Finding authoritative resources on climate change: Introducing the climate cloud: a digital library of NZ climate change related resources

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Abstract. This paper details a digital library that allows land managers and advisors to obtain information to inform decision making towards successful adaptation or mitigation of climate change impacts. The paper reviews the development of the library, metadata, audit procedure, and provides a view of the library as well as how it addresses issues of science communication arising from the information deficit model by relating the libraries' affordances to Bourdieu's theory of practice. Each resource has metadata based on Dublin core with additional subject, audience and geographic taxonomies. The metadata , in particular of content subjects, allows search functions to easily locate the resource , and for post-search refiners. The library provides downloadable copies of resources where copyright permissions have been obtained. Free-text search can be used for attached resources. The audit procedure ensures that resources are well founded, and are based on, or can be traced back to scientific research.

Keywords: Digital Library, Bourdieu, Information Deficit, Resource bank, Climate change, technology transfer.

Introduction

This paper addresses the development of a national digital library, the climate cloud, which provides access to a wide range of climate change related resources addressing the problem of resources being distributed across a wide range of agencies, and where digital availability is limited. This library also address problems associated with accessing copyrighted material, and it contains descriptions of resources that due to copyright cannot be included in the library. The digital library is part of a wider NZ Government programme to build climate change resilience in the primary production facing sectors of New Zealand's economy. The government through a variety of funding mechanisms has commissioned research into climate change impacts, risks and adaptation options across different primary production sectors, as well as research to support the emissions trading system and to support New Zealand's obligations under UNFCCC and the UNFCCC Kyoto protocol. Hence, the target audiences are those involved in managing primary productive land and their advisors, as well as other who have an interest such as policy analysts.

Introduction to the Climate Cloud

The Climate Cloud is a digital library of climate change related resources that may have relevance to people who are working within New Zealand's primary sectors. The requirements of the digital library are:

- To store digital objects, including pdf, word, excel, video, audio resources;
- To search on keywords;
- To use full text search;
- To have customisable views for different audiences;
- To be accessible from any location in NZ; and
- To maintain copyright integrity.

The purpose of the library is to be a site where information on climate change and adaptation options can be found. Access to relevant information about risk, impacts and adaptation options are some of the key inputs into land manager decision making and planning processes.

Digital libraries

Digital libraries are, as the name suggests, digital analogues of the traditional library. The library metaphor implies a collection that is systemised, discoverable and has methods for access and distribution. A digital library, as an asynchronous form of science communication, has disadvantages as it affords limited opportunity for collaborative engagement with end-user and so amplifying failings identified with the information deficit model of science communication. The advantage of digital forms of libraries is the redefinition of the library metaphor to include aspects that may not be able to be undertaken with physical libraries such as the social environment within which the library operates made up of a community of users with specific information needs and uses (Saracevic 2000). As the climate cloud operates within

a defined community, it allows the library functions to be influenced by Bourdieu's theory of practise (Bourdieu 1990, 1997, 1998; Bourdieu and Wacquant 1992). The theory can inform the design of the library affordances to enhance the practise of users.

Bourdieu developed a series of conceptual tools for thinking about 'reasonable action', which aligns with the goals of this project; reasonable action is the assessment of climate change impacts on primary sector businesses with an evaluation of the mitigation or adaptive actions now or in the future that may need to be undertaken (Bourdieu 1998). The tools consist of concepts of field, agent, capital, and habitus. Briefly, the field is a structured place where action occurs and has certain rules, schemas, power, worldviews and opinions. The field is made up from a network of complex relations between people (agents) and institutions. Agents have some quantity of different types of capital which empower their operation within the field. Bourdieu identified four types capital within his framework of practise: Economic - social standing, status and networks; Cultural - the innate knowledge to undertake something 'correctly' or as possessing acknowledged expertise within a field; and Symbolic capital - capital that is awarded as opposed to being personally acquired.

Habitus is the hallmark concept of Bourdieu's theory; it is the dispositions, perceptions, outlook, orientation and action that agents have learnt or absorbed from childhood i.e. from our cultural history (Free and Macintosh 2009). It affects what we see, what we don't see and how we act; i.e. how agents respond and anticipate almost instinctively. It is both structuring and structured – i.e. it both imprints us and also grows through experiences (Schiff 2009, Free and Macintosh 2009). Habitus is focused on the practical, i.e. expressed in the current. It is subject to modification such as when it no longer makes sense or that by changing, one can improve their status (capital) within the field. Habitus also 'makes a virtue of necessity' where agents will incline to the inevitable (Webb et al. 2002, p. 42) as noted in Free and Macintosh (2009) analysis of Enron.

These concepts are relational; they are interlinked and integratively explain social behaviour, e.g. power relations in the field between agents is governed by the amount of capitals that agents have or can acquire, and their ability to trade capital types – e.g. trading using a symbolic capital of a knighthood to get economic capital. Habitus requires a field and which produces practise, for example, Free and Macintosh (2009) explore changes in habitus with respect to changes in Enron's management culture and the impacts that had on Enron's collapse.

Using Bourdieu's framework to help define the digital library

Bourdieu's framework allows us to place a digital library – an information resource – within a social context of use and action. It acknowledges that the success of a website is a social construct which can be analysed and designed by using the Bourdieuian tool box (e.g. Ellis 2008).

The climate cloud is situated within a field of land-based resource management and climate change and is further refined by climate change science including climate interactions with biological processes, risk analysis, adaptation as well as human behaviour, psychology, learning and economics. The habitus of the field of climate change are largely socially constructed, i.e. the public perception of climate change is somewhat contested in the public arena but not anywhere near as much within the science community (Oreskes 2004) and influenced by aspects such as the psychological aspects of near-term and long-term risk (Centre for Research and Environment Decisions 2009).

The field is modelled as consisting of three tiers of agents. The 1st tier is made up of land based managers, the farmers, foresters, horticulturists that are working day to day within the primary sector. The 2nd tier consists of knowledgeable professional advisors to tier 1, such as farm advisors, extension officers, some sales people and professional consultants. The 3rd tier includes others who have input into the sector by providing some more focused services such as banking and insurance, or who operate within the policy or the regulatory environment. An additional agent is the climate cloud itself, as it has capital and can influence the habitus of the field.

While an in-depth analysis of habitus and capitals within a climate change field is outside the scope of the project, the library can help change some aspects of the habitus and capitals that agents can have. The changes to habitus and capitals revolve around:

- Locating agent sources of information about climate change within a collection of evidence based resources.

- Providing a range of resources from fact sheets to the science reports which are largely agent orientated.
- Addressing the trustworthiness of science by allow access to a wide range of science and to the scientific process that developed the current understanding of conclusions which addresses, for example, an illusion that climate change science is highly contested.
- Providing the ability to learn, by affording the enhancement of social and cultural capitals in agents as resilience and adaptive capacity is developed from 'paying explicit attention to learning about past, present and future climate threats, accumulated memory of adaptive strategies and anticipatory action to prepare for surprises and discontinuities in the climate system' (Tschakert and Dietrich 2010).
- Empowering agents that operate in the 'shadow' or informal spaces within institutions or organisations that allow exploration, learning and reflection (Pelling et al. 2008).
- Addressing some of the deficiencies of the information deficit model.

Information deficit

The information deficit model (e.g. Sturgis and Allum 2004) is where science is seen as 'one-way flow from science to publics' (Gross 1994, p. 6) and is based on an assumption of a universal appreciation of the value of science, such that it is a communication from a science sufficiency to a public deficiency, as Gross states, it assumes a 'focus [on] the state of science not the situation of the public' (Gross 1994, p. 6). The information deficit model has three criticisms: (i) assuming public trust in science; (ii) ignoring the social context of the science where ethics, values and politics are of equal importance in public perception; and (iii) isolating science from the public context that makes the issue important. The climate cloud implementation addresses some of these criticisms by including a wide range of science reports written at different levels, from factsheets to science reports. This allows end-users to develop understanding of how conclusions are met and the assumptions that may be assumed in the analysis. The climate cloud primarily has reports and science that are grounded within the field of the agents so that agents can assess impacts on ethics, values and politics as well as the extended climate change context.

Public science-literacy development needs to focus on developing public knowledge about the field, where knowing or understanding information can make a difference to an agent, i.e. increase or enhance their social, cultural, economic or symbolic capitals. Gross (1994) references an assessment of science literacy where 40% of the public didn't know that Aids was caused by a virus, his comment is that it does not really make a tangible difference to the public to know that.

Gross (1994) redefines the deficit model to be used where the 'transfer of relevant knowledge in situations where public health and safety are clearly at stake' (Gross 1994 p 9). The climate cloud communication is not a public safety and health concern, but it is importantly focused on the risks and impacts that are expected to occur at some level and in the future that could have an effect on land-based business as they are currently managed; such as increase incidences of drought, or as sea level rise occurs the increased frequency of extend coastal flooding. The library addresses the future potential changes in agent economic, social and cultural capitals. What the climate cloud isn't attempting to do is to inform the stakeholders and wider public on climate change, nor to improve climate science literary.

Within the constraints of an asynchronous system, some of the deficiency of an information model has been addressed in the design and operation of the digital library:

- Resources are those that are seen as potentially relevant to the end users, in that they provide information that to support planning and decision making. i.e. the library focused on science that provides relevant and useable knowledge to end users.
- Trust is enhanced and developed by having a review process for inclusion of relevant resources into the library. All relevant resources developed by science organisations such as NZ CRI's, NZ Universities, and Government and some overseas agencies are included, these resources are not further vetted. (Any further exclusions are due to copyright restrictions).

Climate Cloud design

The library has been developed in Microsoft SharePoint software and will be available at the web address – www.climatecloud.co.nz. The front page is given in Figure 1.

Figure 1. Climate Cloud Front page
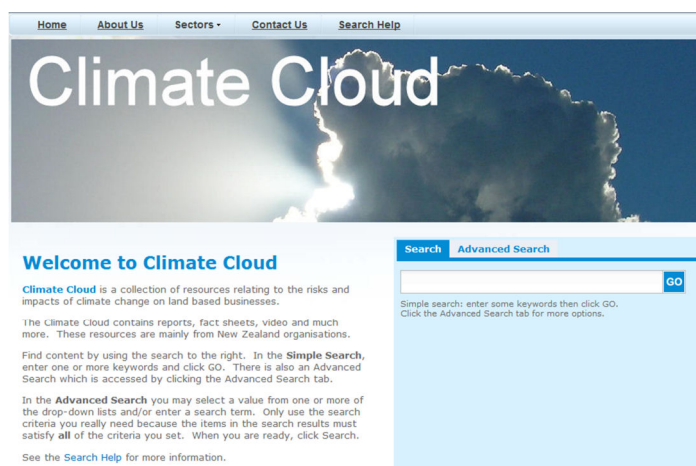
The key design elements that comprise the library are: Metadata that describes the resources; a subject & geographic taxonomy; a formal review process of inclusion of resources; a permission process so that resources can be immediately downloaded; and the storage of the resource rather than links to it.

The climate cloud uses metadata from the Dublin core metadata initiative (DCMI) element set supplemented by items from the DCMI meta type vocabulary[4]. The key elements are given in The permission process is based on obtaining the digital resources from providers with a permission statement either directly or from the resource, or from the download site. Most NZ Government websites have enacted usage policies that reflect the aims of New Zealand Government open access licensing framework (NZGOAL) which has a Creative Commons share-alike license at its starting point for Government resources.

Table 1, with additional metadata (not listed) providing process status and QA/QC information.

The metadata elements of subject, sector, location, type and audience are a further defined with taxonomies and are implemented using SharePoint's structured lists. The subject metadata item taxonomy is based on known climate change risks, impacts, and adaptation. The list is hierarchical, in that further specialisations can be added to more precisely define the subject. Figure 5 show the first level. Subject items are non-exclusive as each resource can have multiple subject categories assigned. The place name uses a hierarchical list, nominally based on the Getty Thesaurus of Geographic Names[5].

The review process is a two level review. Level 1 accepts items where it is a book, chapter in a book, science report or a scientific journal article written on a relevant topic (e.g. climate change effects on NZ's primary sector; agricultural greenhouse gas emissions; managing climate variability or adapting to climate change for the rural sector). The main emphasis for level 1 is that the library will accept science publications that have a presumption for peer-review. The Level 2 review is for resources that didn't meet level 1, and is based on whether the authors are from recognised scientific institutions or societies; or for science-based resources the scientific results are from recognised sources, where new scientific results can be linked to a recognised study or research group including industry groups. For other resources (e.g. related to government policies, markets, end-user workshops, case studies, etc.), the information appears to be well-founded (e.g. is based on a traceable report, study or website associated with a recognised and reliable source). Options include the reviewer to ask for a second opinion of the classification. The review process will exclude opinion pieces from the library such as newspaper articles or material written in response to climate change policy.

The permission process is based on obtaining the digital resources from providers with a permission statement either directly or from the resource, or from the download site. Most NZ Government websites have enacted usage policies that reflect the aims of New Zealand

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[4] http://dublincore.org/documents/dcmi-terms/
[5] http://www.getty.edu/research/tools/vocabularies/tgn/

Government open access licensing framework (NZGOAL)[6] which has a Creative Commons share-alike license at its starting point for Government resources.

Table 1. Key metadata elements

Field name	Description	Dublin Core
Title	The title of digital resource.	DCType:Title
Author	The names of the authors or the organisation	DCType:creator
Date Published	Publication date of the resource.	DCType:Created
Publication Name	Name of publication	DCType:bibliographicCitation
Citation Details	Sufficient bibliographic detail to identify the resource as unambiguously as possible	DCType:Bibliographic Citation
Publisher	An entity responsible for making the resource available	DCType:Publisher
Resource Type	The type of resource	
Bibliographic Identifiers	One or more digital identifiers (DOI).	DCType:Identifier
Language	A language of the resource	DCType:Language
Audience	Class of entity for whom the resource is intended or useful.	DC:terms:Audience
Level	The level of detail	
Subject	Science context of resource	DCType:subject
Sector	Primary sector(s)	
Location	A geographic place to which the resource applies.	
Copyright Holder	Who ultimately holds the copyright and various property rights.	DC:Terms:RightsHolder
Type	The file format or physical medium of the resource.	DCType:Format

Search is implemented with the addition of the Ontolica Search[7] environment. The front page provides a simple box where any word can be entered (Figure 1), affording full-text and the metadata taxonomic searches. An advanced search option (Figure 1, Figure 3 and Figure 4) allow for searching based on different metadata categories. Figure 2 shows the results of a search, where the Ontolica product provides a document preview, extra information about resources in the results list, and use of search refiners based in metadata list categories. The refiners for subject are shown in Figure 5 where the + sign indicates a further sub hierarchy.

Searching within a database typically can be restricted by user knowledge of search keywords and how they relate to their situation. Sector and theme pages are being developed to assist new users with a brief subject introduction and a list of key resources in the library. Pages are developed for each primary sector. The sector information is summarised from Nottage et al. (2012).

Where possible copies of resources are stored in the library and are available for download by users. Where there are restrictions, typically copyright, a 'place holder' template is developed with the full metadata and abstract and a hyper-link to the resource. For reason of space, video files are stored on an independent site and placeholder metadata is developed for the library.

The digital library content, at May 2013, contains ~700 (of 1300) resources where there is clear permission to publish. The library is due for public release c. Dec 2013.

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[6]http://nzgoal.info/
[7] http://www.surfray.com/

Figure 2. Partial view of search results page
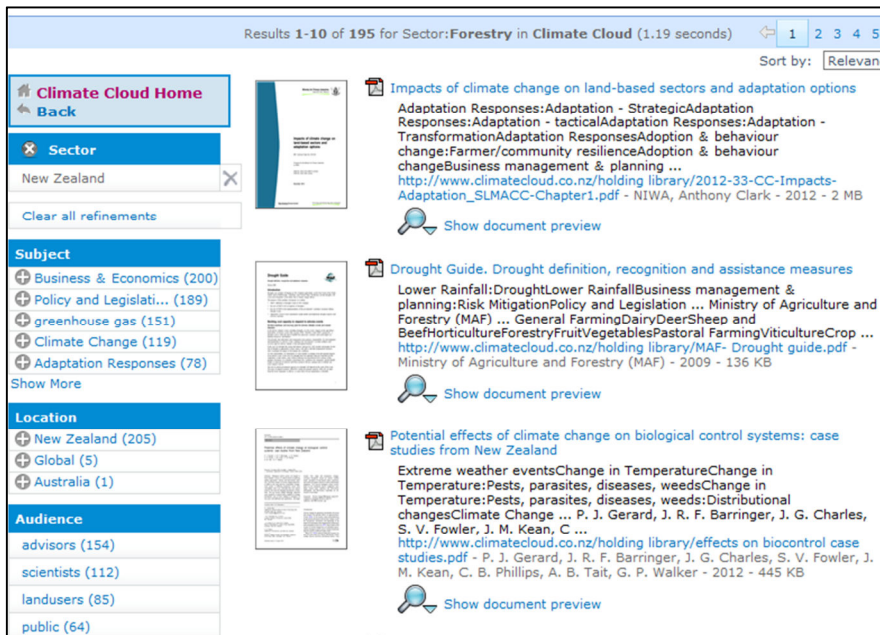

Figure 3. Top level subject categories in advanced search
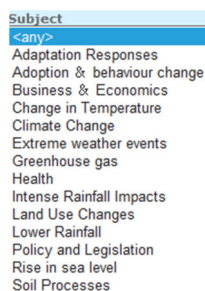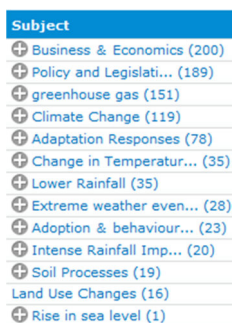

Figure 4. Sector options for advanced search

Figure 5. Subject refiners

Final word

Digital libraries and the climate cloud has a place in informing end users and the public on climate change albeit with limited functions and affordances for developing full engagement with end-users on climate change.

The library does for the first time collate a significant amount of the New Zealand relevant and reliable information on climate change in one place, which affords uses the ability to learn and develop a knowledge base from which they can inform their decision making increasing capital. The large body of material that reinforces the science consensus that land managers need to critically assess risks, impacts and vulnerabilities of a changing climate on their business, it allows users to assess the assumptions and conclusions that have been derived from the science and fits those into their own value systems.

The wider project addresses further communication by developing resources that are responsive and applicable to particular end-users needs and will consider how feedback mechanisms such as social media or sematic wiki's can enhance two-way interactions with end-user and scientists.

The next steps are a further review of functionality, the inclusion of video and audio resources. An analysis of content by subject and content will commission some shorter more plain English versions of some reports. To aid discovery of introductory material, sector and theme pages are being developed that summarise current knowledge and that identify the key resource material for ach sector or theme. Further work will address whether communication and engagement can be enhanced with the use of social media.

Acknowledgements

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