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# Knowledge Gaps in the Global Climate Change Research Distribution

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The following extended abstract represents a discussion of the results in:

Pasgaard, M. and Strange, N. (2013). A quantitative analysis of the causes of the global climate change research distribution. *Global Environmental Change*, In Press. Available online at:

<http://www.sciencedirect.com/science/article/pii/S0959378013001489>

## Extended abstract

The scientific community has contributed extensively to the public debates on climate change with various data, projections and discussions on the future climate, as well as on the causes and effects of the expected climatic changes. The impacts of a warmer, more unpredictable and extreme climate are not expected to be evenly distributed across the globe. Some regions will experience potentially detrimental changes such as increased drought or flooding, while others may find that conditions for agricultural production improve (IPCC, 2007; Richardson et al., 2009; Stern et al., 2006). Many regions with a high risk of negative impacts from climate change are found in the less developed parts of the world and often have a low adaptive capacity (Richardson et al., 2011). Scientific knowledge has been shown to play an increasing role in understanding potential climate change impacts and in forming debates and policies (Dessler and Parson, 2010) at global, regional and national scales. Increasing scientific knowledge transfer may contribute to decreased uncertainties and increased adaptive capacity of individuals, institutions or governments (Adger et al., 2009). However, scientific research on climate change appears to focus predominantly on the more developed and less vulnerable regions of the world (e.g. Ho-Lem et al., 2011). Indeed, the Intergovernmental Panel of Climate Change (IPCC) notes a “lack of geographical balance in the data and literature on observed changes in natural and managed systems, with a marked scarcity from developing countries” (Rosenzweig et al., 2007, p. 117). This leaves a potential gap or mismatch between the supply of

and the need for knowledge on climate change to be explored and addressed. This study (Pasgaard & Strange, In Press) is one of the first to analyse for congruence between research efforts and research needs at the country scale in relation to climate change. It implements a quantitative analysis of more than 15.000 scientific publications from 197 countries investigating the distribution climate change research. We expand by analysing the potential causes of this global distribution of climate change research. With a bibliometric analysis we aim to identify potential mismatches between the global need for knowledge, measured as climate change vulnerability, and the supply of knowledge, measured by scientific publications. The analyses presented here include country level indicators on wealth, education, press freedom, state stability, corruption, development assistance and environmental footprint. These explanatory factors are included in order to facilitate a discussion on some of the potential causality and reasons for any mismatch between recent supply of and need for scientific knowledge in climate change.

**Research questions:**

To address the gaps outlined above this study explores the following questions:

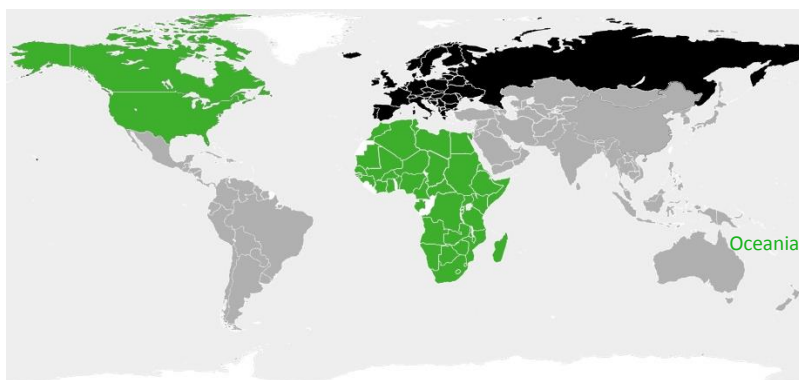
- How does the number of climate change publications match the vulnerability in a country to climate change?
- How is this relationship related to the socioeconomic and institutional characteristics of a country?
- How is this affecting the potentials for knowledge transfer across regions and nations?

In order to analyse the potential gap between the supply of and need for climate change knowledge, data was collected on the global distribution of the *supply of knowledge* (measured by climate change publications) and the *need for knowledge* (measured by climate change vulnerability). In order to analyse and explain this relationship, data was collected on various socio-economic and socio-political variables. The search and review of climate change publications follow the guidelines for systematic reviews (Pullin and Stewart, 2006) adapted to the research questions and purpose of this study.

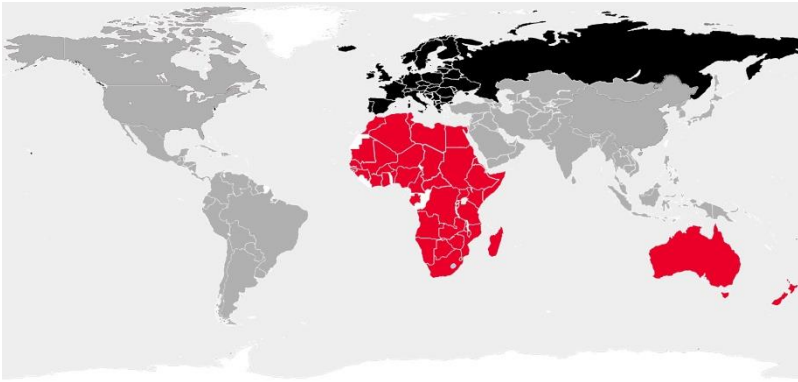
Publication data was obtained from the Web of Science database (part of Web of Knowledge databases provided by Thomson Reuters) between July 12 and July 16, 2010. The database was searched for articles, proceedings papers and reviews within the time span 1999 to July 2010 using a range of search phrases on climate change and knowledge domains within climate change research including human dimensions such as *effect*, *impact* and *adaptation*. The search was run for 197 countries of the world based on the United Nations list of recognized countries (UN, 2006) plus Antarctica and Greenland. The search was narrowed by

excluding selected “Subject Areas” in Web of Science, and finally, the country publications were manually checked to exclude irrelevant publications from the database, such as terminological or geographical noise. Finally, in order to supplement the quantitative analyses presented above, we did a systematic keyword screening of titles and abstracts of all publications to assess certain knowledge domains, which were found relevant to investigate for the study of the supply and need for climate change research. These domains were categorized as *primary research focus* (mitigation or adaptation), *climate change effects* (natural or social/human), *scale* (large or small), *dominant scientific approach* (natural or social science), and whether an *economic perspective* was present.

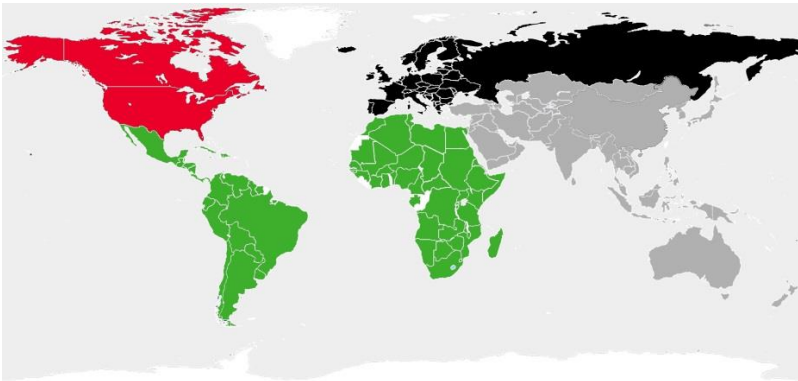
More than 13 explanatory variables representing vulnerability, geographical, demographical, economical and institutional indicators are included in the analysis. The results show that the supply of climate change knowledge is biased towards richer countries, which are more stable and less corrupt, have higher school enrolment and expenditures on research and development, emit more carbon and are less vulnerable to climate change. Similarly, the production of knowledge, analysed by author affiliations, is skewed away from the poorer, fragile and more vulnerable regions of the world. A quantitative keywords analysis of all publications shows that different knowledge domains and research themes dominate across regions, reflecting the divergent global concerns in relation to climate change. In general, research on climate change in more developed countries tend to focus on mitigation aspects, while in developing countries issues of adaptation and human or social impacts (droughts and diseases) dominate (Figure 1). Based on these findings, this paper discusses the gap between the supply of and need for climate change knowledge, the potential causes and constraints behind the imbalanced distribution of knowledge, its implications for adaptation and policymaking, and their potential use for filling the knowledge gap in different regions of the world. Furthermore, the paper discusses the opportunities and limitations for knowledge transfer across regions and neighbouring nations.



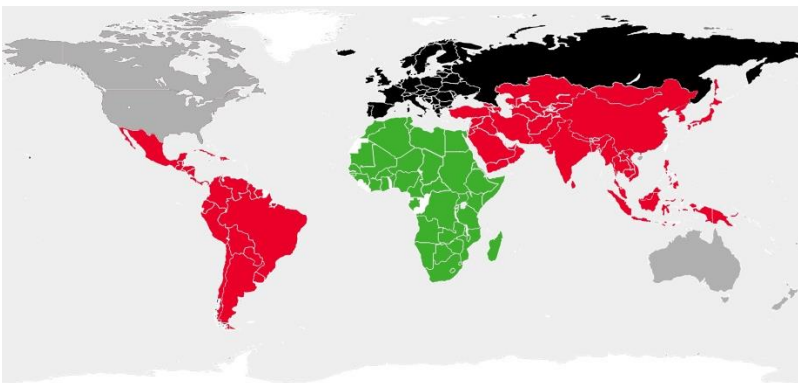
**Figure 1a:** Relative to Europe (black) research on *adaptation* to climate change is more common in North America, Africa and Oceania (green)



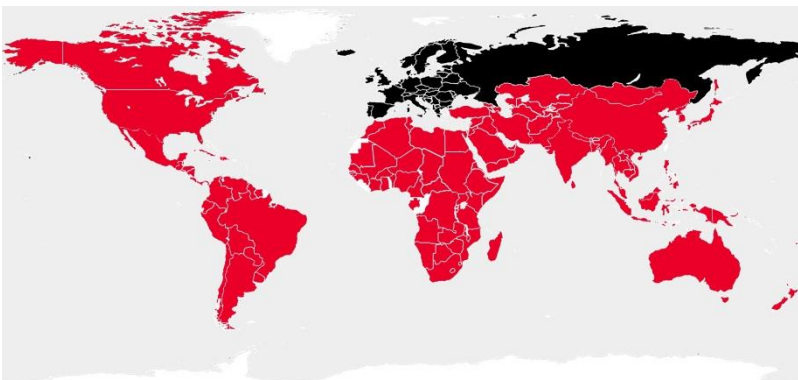
**Figure 1b:** Relative to Europe (black), research on climate change *mitigation* is significantly less common in Africa, Australia and New Zealand (red)



**Figure 1c:** Relative to Europe (black), research on *disease* and climate change is significantly more common in Africa and South and Latin America (green), but less common in North America (red)



**Figure 1d:** Relative to Europe (black) research on *drought* and climate change is significantly more common in Africa (green), but less common in Asia and South and Latin America (red)



**Figure 1e:** Relative to Europe (black), research on *flooding* and climate change is significantly less common in North America, South and Latin America, Africa, Asia, Australia and New Zealand (red)

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