Edgar: Improving research and understanding of climate change through public engagement and education

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ABSTRACT

Climate change is occurring and research on climate change and its potential impacts is largely remaining in the scientific literature. Similarly, there is a vast amount of largely untapped knowledge of our natural ecosystems associated with the general public. The Edgar project has built an interactive website that aims to make available to the general public the current research on the impact of climate change on Australian bird species and involve them in assisting with improving the research by contributing to the quality of the input datasets. Thus, not only is the quality of the research improved, the knowledge of the potential impacts of climate change are transferred to all end-users (general public, conservation managers, decision-makers, etc.) in a transparent, easy-to-understand way. The project makes use of the data available from the Atlas of Living Australia and has been funded by the Australian National Data Service Applications project and the Queensland Cyber Infrastructure Foundation.

INTRODUCTION

Currently there is a general lack of engagement and knowledge transfer between professional researchers and end-users of research (general public, conservation managers, decision-makers, etc.). This is reflected in a general lack of acceptance and acknowledgement by the general public of the potential impacts of climate change. Indeed, the ABC reported 27 June 2011 that

> *"The Lowy Institute's annual poll asked about 1,000 people for their opinions ... The poll shows that there has been a steep fall in the number of Australians who think climate change is a serious problem which needs addressing now."*

There is further, a relatively untapped resource of knowledge, the general public, that researchers generally ignore due to lack of efficient methods to extract this information. For example, research individuals or groups spend considerable time and effort to bring together information on where species occur; this information comes from museums, published literature, government agencies, etc.. Despite the quality of the data sources, the problem is that substantial effort is still required to verify the accuracy of the locations and identifications. Currently, researchers must either a) assume the observations are correct (removing only blatantly incorrect records such as terrestrial species being observed in the ocean), or b) using painstaking manual processes whereby observations are presented as hardcopy maps to "species experts". These experts then write metadata (e.g. provenance information), corrections, and other information about further records on the maps and return the comments for interpretation. This is a cumbersome, labour-intensive, and error-prone process that needs to be repeated for each project. However, this data vetting need not be done by 'species experts' – there is often knowledgeable public that could be used given the appropriate method.

The purpose of Edgar was to overcome these limitations by allowing a broad range of end-users to a) explore with the potential impacts of climate change on bird species in Australia; and b) engage the public in improving our understanding of the species by using their knowledge and time to verify species observations and distributions.

This tool that reuses publically available data associated with Atlas of Living Australia (ALA) and the Tropical Data Hub and open-source methods to ensure transparency.

DESIGN

The project design has been challenging in that we have 3 distinct user groups who need to be satisfied:

- researchers who want access to data,
- knowledgeable public (e.g. birders, twitchers and backyard enthusiasts) that can provide information and quality check reported observations of species and who can assess the likely limits to a species range, and
- general public, managers, policy makers, etc. who want to understand more about climate change impacts.

For the researchers, we need to be able to provide them with sufficient information about the model generation process to enable them to use the output datasets in an informed manner. Knowledgeable public need an easy-to-use interface that will make the verifying of observations and distributions as painless as possible. The general public need a simple to use and understand site that presents the information without an overload of technical jargon. All users expect a beautiful website that works equally well on desktop and mobile devices.

OUTPUTS

First and foremost, the project produces a clean, easy-to-use interface for anyone to explore the potential impacts of climate change on Australian birds. This was vital to ensuring education on climate change impacts. It allows people to explore where a species occurs today and how this may change into the future.

Second, the project produces a continuously improving suite of model inputs and outputs (data) that serve to improve our understanding of climate change. Users visiting the project website can both browse visual representations of all data and download it from the site or from the Tropical Data Hub.

Three datasets are available. The first production of data is a 'cleaned' collection of species observation records. This is comprised of observation records imported from Atlas of Living Australia (ALA) and filtered through:

- invalid record removal based on ALA metadata;
- plausibility checking based on species ranges supplied by BirdLife Australia (http://www.birdlife.org.au/);
- crowd-sourced classification of observations (through Edgar); and
- manual resolution of conflicting classifications

in order to select only those observations that represent genuine survival in the wild.

The second dataset is the suite of current and future climate surfaces. These are sourced from Climascope (http://climascope.wwfus.org) and are rescaled to be appropriate for Australian coverage. Updates of these climate surfaces occur as new climate projections become available.

The third production of data is a set of current and future climate suitability maps for each species. These use the cleaned observation records and the Maxent algorithm[1] to calculate climatological sensitivities for the species; the sensitivities are to mapped to display the species distribution across Australia for both current and future climate scenarios.

The production data sets are regenerated as new information is obtained and the updated data is immediately available. Dataset descriptions in metadata stores are periodically updated to reflect the latest information.

REFERENCES

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ABOUT THE AUTHOR(S)

Dr Jeremy VanDerWal is spatial ecologist and a Senior Research Fellow at the Centre for Tropical Biodiversity and Climate Change, James Cook University. His research is focussed on assessing the potential impacts of past, present and future climate on the distribution and abundance of species. Although much of his research explores ecological theories with applied aspects, Dr VanDerWal is also interested in ensuring the science is not just 'theoretical' but rather is used to engage and inform a wide variety of end-users.

Professor Ian Atkinson is the Director of the eResearch Centre, James Cook University. Ian has a background in computational chemistry that led him to the world of Supercomputing. More recently he has been engaged in e-Research and grid computing service development. He has a long-standing interest in eResearch methods, tools, scientific data management and user interfaces for HPC tools.

Marianne Brown is the project manager for the Tropical Data Hub projects at the eResearch Centre, James Cook University. She has a masters degree in Computer Science and has worked in the IT industry since 1994 in a variety of roles from research programmer, university lecturer, software engineer and systems analyst and designer. She has worked at the eResearch Centre at JCU since 2009, working on various web applications projects and has been involved in several ANDS/QCIF funded projects.

Daniel Baird has bachelor degrees in Psychology and Computer Science, and has worked in software and technology for fifteen years. His experience ranges though the retail, higher education and corporate sectors. Daniel has developed commercially deployed software in Borland Delphi, Java Swing, C++Builder, PHP, Microsoft Access, Crystal Reports, ColdFusion, Ruby, and web technologies. He has been a significant contributor to the TiddlyWiki community and with Simon Baird, founded the wiki hosting site tiddlyspot.com.

Robert Pyke is currently completing a double degree in Computer Systems Engineering and Information Technology. Robert has worked as a software engineer for the last five years. He has experience in a wide variety of technologies including mobile applications, web application frameworks and custom language parses. He is an active member of the developer community, routinely publishing his code on-line, and participating in various coding competitions.

Tom Dalling graduated from JCU with a double degree in IT and Business in 2009. He was employed as a website developer during 2007, and has been doing web development on a freelance basis since then. After graduating he started working as an OSX software developer.