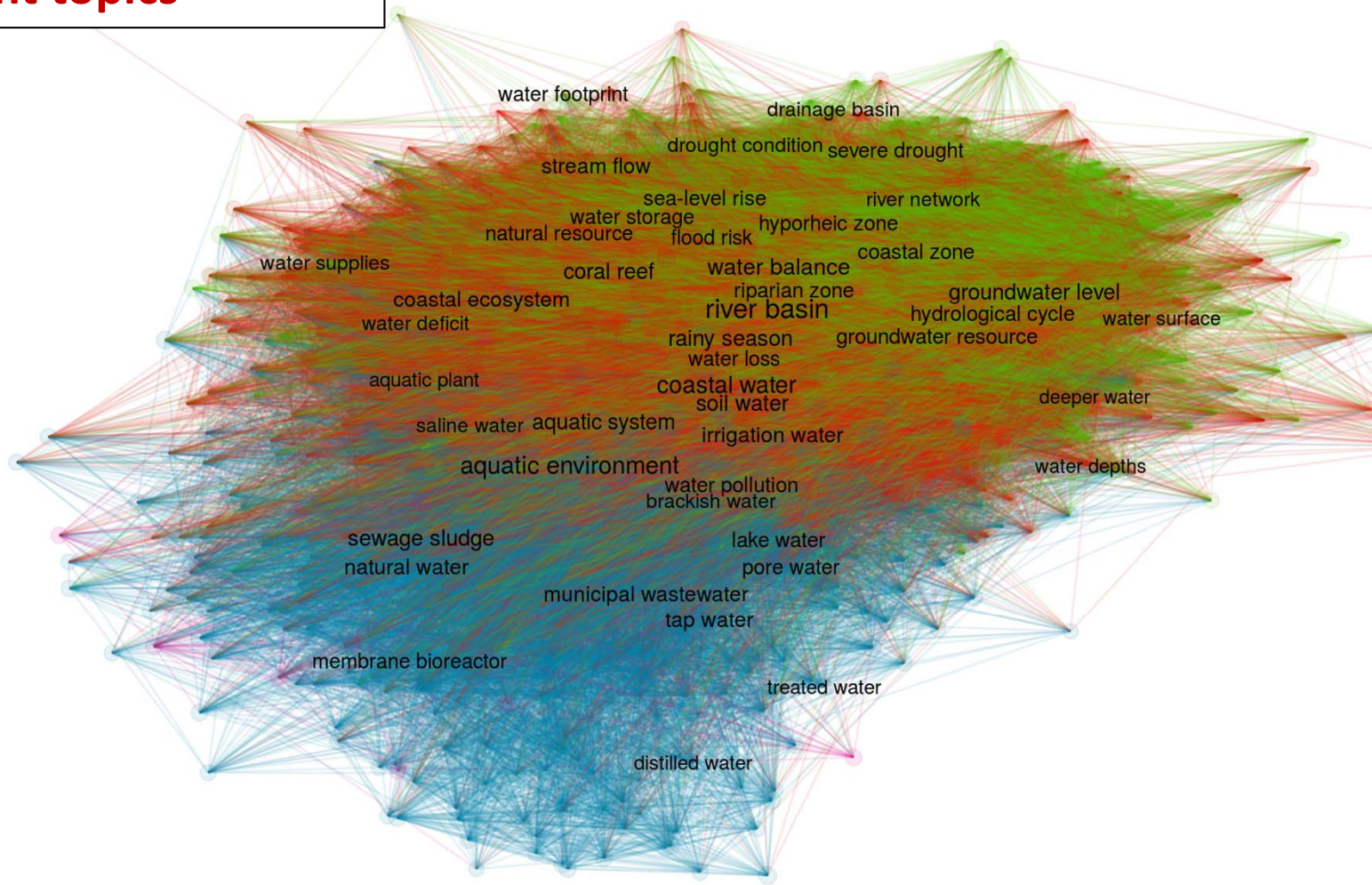
Source: NRU HSE GTMS system

Semantic map of the global environment-related water management topics

Water scarcity, negative climate change effects on water resources, waterborne diseases, agro&energy water footprint, dying water ecosystems, Global Ocean vulnerability, new water purification and water desalination technologies seem to be in the center of expert debate worldwide



Source: NRU HSE GTMS system

Coverage of the key topics in water management: **media vs. research**

Scientific concepts in water use effectively translate into the media disco

ation

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fall

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pump

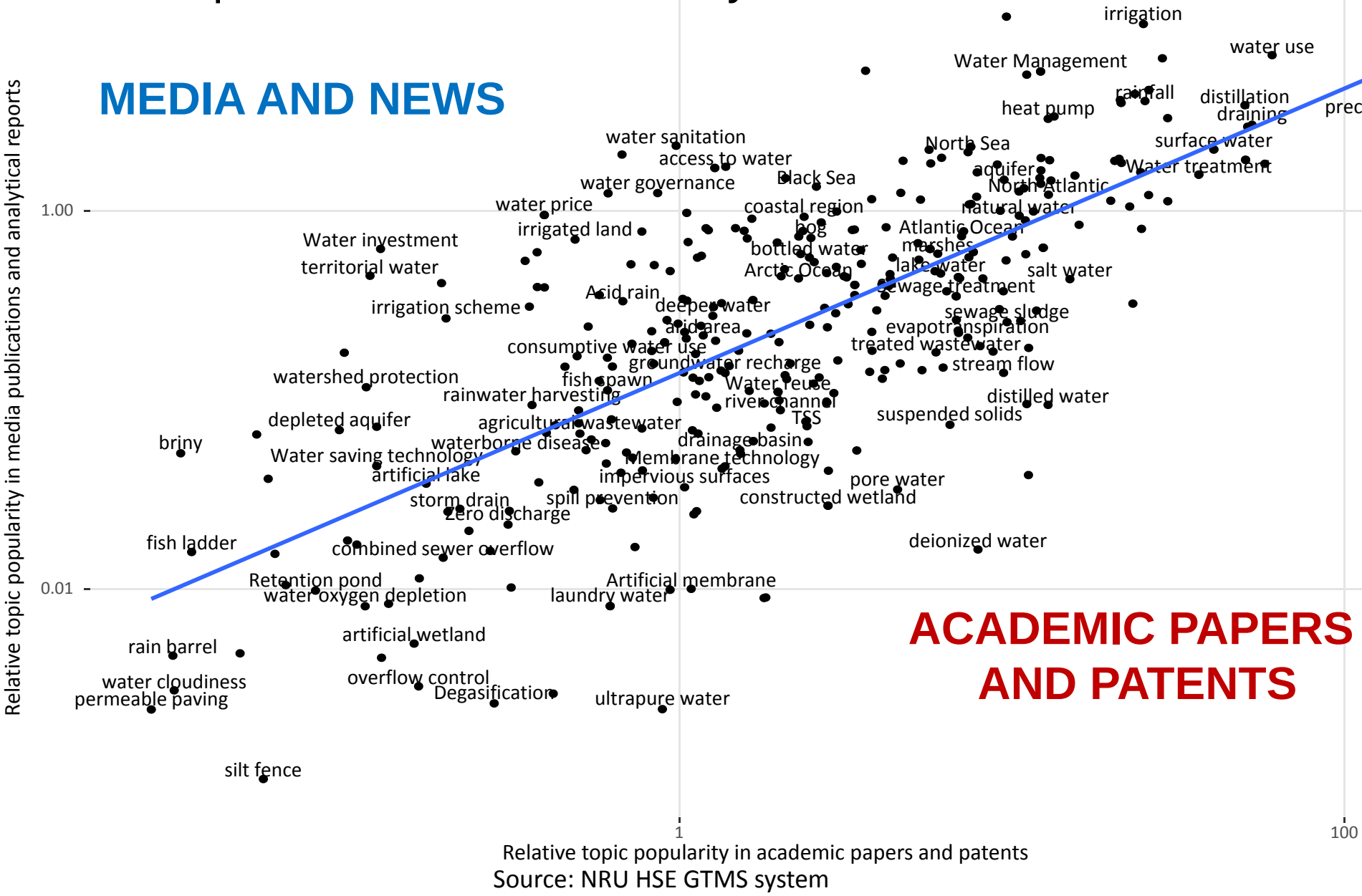
age sludge

ended solids

nized water

prevention

nbrane



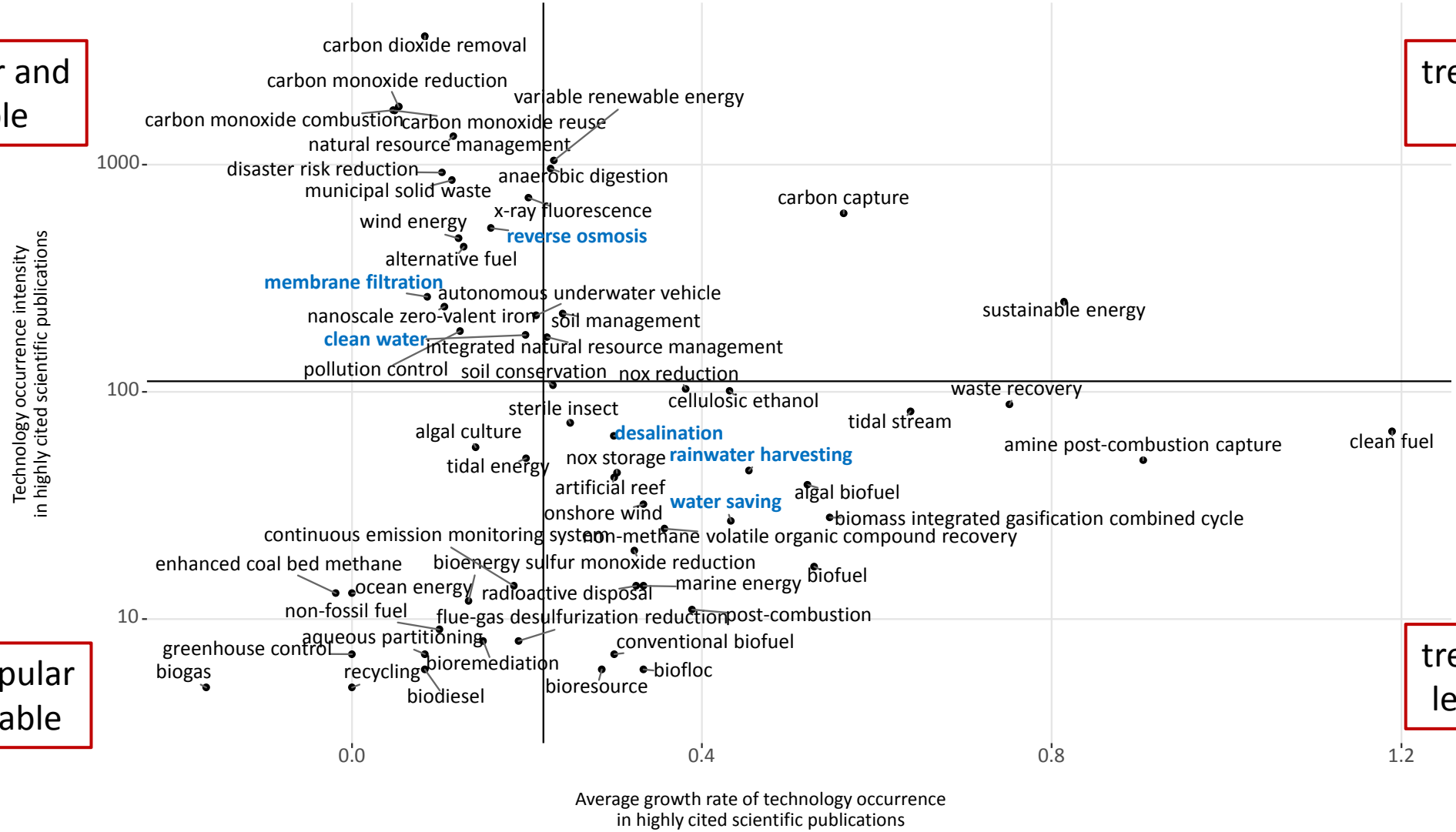
Source: NRU HSE GTMS system

Water on the map of environmental technologies:

Water-treatment techniques and hardware stay in the shadow of decarbonization, renewable energy, biofuels and waste utilization

popular and stable

trending ar popular



less popular and stable

trending ar less popula

** Source: NRU HSE GTMS system

Knowledge discovery snapshot: WATER SCARCITY

Water scarcity is a very hot topic: on the agenda of global institutions + a lot of models, projections and expert quantitative estimates

, the number of people living under **severe water stress** is expected to increase by more than 1 billion **to 3.9 billion people**, nearly ected world population OECD. **(2009)** Green At Fifteen? How 15-Year-Olds Perform In Environmental Science And Geoscience In PI aris: OECD

se projections to 2050 suggest that the water supply to some **47% of the world's population (compared to 35% in 2005)**, mostly i ing countries, will be under **severe stress**, largely because of developments outside of agriculture. OECD/FAO. **(2011)** OECD-FAO ural Outlook 2011-2020.OECD/FAO

ent, **agriculture** accounts for over **70% of water use** globally, but both the absolute amount of water available for agriculture and its ected to **decline (to 40% by 2050)**. OECD/FAO. **(2012)** OECD-FAO Agricultural Outlook 2012-2021.OECD/FAO

reshwater resources will be further strained in the future in many regions, with **over 40% of the world's population** projected to b basins experiencing **severe water stress by 2050**. **(2013)** Global Food Security CHALLENGES FOR THE FOOD AND AGRICULTURAL S

ide, researchers have recently called for ... a reduction in the **proportion of animal protein in diets from the current 20% to 5% in** about water ... security amid population increase. Abbas El-Zein. **(2014)** Health and ecological sustainability in the Arab world: a n val The Lancet383. (2) p. 458--476

vater demand ... are **projected to increase by 55% by 2050**, mainly because of the growing demands from **manufacturing (400%)**, electricity generation (140%) and domestic use (130%). Walsh, Brendan P.; Murray, Sean N.; O'Sullivan, D.T.J. **(2015)** The water er . / Water Resources and Industry10. (06) p. 15-28

Knowledge discovery snapshot: CLIMATE CHANGE EFFECTS ON WATER RESOURCES

e climate change is generally perceived by expert community as a threat to water resou
inability, there are still very few quantitative evidence.
e are more than 17 times more qualitative statements on climate change in relation to w
urces than quantitative ones in our text mining database

OECD analysis suggests that without intensified policy action, global greenhouse gas (**GHG) emissions are likely to increase**
2050. OECD. (2011) Fostering Innovation for Green Growth. PARIS: OECD

liest global **effects of climate change, including water stress and scarcity**, will begin to occur in Sub-Saharan Africa **by 2025**
al intelligence council, US Government. (2008) Global trends 2025: a transformed world. Washington: National intelligence
. US Government

the gravest consequences of climate change are **likely to be felt after 2030**, it will affect living standards and food security
bating water and food scarcity long before then ... Institute for Security Studies European Union . (2012) European Strategy
Analysis System (ESPAS) Global trends 2030 ...

orld Bank estimates that by 2025 climate change will result **in 1.4 billion people** across 36 countries **facing crop or water sca**
llion people in 21 countries are currently affected by this). Institute for Security Studies European Union . (2012) European
y and Policy Analysis System (ESPAS) Global trends 2030 ...

Knowledge discovery snapshot: EXTREME HYDROLOGICAL EVENTS

Destructive floods are among the major concerns related to water sector globally
Increasing floods risks are generally perceived by experts as caused mainly by climate change and overpopulation of lowlands.

e seems to be a number of quantitative models to predict climate change effects on floo
but mostly in relation to sea level rise.

CD Environmental Outlook to 2050 emphasizes the consequences of inaction in terms of growing competition among water users t
vater resources of adequate quality, **growing vulnerability to floods**, and increasing pressures on water quality. OECD. (2013) Wate
for Better Lives. PARIS: OECD

, **flood risks** are projected to affect **more than 1.6 billion people** (nearly 20% of the world's population) and the value of assets at
ficantly higher than today. OECD. (2013) Water Security for Better Lives. PARIS: OECD

etherlands alone, the cost of implementing a comprehensive set of flood protection and **flood risk management measures** is proj
around **EUR 1.2-1.6 billion per year up to 2050** and EUR 0.9-1.5 billion per year during the 2050-2100 period. OECD. (2015) Climate
Risks and Adaptation: Linking Policy and Economic. PARIS: OECD, page 17-18

2011) estimated that commercial, industrial, road, rail, and residential assets worth more than **AUD 226 billion would be at risk of**
g ... by 2100 ... OECD. (2015) Climate Change Risks and Adaptation: Linking Policy and Economic. PARIS: OECD

rban centers are also vulnerable to potential shocks from flooding, particularly given inadequate drainage systems. **By 2030, few fo**
s, wetlands, and freshwater sources will be located on the perimeter of the impact zone of this fine-meshed urban network. NIC. (
tive Worlds a publication of the National Intelligence Council

Water pollution and water purification