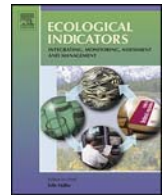


US EPA ARCHIVE DOCUMENT



Short communication

# Digital repository of associations between environmental variables: A new resource to facilitate knowledge synthesis



C. Richard Ziegler<sup>a,\*</sup>, J. Angus Webb<sup>b,c</sup>, Susan B. Norton<sup>a</sup>, Andrew S. Pullin<sup>d</sup>,  
Andreas H. Melcher<sup>e</sup>

<sup>a</sup> Office of Research and Development, United States Environmental Protection Agency, 1200 Pennsylvania Avenue, NW (8623-P), Washington, DC 20460, United States

<sup>b</sup> Department of Resource Management and Geography, The University of Melbourne, Parkville 3010, Victoria, Australia

<sup>c</sup> Department of Infrastructure Engineering, The University of Melbourne, Parkville 3010, Victoria, Australia

<sup>d</sup> Centre for Evidence-Based Conservation, School of Environment, Natural Resources and Geography, Bangor University, Bangor LL57 2UW, United Kingdom

<sup>e</sup> Department of Water, Atmosphere and Environment, University of Natural Resources and Life Sciences (BOKU), Max Emanuel-Strasse 17, 1180 Vienna, Austria

## ARTICLE INFO

### Article history:

Received 6 February 2014

Received in revised form

24 December 2014

Accepted 2 January 2015

### Keywords:

Environmental assessment

Systematic review

Meta-analysis

Bibliometrics

Informatics

Crowdsourcing

## ABSTRACT

Responsible care and management of Earth's resources requires scientific support, but the pool of under-used research is growing rapidly. Environmental science research studies describe associations between variables (e.g. statistical relationships between stressors and responses). We propose open-access and online sharing of such associations. This concept differs from various efforts around the world to promote sharing of primary research data, but holds similar goals of improved use of existing knowledge. The initiative is made possible by recent developments in information technology and evolving online culture (e.g. crowdsourcing and citizen science). We have begun to connect existing projects that catalog and store associations, thereby moving toward a single virtual repository. Researchers and decision makers may share and re-use associations for myriad purposes, including: increasing efficiency and timeliness of systematic reviews, environmental assessments and meta-analyses, identifying knowledge gaps and research opportunities, providing evolved metrics of research impact, and demonstrating connections between research and environmental improvement.

© 2015 Published by Elsevier Ltd.

## 1. Introduction

Environmental managers and policy makers require timely and quality scientific support for effective assessments, decision making and actions (e.g. [Abbot, 2009](#); [Cane, 2010](#)). There is a critical need for mechanisms to help organize and distil the vast scientific literature to support these activities (e.g. [Parr et al., 2012](#)). However, while the published paper has long been the accepted means of disseminating research findings, "It isn't the documents which are actually interesting, it is the things they are about!" ([Berners-Lee, 2007](#)).

Imagine therefore being able to efficiently access summarized findings of all research studies on a chosen environmental topic. Findings from studies can be extracted, atomized, and stored,

thereby facilitating retrieval, synthesis and sharing with wide audiences beyond what is easily achievable with a collection of written manuscripts. The challenge is to manage and/or summarize research findings so that they can be discovered and re-used by investigators asking new or different questions. Multiple types of information from the fields of ecology and environmental science have been, or could be, cataloged and shared ([Table 1](#)). Our focus is on a specific sub-set of research findings – associations between two variables.

Associations are of particular interest because they often provide evidence of underlying causal processes that produced them. For example, one variable may directly cause another, or the exact causal web may be complex ([Pearl, 2009](#)). Importantly, associations are raw findings from research studies rather than the study author's interpretation of those findings. In environmental studies, an association typically has three parts: the statistical dependence (1) between a stressor, driver or condition (2) and an observed response (3). For example, [Mims and Olden \(2012\)](#), examining responses of fish assemblages to hydrologic alteration, found a statistically significant positive association (dependence)

\* Corresponding author. Tel.: +1 703 347 8554; mobile: +1 202 577 9031.

E-mail addresses: [ziegler.rick@epa.gov](mailto:ziegler.rick@epa.gov), [zieglermail@yahoo.com](mailto:zieglermail@yahoo.com) (C.R. Ziegler), [angus.webb@unimelb.edu.au](mailto:angus.webb@unimelb.edu.au) (J.A. Webb), [norton.susan@epa.gov](mailto:norton.susan@epa.gov) (S.B. Norton), [a.s.pullin@bangor.ac.uk](mailto:a.s.pullin@bangor.ac.uk) (A.S. Pullin), [andreas.melcher@boku.ac.at](mailto:andreas.melcher@boku.ac.at) (A.H. Melcher).