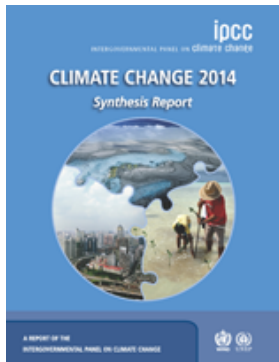


# A Topography of Climate Change Research

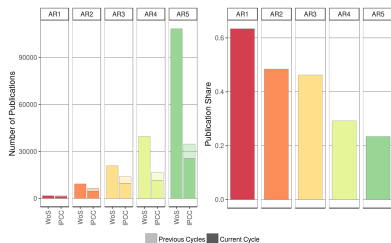
Max Callaghan



November 8, 2017



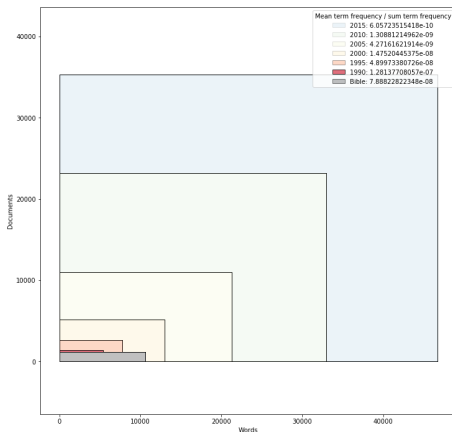
- To contribute evidence-based policy-making on climate change, the IPCC aims to *comprehensively* assess
- These assessments should be aim to balance legitimacy, credibility and relevance (Cash and Clark, 2001)



- Comprehensive, credible and relevant assessments become more challenging as the literature grows

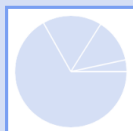
*To understand, and to aid, scientific assessments of climate change, we need to machine read the literature*

Figure: Source: Minx et al. (2017)



- Topic modelling is a way of reducing the dimensionality of a corpus of documents
- A large matrix of documents  $\times$  words is factorised by a matrix of topics  $\times$  words and a matrix of topics  $\times$  documents (Lee and Seung, 1999)
- Topics describe the latent structure of the document corpus

## Biomass carbon density of human typical forest types



### related topics

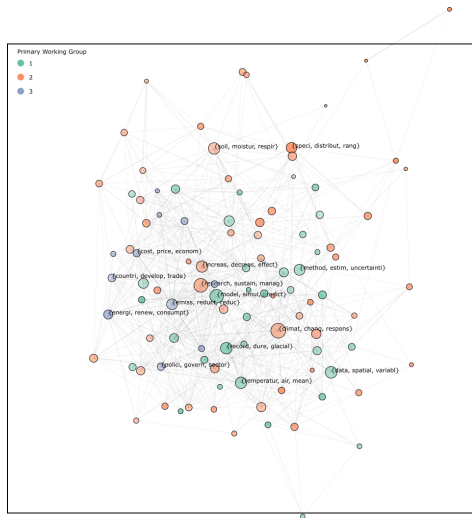
(forest, tropic, deforest)  
(biomass, aboveground, root)  
(carbon, sequestr, organ)  
(food, agricultur, secur)

Chen, J.; Li, X.; Wang, E.; Zeng, Y.; Zeng, Z.; 2016

The forest carbon reserve is very important to forest ecosystems. The amount of carbon of forest plays an important role in improvement of the global warming. Both field surveys and laboratory analysis were employed to investigate biomass and biomass carbon density in six typical forest types (Cupressus funebris forest, Eucalyptus forest, Pinus massoniana forest, Cunninghamia lanceolata forest, Quercus fabri forest and Populus tremula forest) of the Hunan Province. Results show that the biomass, biomass carbon and carbon density of the selected six forest types increase with the increasing ages. The carbon density per unit for young forests, middle forests and premature-mature-overmature forests of each forest type were as follows: 30.1, 73.4 and 121 t/hm<sup>2</sup> in Cupressus funebris forest, 25.6, 39.7 and 97.1 t/hm<sup>2</sup> in Eucalyptus forest, 17.7, 48.4 and 80.9 t/hm<sup>2</sup> in Pinus massoniana forest, 22.5, 43.9 and 99.5 t/hm<sup>2</sup> in Cunninghamia lanceolata forest, 16.6, 19.6 and 59.1 t/hm<sup>2</sup> in Quercus fabri forest, and 16.6, 26.7 and 53.7 t/hm<sup>2</sup> in Populus tremula forest. Because the forest types in Hunan Province are mainly in the young and middle-aged forest stands, the biomass carbon density is regarded to increase. This study provides important information for forest management and evaluation of carbon sequestration. © 2016, World Food Ltd. and WFL Publishers. All Rights Reserved.

Adjust topic threshold:

- Documents are mixtures of topics, based on the words which occur in them



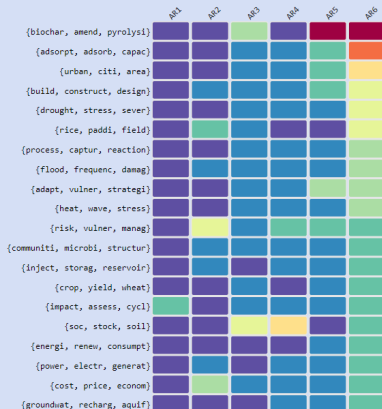
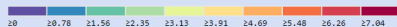
- A network of comprehensible topics is generated with 100 topics
- Topics can be matched to the IPCC working group from which the majority of the topic documents are referenced in
- Topics from the same working group are **significantly** more likely to be correlated with each other than those which are not



- In later assessment periods, the largest topic is on research priorities and sustainability

words	Related Documents		related topics
<a href="#">research</a> <a href="#">sustain</a> <a href="#">manag</a> <a href="#">model</a> <a href="#">simul</a> <a href="#">predict</a> <a href="#">climat</a> <a href="#">chang</a> <a href="#">respons</a> <a href="#">process</a> <a href="#">captur</a> <a href="#">reaction</a> <a href="#">speci</a> <a href="#">distribut</a> <a href="#">rang</a> <a href="#">emiss</a> <a href="#">reduct</a> <a href="#">reduc</a> <a href="#">soil</a> <a href="#">moistur</a> <a href="#">respir</a> <a href="#">energi</a> <a href="#">renew</a> <a href="#">consumpt</a> <a href="#">data</a> <a href="#">spatial</a> <a href="#">variabl</a> <a href="#">temperatur</a> <a href="#">air</a> <a href="#">mean</a>	Sort by: (Score (descending))		<a href="#">(climat, chang, respons)</a> 0.2627 <a href="#">(environment, econom, environ)</a> 0.2000 <a href="#">(polici, govern, sector)</a> 0.1990 <a href="#">(adapt, vulner, strategi)</a> 0.1548 <a href="#">(risk, vulner, manag)</a> 0.1257 <a href="#">(countri, develop, trade)</a> 0.1217 <a href="#">(technolog, ccs, captur)</a> 0.1137 <a href="#">(system, oper, integr)</a> 0.1081 <a href="#">(impact, assess, cycl)</a> 0.0963 <a href="#">(food, agricultur, secur)</a> 0.0876
PR	Title	doctopic__score	
2010	<a href="#">Rethinking the role of ecological research in the sustainable management of freshwater ecosystems</a>	0.0362	
2016	<a href="#">Towards an umbrella science of sustainability</a>	0.0349	
2011	<a href="#">Structuring sustainability science</a>	0.0344	
2013	<a href="#">Conceptualising "coupling" for sustainability implementation in the industrial sector: a review of the field and projection of future research opportunities</a>	0.0333	

# Preliminary results - growth

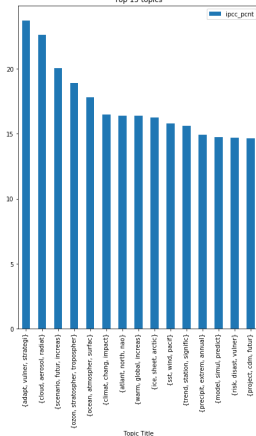


- Negative emissions related topics have shown strong growth since the end of AR5
- As have topics on cities and extreme weather events

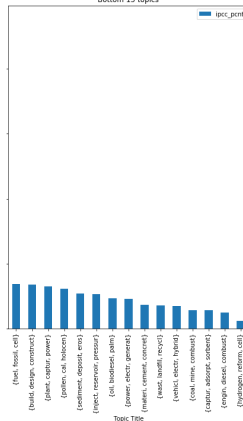


# Preliminary results - gaps in coverage

Top 15 topics



Bottom 15 topics



- The physical science aspects of climate change, as well topics on impacts, adaptation and scenarios are well covered by the IPCC
- “Niche” topics on specific technological solutions, are less well covered

- Can I get a clearer research question, and make the analysis less descriptive?

- Cash, D. W. and Clark, W. C. (2001). From science to policy : assessing the assessment process. *Social Science Research Network*, (November):1–45.
- Lee, D. D. and Seung, H. S. (1999). Learning the parts of objects by non-negative matrix factorization. *Nature*, 401(6755):788–91.
- Minx, J. C., Callaghan, M., Lamb, W. F., Garard, J., and Edenhofer, O. (2017). Learning about climate change solutions in the IPCC and beyond. *Environmental Science & Policy*.