Investigating interdisciplinary research discourse: the case of Global Environmental Change

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In brief

- In cooperation with the international scientific publisher, Elsevier, we are investigating the discourse of interdisciplinary research (IDRD) through comprehensive corpus linguistic analyses of the full holdings of a successful IDR journal, *Global Environmental Change*.
- This analysis will be complemented by linguistic analyses of samplings of 5 other IDR journals and 5 discipline-specific journals, and by surveys of, and interviews with editors, reviewers and researchers.

Outline

1) About the project
2) Terminological issues
3) Data selection issues
4) How do articles cluster?
   Using Multi-dimensional Analysis
5) Investigating phraseology:
   first steps

Main aim

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- to achieve a fuller understanding of the distinctive features of discourse practices in interdisciplinary research and of how they differ from discourse practices in conventional disciplines

Broad questions

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- To what extent does the field of ‘global environmental change’ operate as a unified whole?
- Do authors in the field broaden their messages to a multidisciplinary audience, or do they write in the same way that they would if they were writing for a monodisciplinary audience?
- Does each discipline in the field maintain a discrete identity?

Data

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- Full holdings of a successful IDR journal, *Global Environmental Change,* 1990-2010
  - 676 articles
  - Identified by Elsevier as a successful journal
- Samples from 5 IDR journals and 5 specialist journals, 2001-2010 (20 a year)
  - Not yet identified
- Surveys, interviews with editors, board members, authors

Terminology

- interdisciplinarity
- multidisciplinarity
- transdisciplinarity
- cross-disciplinarity

Theoretical notions:

- Postdisciplinarity
- Antidisciplinarity
- Supradisciplinarity

multidisciplinarity

cross-disciplinarity

interdisciplinarity

integrating

Not a set of mutually exclusive categories

- Monodisciplinary journals can include multidisciplinary texts
- Interdisciplinary journals can include monodisciplinary texts

- IDR journals are expected to be highly inter- disciplinary
- Discipline journals are expected to contain mostly monodisciplinary texts

Finding comparison corpora

We are looking for journals that represent the 'disciplines' involved in research into global environmental change

- Economics
- Policy studies
- Geography
- Meteorology

Difficulty: many journals proclaim themselves to be 'interdisciplinary' but how interdisciplinary are they?

Resources Policy

The International Journal of Minerals Policy and Economics

Resources Policy is an international journal devoted to **minerals policy** and **economics**, aimed at individuals in academia, government, and industry. Submissions are invited that analyze issues of public policy, economics, and business in the areas of mining, minerals, metals, and materials.

Topics covered in the broad discipline of **mineral economics** include mineral market and price analysis, project evaluation and real options valuation, mining and sustainable development, mineral resource rents and the resource curse, mineral wealth and corr
and regulation, the rise of China and India as ma
and the impact of mineral development on local
indigenous populations.

3

Space Policy

An International Journal

Space Policy is an international, interdisciplinary journal which draws on the fields of international relations, economics, history, aerospace studies, security studies, development studies, political science and ethics to provide discussion and analysis of **space activities** in their **political**, **economic**, **industrial**, **legal**, **cultural** and **social** contexts.

Alongside full-length papers, which are subject to a double-blind peer review system, the journal publishes opinion pieces, case studies and short reports and, in so doing, it aims to provide a forum for the exchange of ideas and opinions and a means by which authors can alert policy makers and international organizations to their views. *Space Policy* is also a journal of record, reproducing, in whole or part, **official documents** such as treaties, space agency plans or government reports relevant to the space community. Views expressed in the journal are not necessarily those of the editors or members of the editorial board.

Selection strategy

- Identify mono and multi disciplinary journals by looking at the counts of subjects they belong to in Scopus, relative to what can be expected for a journal in the relevant field
- See which other journals they cluster with according to their citation relationships

The next stage: clustering articles

- Using Multidimensional Analysis
  - When the articles in the Global Environmental Change journal are ‘clustered’ according to linguistic features, do the clusters that are identified represent communities of practice, disciplinary or otherwise?
  - Do the clusters remain the same over time?

Multidimensional Analysis

- Doug Biber, NAU – consultant
- Tag all data for up to 120 features (variables)
- Develop ‘dimensions’ from the factor analyses
- See how texts ‘cluster’ on different dimensions
- Lengthy iterative process
- This project will lead (potentially) to new set of dimensions

MD analysis

Step 1:

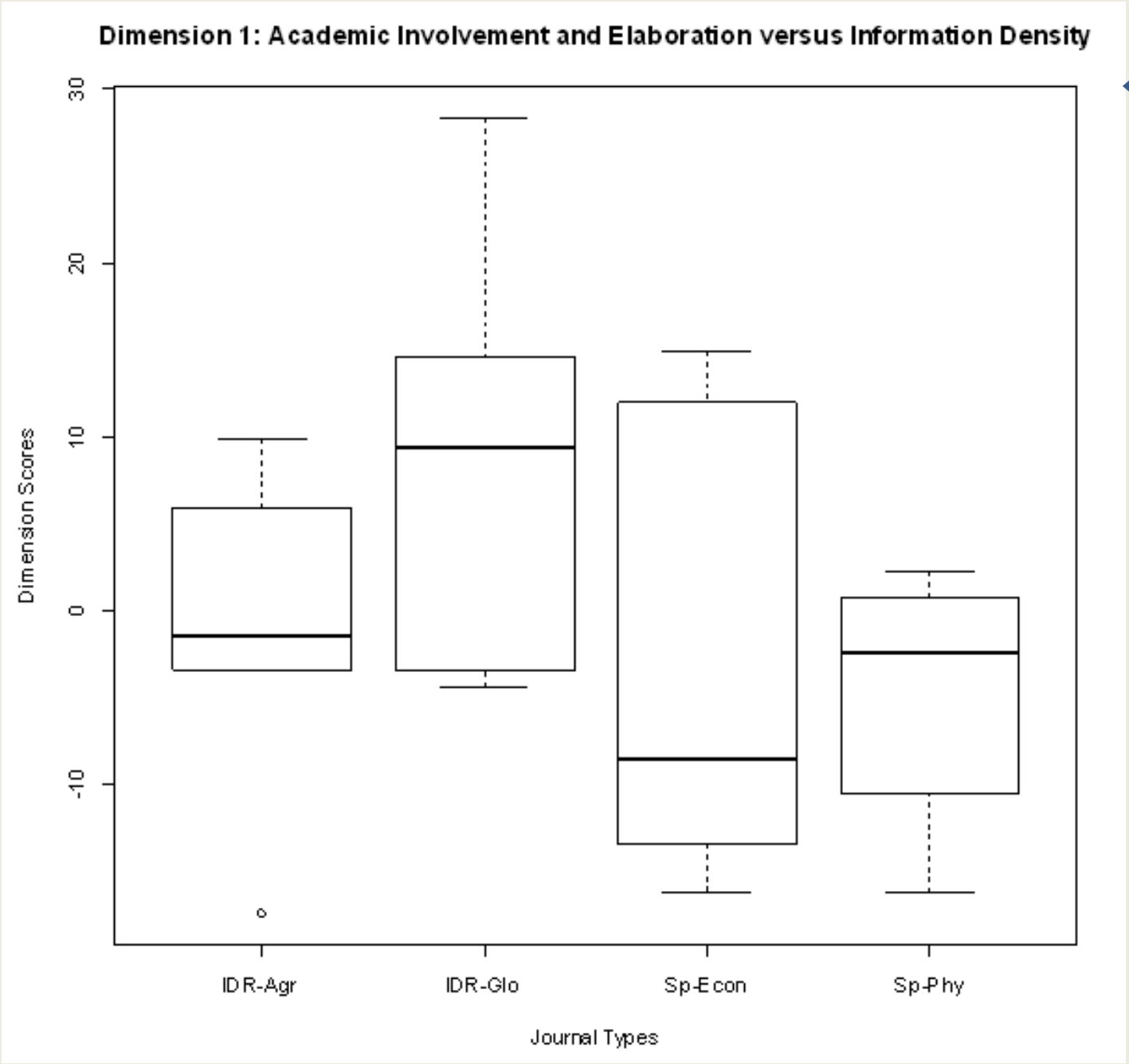
Identify the set of linguistic features to study (eg, past tense, personal pronouns, wh- clauses)

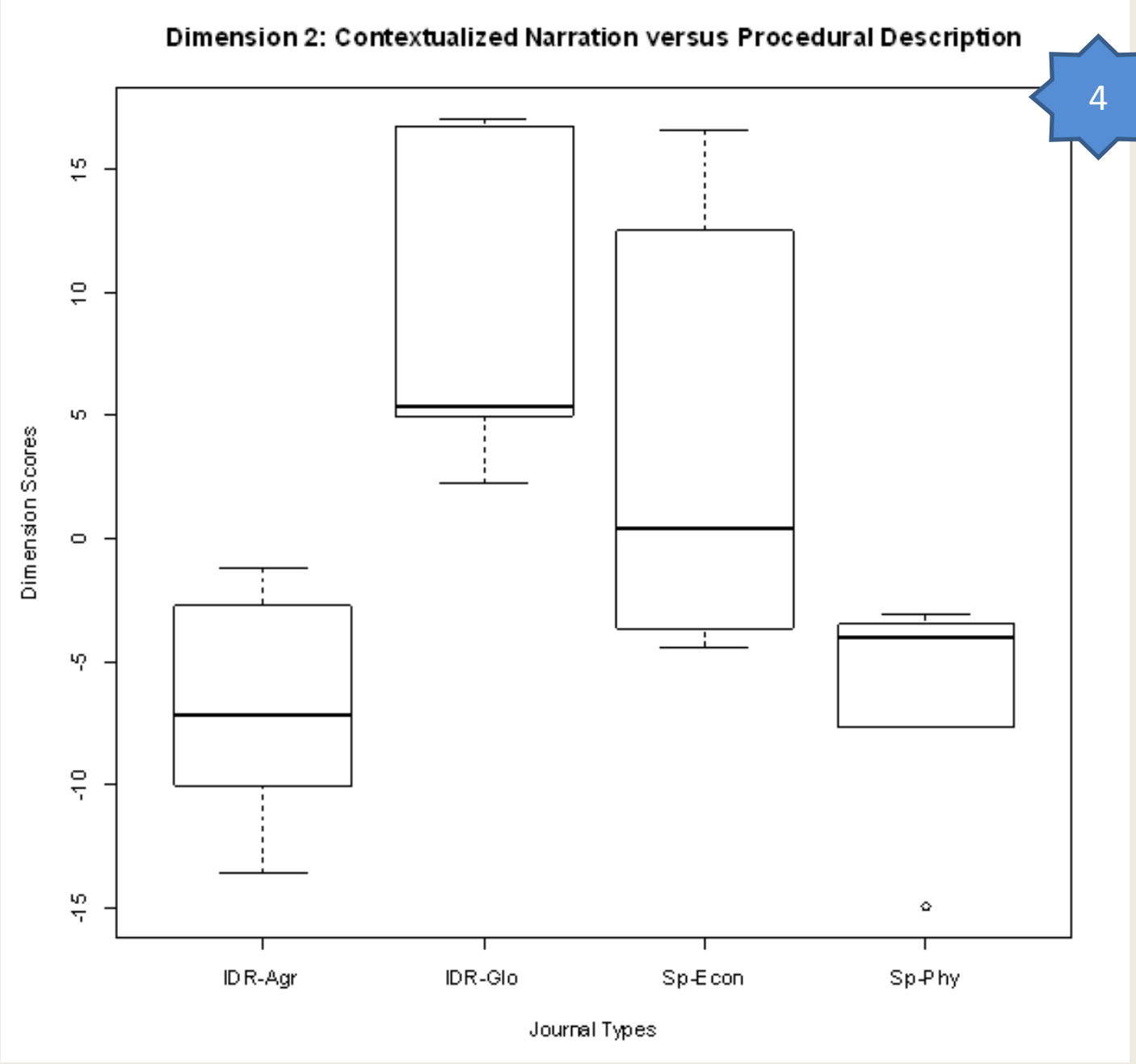
Step 2:

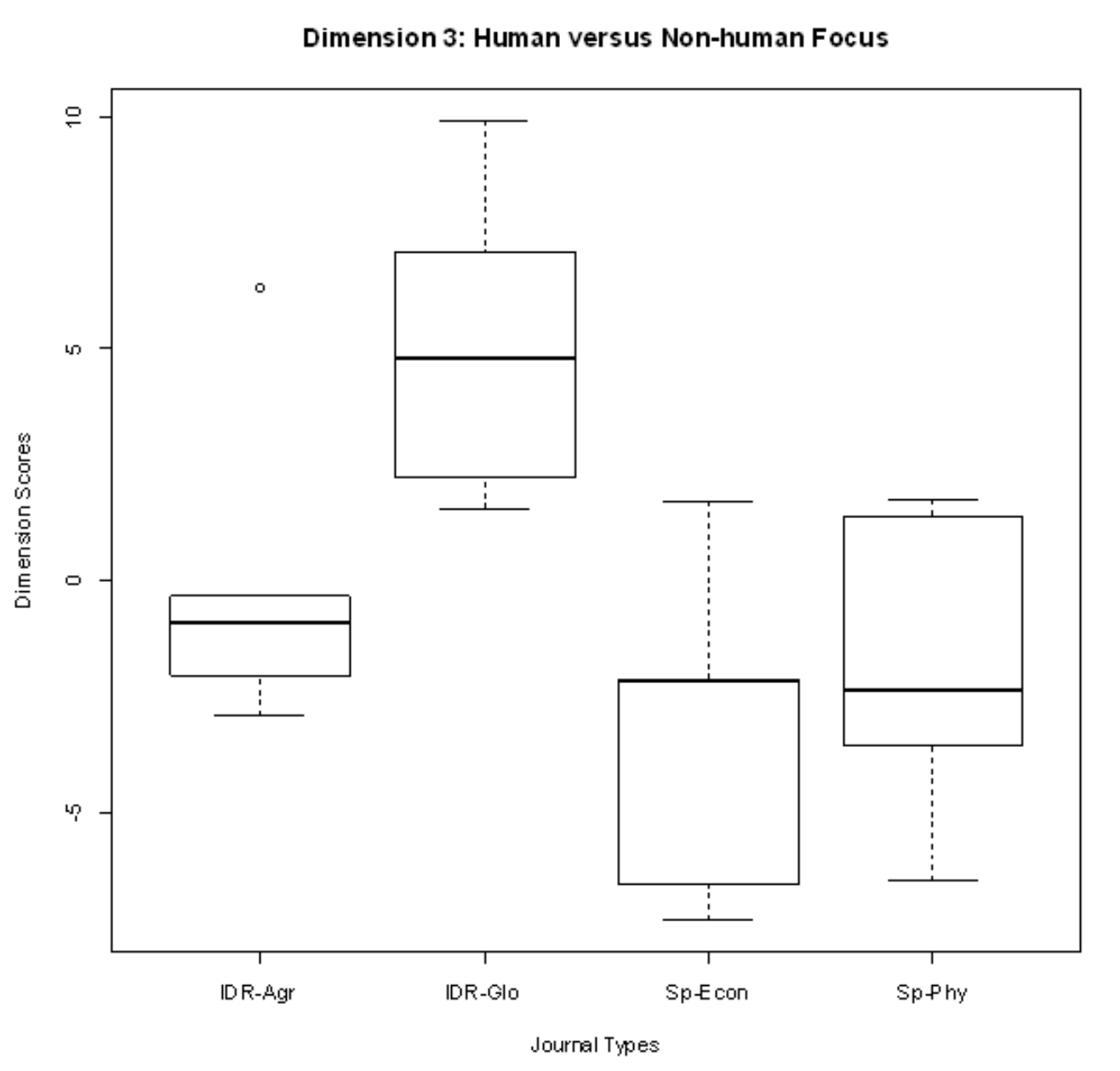
Use a grammatical tagger and then count the occurrences of the features in the corpus.

Step 3:

Use factor analysis to identify sets of variables that tend to co-occur in texts. These correlations are used to determine 'factors' which are then conceived as **dimensions**


Dimension 1: Academic Involvement and Elaboration versus Information Density
Dimension Scores
30
20
10
0
-10
IDR-Agr
IDR-Glo
Sp-Econ
Sp-Phy
Journal Types


Dimension 2: Contextualized Narration versus Procedural Description
4
Dimension Scores
15
10
5
0
-5
-10
-15
IDR-Agr
IDR-Glo
Sp-Econ
Sp-Phy
Journal Types



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MD analysis for main project to be completed by mid 2014

Phraseology

- What is the phraseological profile of the GEC articles?
- Does this profile distinguish clusters of articles; and are these clusters the same as those identified by the MD analysis clustering technique?
- Do phraseological profiles change over time?

Trigram clusters

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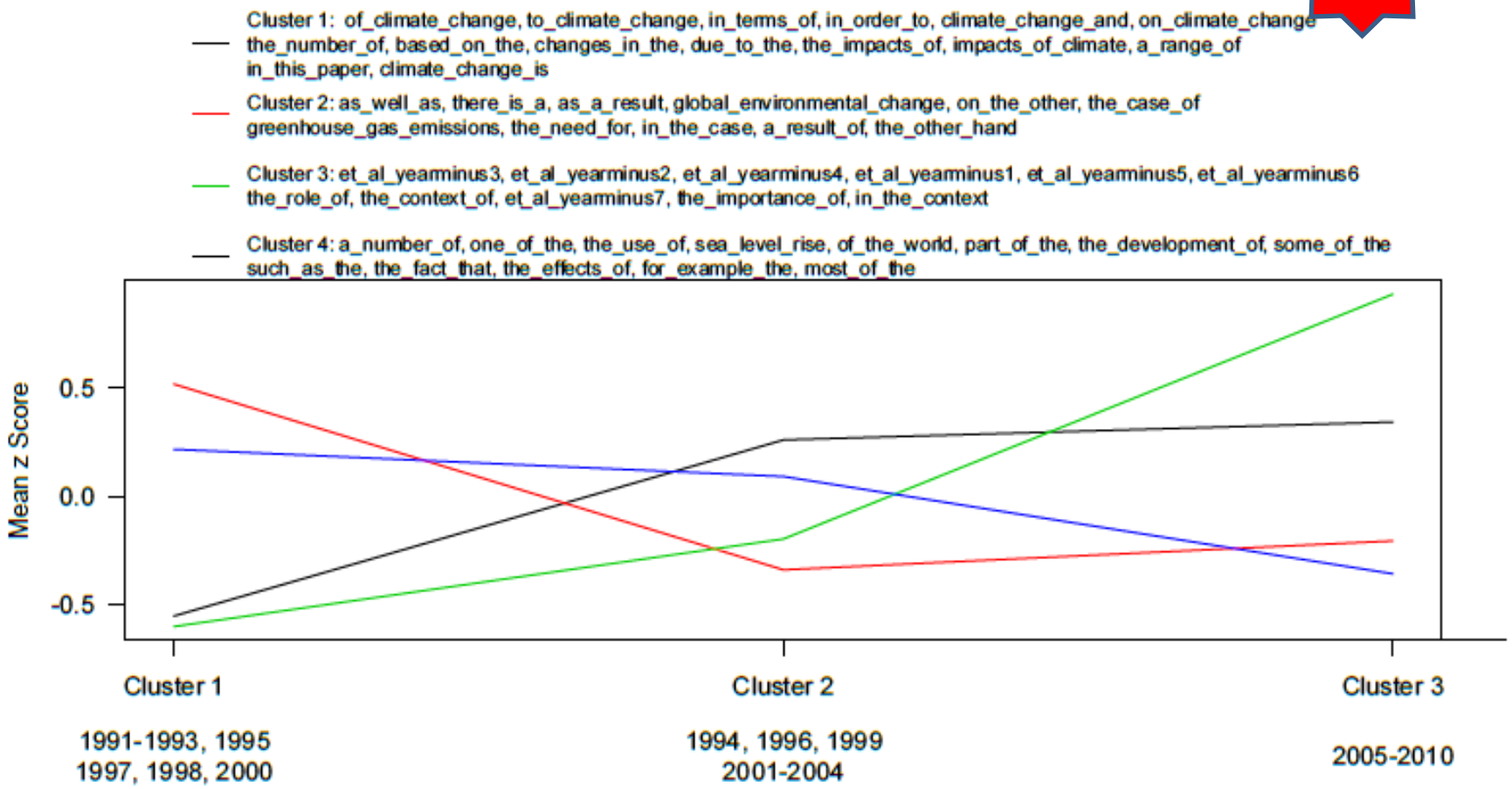

Figure 4: Frequency of Clusters of Trigrams by Volume Clusters

Volume clusters

In this paper - Association of phrase with strong claims

- In this paper I attempt to illustrate and characterize these fundamentally different kinds of uncertainty which the shift to the preventive paradigm allows us to recognize.
- I have aimed in this paper to identify less obvious issues for risk assessment and regulatory knowledge exposed by the policy shift towards preventive, or upstream strategies for integrating environmental criteria into decision making.
- In this paper, I have developed the argument that the relationship of knowledge to the world of policy is fundamentally different from dominant notions.

What kind of paper?

- *In this paper* we focus on the mitigation of energy related CO2
- The analysis presented *in this paper* is based on calculations with an energy model
- comparing regional cost levels as proposed *in this paper* still provides useful information
- *In this paper* we have used the Baseline A scenario
- we plan to improve the calculations presented *in this paper* in two ways.

‘Perception’ studies

- Judging from the results presented *in this paper*, current lay perceptions may prove a substantial impediment to enacting meaningful responses to these complex and worrisome processes.
- *In this paper*, we explore the extent to which members of the general public are receptive to calls to change aspects of their everyday behaviours for the sake of the environment.

The effect(s) of

- 952 occurrences in 350 files
- Some files have a high frequency:
  - **1999_1_Arnell_body** 26
  - 2010_1_Wolf_body 19
  - **2004_1_Arnell2_body** 18
  - 2009_1_Wei_body 17
  - 2008_3_Larsen_body 14
  - 2010_2_Oh_body 14
  - **1999_S1_Arnell_body** 13

The effects of

- **Schulze 1993 paper**
- This paper has considered a vegetative response impact analysis which has concentrated directly on estimating **the primary effects of** environmental variables on crop yields. The approach used has been to quantify **the effects of** increasing atmospheric CO_2 concentration, and resultant expected increases in air temperature, on crop response and primary productivity. No precipitation changes were considered because of the large uncertainty surrounding the quantification of such changes. The approach assumes an instantaneous change in climate state and estimates the 'before-and-after' yield effects.

The effect(s) of

- 2008 Larsen
- McBeath (YEARMINUS5) points out that there is no formal criterion for evaluating the long-term consequences of climate change on the Alaska transportation system. However, he does note that the agencies responsible for Alaska's roads, railroad, airports, and ferry systems do consider **the effects of** climate change on the permafrost layer and other factors when building and maintaining structures.

Larsen continued

Alaska climate change adaptive model.

We considered how the various kinds of responses to different natural disasters might apply to analyzing **the effects of** climate change on public infrastructure costs. Earthquakes are a regular occurrence in the US West, hurricanes are regular events in the Southeastern US, and floods make annual appearances in the US Midwest. Although these natural events are not directly analogous to climate change, the local, regional, and federal government responses that have been documented over the last several decades provide foundational models from which to anticipate the adaptation response that may occur in the case of climate change in Alaska.

We have

Rhodes 1993

Accelerated removal of toxic sediments, accompanied by treatment and/or permanent disposal, would be an appropriate policy option for eliminating any future risk of atmospheric exposure due to declining lake levels. On the other hand, the prospect of declining lake levels may present opportunities for deferring toxics clean-up into the future when sediments may be more easily (and perhaps more safely) handled outside the aquatic environment. **We have** suggested here some examples of creative alternatives for addressing Great Lakes toxics remediation in the context of global warming.

de Chazal 2009

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We have examined some potential under- and over-estimations highlighting that biodiversity changes are likely to be more complex than often assumed. We have discussed some limitations of these models to represent simple through to more complex characterisations of land-use change and the associated range of biodiversity responses. We have also discussed the limitations of the few studies that include land-use change as a driver, and suggest that these limitations such as the wide range of uncertainties in biodiversity responses associated with the present set of land-use change scenarios is not widely appreciated or acknowledged. We suggest that a better approach for continued research in this field is to at the very least include both climate and land-use change as drivers, or better still include other drivers of change.

Initial observations

- Trigrams can be primarily discourse reflexive or can be substantive (main concerns of research)
- Different types of paper:
  - Model building
  - Public perceptions
  - Policy assessments
    Are differences attributable to 'discipline' or to research paradigm? Or both?
- Possible approach – to explore the phraseologies around selected words. Which words? … *we*, *he*, *important* etc.