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# in,
# Science for,
# by Society

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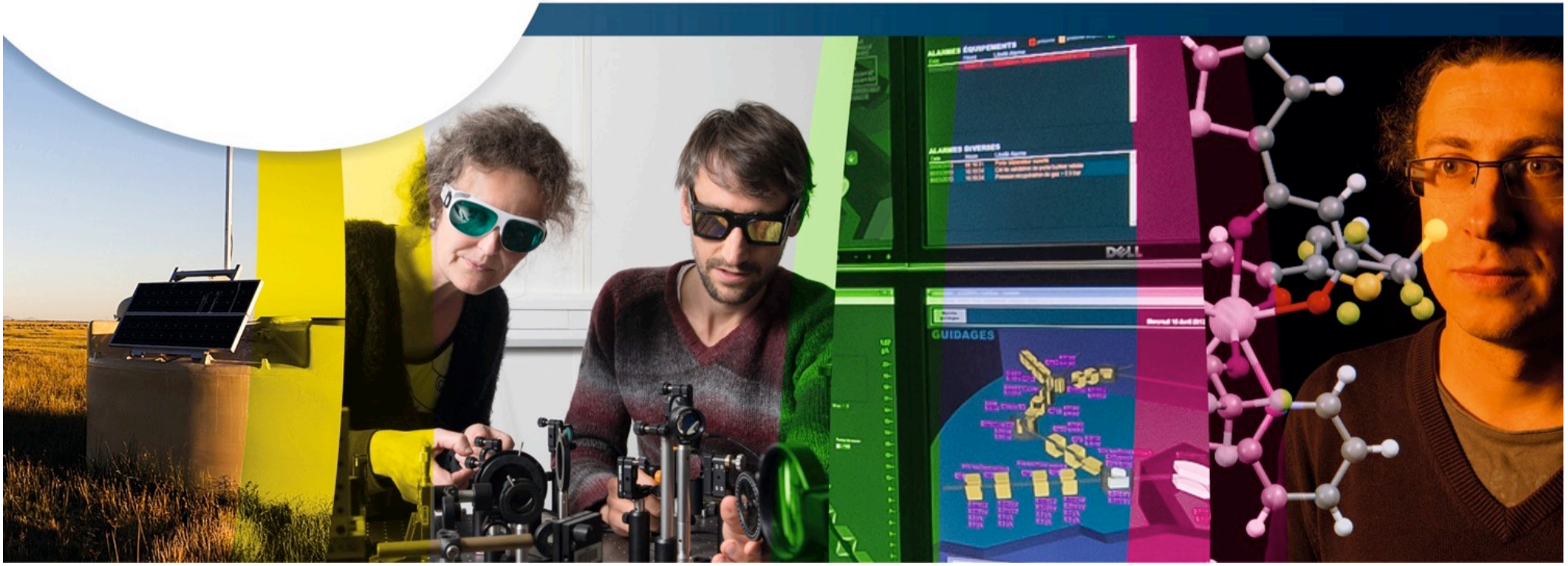

# Introduction

A shared, powerful hope: innovation and technology will stop

-Economic and social stagnation,

-Risks caused by climate change,

-Risks caused by human security threats…

- Innovation, progress, need integration of knowledge from SSH.
- Policymakers ask SSH to play a significant role, but what role?...
- At best adjusting policies to social demands or human needs.
- For us, the human factor has to be involved at the outset in designing science.

Having a better understanding of the social and human dimensions of science and technology improves our understanding of global challenges and consolidates efforts to solve them.

Scientists: individuals belonging to a society, but they are not representative of the populations, their diversity, their values, their goals, their priorities

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**I. Science for and in Society: SSH in Science and Progress.**

**II. Science with Society: Data Science and Public Participation.**

**III. Science and Innovation by Society: Garage Science, DIY(Do-It-Yourself).**

# • I. Science for Society: The Role of SSH in the Progress of Science

- Human applications of science and technology seem today to be the greatest source of threats to global sustainability.

- These applications arise out of complex contexts that make human and social concepts and data essential to understanding and responding to societal challenges.

- Science and technology are central to efforts to improve human health and wellbeing, but….this is not always the case!
- Research on the relationship between science, technology, and society has to be integrated in the broader research agenda.
- SSH research focuses on the hybrid systems that link human and social values and behavior to actual progress.

- The relationship between science and the human has changed over the last century in two ways:
  - The SSH: new attention to the ways in which humans are inscribed within the natural and technical world.
  - The sciences « of nature » include humans facts, the human is part of natural causality.

- Science is practiced in a world of humans who are affected by it.
- What we are trying to understand is something that we ourselves have partially manufactured, and that depends on us.
- The good news is that we can change and transform this human world. Today, the scope of what depends on us is enormous, and the climate crisis expresses this.

- The question of well-being, progress
- The SSH mobilized because:
  - We are living in a time of crisis: world leadership, role of religious conflicts, loss of confidence in institutions, social norms.

More fundamental level:

-After the Enlightenment, we thought that the advancement of knowledge and technology would necessarily lead to social progress.

- This causal connection has been broken during the last century:
- Emergence of Nazism in a culture that was a leader in the sciences and humanities;
- Crises and disasters in advanced countries (chemical and nuclear accidents).
- Loss of faith in science in large parts of the population in many countries.

- The universal dimension of Progress has been shaken by awareness of the unequal distribution of well-being among different populations.
- Global, environmental inequalities are the main discovery in this new field for SSH and for science.
- To grasp the importance and consequences of progress in a certain area, and take the well-being of persons into account.

- Neither anti-scientific relativism nor positivist universalism:
  - Irreducible uncertainty of the results of human agency (patients' varying reaction to the same treatment, society's unexpected reactions).
  - Unlike science, practical wisdom, deliberation, *phronesis* does not claim universality but attention to particular situations

- Having to take into account a disturbance or a risk always leads to discovery and innovation. This is how science works.
- The interesting point is that taking context into account does not lead to relativism but rather to greater precision and accuracy.

# II. Science with Society:
# Data Science and Public Participation

- If human needs are to be met, or *included*, in science, then public expression of these needs should matter.
- The public: no longer ignorant; seen today as a community of citizens capable of understanding the stakes of science….
- Science as a public good, no longer reserved to scientists. An ideal…

- A new challenge for SSH today could be to analyze how the public can be built as a collective intelligence and become part of science.
- The example of crowdsourcing: Wikipedia,
- Data gathering and mining, document editing, opinion sollicitation, policy analytics, collaborative intelligence.

- Interdisciplinary efforts in human computer interaction, cognitive psychology, economics, data bases, information retrieval, artificial intelligence.
- A shared concern for SSH and Information sciences and technologies, and a way to include more relevant data in knowledge and discovery.

# Crowdsourcing

Examples of crowdsourcing and collaborative science:

- Galaxy Zoo
- Foldit
- Language-related data
- Politics and Policy Research: for knowledge search and civic engagement.
- Competing mechanisms of consultation: Integration of ordinary citizens alongside public authorities and scientists.

# Big Data

- The transformation of public decision-making: **inclusion** of stakeholders, integration of values, and citizen participation.
- The mass production of data and its analysis is also a new method of discovery, it allows us to take into account neglected data or reconfigured indicators.

# Big Data- Citizen Science

- For changes in behavior analysis, big data makes it possible to envision the phenomena and transformations underway in society, emerging innovations, and invisible processes at work.
- **Citizen Science** : scientific work undertaken by members of the general public, in collaboration with or under the direction of professional scientists and scientific institutions.

# Citizen Science

- Today's citizen science differs from its historical forms in terms of access for, and subsequent **scale** of, public participation; (cf. explosion of citizen science activity with Big Data, policy analytics).
- Now the need is for epistemological and sociopolitical analyses of these processes and it is the job of SSH to provide them.

# Bridging the gap…

- By bringing crowdsourcing, big data, community based research, and open data into our research priorities,
- we can sketch the shape and methods of a « participatory » science on the basis of the public's proven capacities….
- The public's strong demand to be included in the handling of matters that concern the quality of life of present and future generations.

- SSH has significantly advanced conceptual models of knowledge and decision-making.
- Understanding these new knowledge and decision-making ecologies requires conceptual frameworks and methodological approaches drawn from SSH research.

# Community services
# a paradigm

- beyond traditional models such as **Charity or Volunteer work**, community services can be shaped into the co-production of data and knowledge by groups connecting ordinary citizens, students, and scientists.
- This is science **with** society.

# The climate tweetoscope

- http://tweetoscope.iscpif.fr

CLIMATIC TWEETOSCOPE

# OUR DIGITAL WORLD

FROM SCIENCE TO POLITICS AND CITIZENS ATTENTION VARIES OVER DIFFERENT TIME SCALES.

THE DIGITAL WORLD IS A COMMON/SHARED PRODUCTION OF SCIENCE AND THE PUBLIC.

HOW CAN THESE VIEWS **WORK TOGETHER** TO BUILD A GLOBAL SCIENCE OF CLIMATE CHANGE ?

CLIMATIC TWEETOSCOPE

# OUR COMMON DIGITAL WORLD

TIME SCALES

Seconds — Google — > 180M Queries per hour

Minutes — > 400M tweet/d ; >540M SMS/d

Hours — 

>100M blogs, +120.000 new blogs per day

Days — 

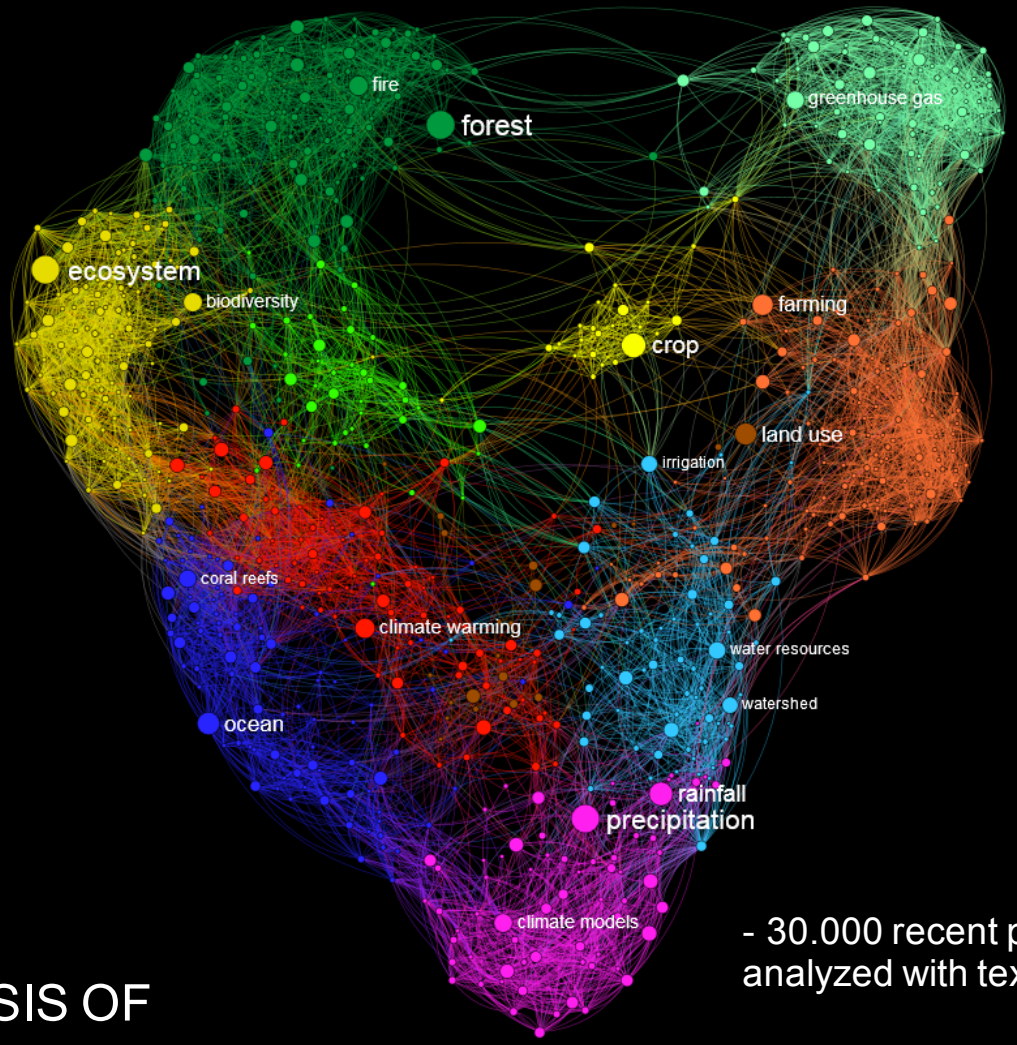
~3200 AFP press release per day

Months — 

~1,6M academic papers/year in the WoS (79.000 for FR, 216/d)

CLIMATIC TWEETOSCOPE

# SYNTHETIC MAP OF TOPICS RELATED TO CLIMATE CHANGE : THE SCIENCE POINT OF VIEW




ANALYSIS OF SCIENTIFIC LITTERATURE

(Web of Science)

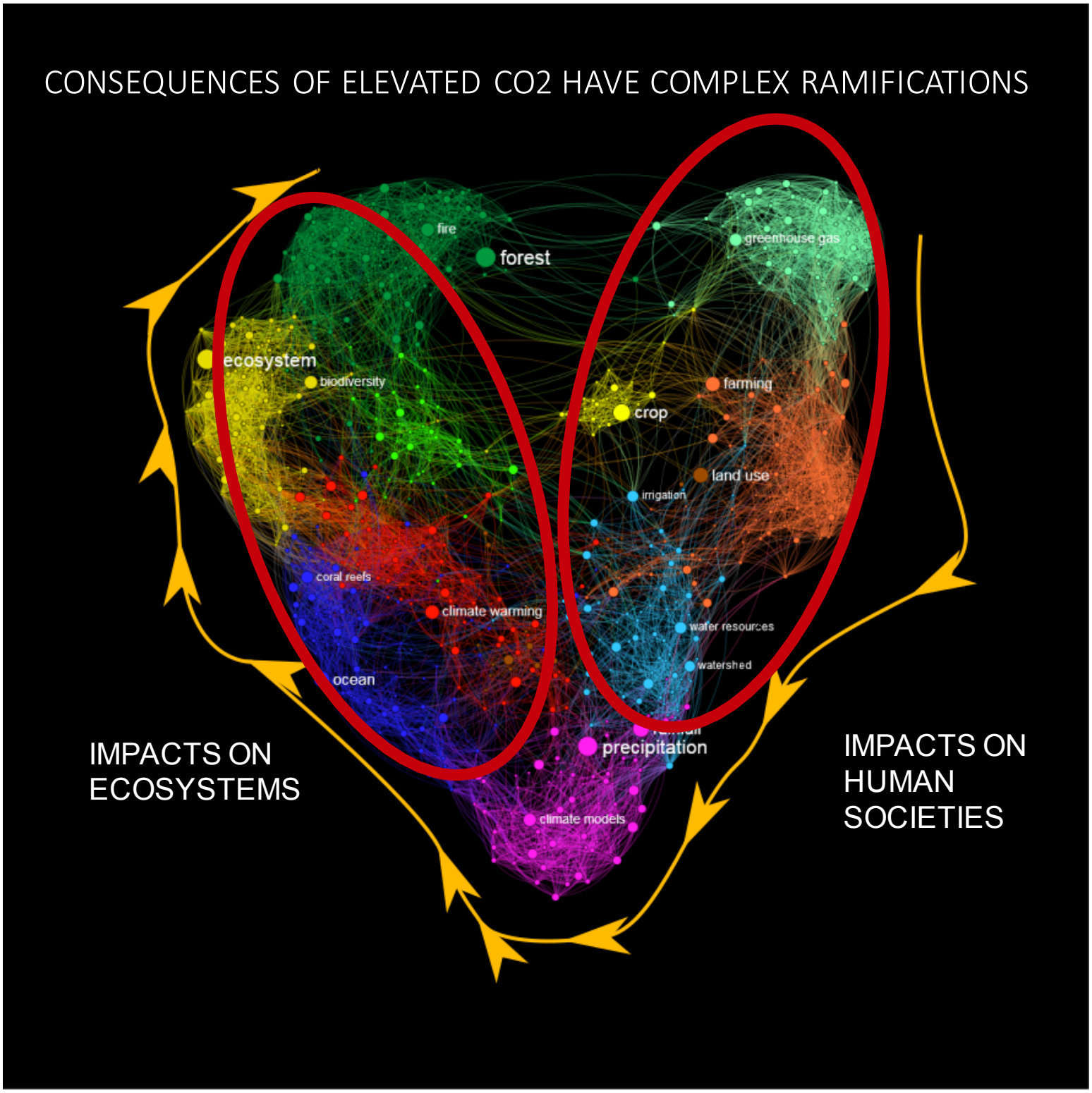
- 30.000 recent publications analyzed with text mining

- Salient terms extracted (nodes)

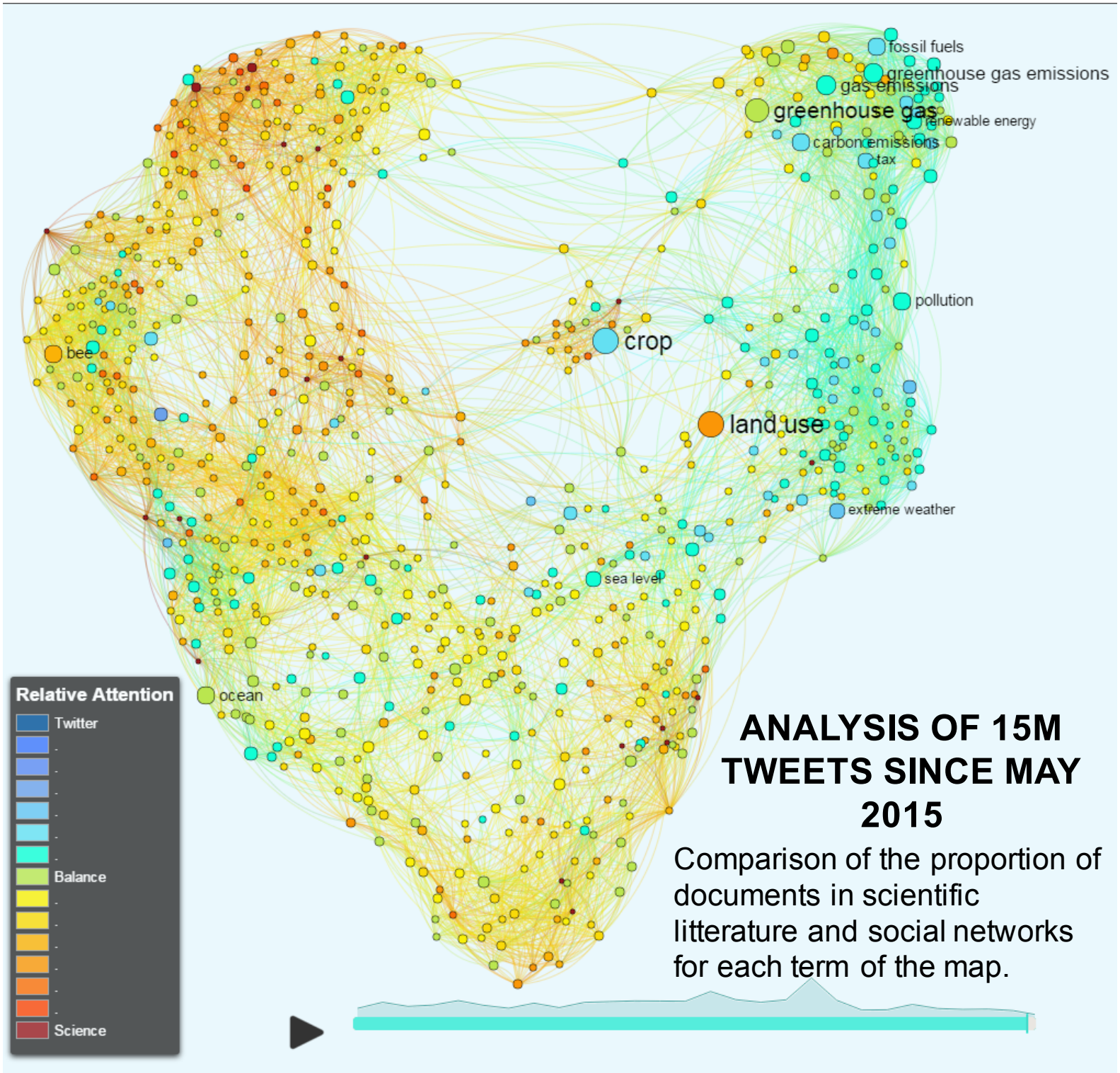
- Thematic proximities processed (links)

CLIMATIC TWEETOSCOPE

# CONSEQUENCES OF ELEVATED CO2 HAVE COMPLEX RAMIFICATIONS



# CLIMATIC TWEETOSCOPE

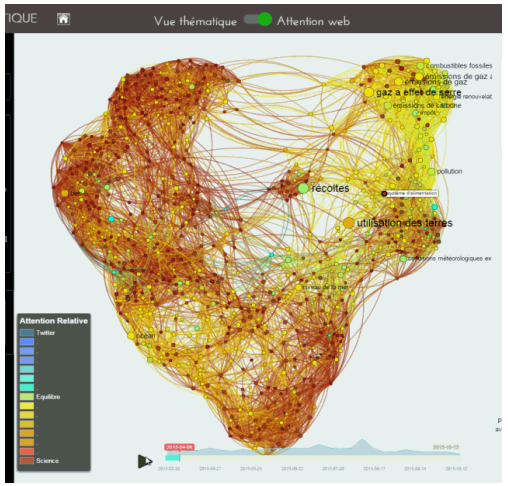


CLIMATIC TWEETOSCOPE

# Perspectives

## studying the pulse of social systems

The innovation proposes new starting points for research with the opportunity to empirically address the **multi-scale nature of social dynamics**.




It opens a wide range of applications from **information retrieval to policy-making**.

It helps **include public concerns in shaping science and adjusting policies**.

# • III. Science BY Society: Do-It-Yourself

- Science by society : the **next step or limit**…
- How can science emerge from citizen practices ?
- Innovation (Steve Jobs) and utopia
- **Grow your ink** : The French Lab La Paillasse has proposed a workshop to grow your own ink.
- http://growyourink.lapaillasse.org/
- new behaviors and uses that technology engages!

# The rise of DIY biology

- DIY biology (and DIY practices) is a visible phenomenon attracting an increasing number of practitioners, academics, scientists, students, citizens, hackers, artists and potential entrepreneurs.
- Extracting DNA, « hacking » yoghurt, bio-art projects, producing biosensors to detect pollutants in food and in the environment.... 40 labs

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3740105/figure/Fig1/

# DIY Biology

- A shift: DIY biologists aim at experimenting with, and (re) engineering the biological world. Empowerment.
- Traditionally, amateurs would only observe and describe the natural world.
- Within the broader open science movement the engineering vision of synthetic biology has played an important role.

# DIY

- DIY biology aims at democratizing biology spatially, technically and economically.
- DIY has conceptual, social and epistemological ambitions.
- The politics of openness of DIY biology is at once celebrated and dreaded by scientists – interesting to observe, since usually it is the “public” that is considered to have irrational fears about science.

# Two contributions of DIY to global health issues

- Cheap PCR device, like Amplino, allows for quick malaria detection in developping countries.

- Biological blue ink, non-toxic, cheap and biodegradable !

# DIY: yoghurt biosensor

- Genetically modified lactic ferments could detect melamine contamination in milk and trigger a visual response (after Chinese problems).

- Biowearthermap: monitor and detect the bacterial strains present in various surfaces in a house, in a city, or in a country!!

- Open source platforms like
- OpenWetWare database (an MIT initiative).
- There are new biosafety and biosecurity threats associated with the synthetic biology era.
- **DIY is a method to deal with fear by empowering the people**.

# DIY and Security

- There haven't been any reported cases of security or safety threats stemming from DIYbio practitioners.
- DIYbio communities are well-positioned to develop a positive culture around citizen science and to set the standard for best practices for biotechnologies.
- In 2012 DIYbio.org set up a Question and Answer platform on biosafety, which is an example of what global governance can be.

# DIY and Security

US national strategy for countering biological threats even states that garage biology is good and necessary for the future physical and economical security of the USA.

- DIYbio labs and practitioners are working to make scientific equipment cheaper, more available, more mobile, more usable.

# CONCLUSION

- No science against citizens or even without citizens today.
- Importance of SSH analysis for understanding  what is emerging in a population (tweetoscope)
- Bridging the gap between science, technologies, and populations:
- Crowsourcing, Citizen sciences, DIY.
- A new paradigm for collective security…?

# Thank you for your attention