



Ecosphere Ecology Ecological Monographs Ecological Applications Frontiers Bulletin Ecological Archives

ESA Publications Home Online Journals Home EcoTrack Subscriptions

Quick Search

[All Publications](#) > [Ecological Applications](#) > [September 2011](#) > Spatial covariation between freshwater and terrestrial ecosystem servi... [Advanced Search](#)

Volume 21, Issue 6 (September)

[< Previous](#) [Next >](#)



[Current Issue](#)  
[Available Issues](#)  
[Preprints](#)

Share this Article

[Share](#) |

Journal Information

ISSN: 1051-0761  
Frequency: 8 times per year

[Mission and Scope](#)

[Types of contributions](#)

[Editorial Board](#)

[Staff](#)

[Instructions for Authors](#)

[Reviewer Guidelines](#)

[Permissions](#)

[< Previous Article](#)

Volume 21, Issue 6 (September 2011)

[Next Article >](#)

[Add to Favorites](#)

| [Email](#)

| [Download to Citation Manager](#)

| [Track Citations](#)

| [Permissions](#)

[Full-text](#)

[PDF](#)

Holland, Robert A., Felix Eigenbrod, Paul R. Armsworth, Barbara J. Anderson, Chris D. Thomas, Andreas Heinemeyer, Simon Gillings, David B. Roy, and Kevin J. Gaston. 2011. Spatial covariation between freshwater and terrestrial ecosystem services. *Ecological Applications* 21:2034–2048. <http://dx.doi.org/10.1890/09-2195.1>

Articles

### Spatial covariation between freshwater and terrestrial ecosystem services

Robert A. Holland,<sup>1,6</sup> Felix Eigenbrod,<sup>1,7</sup> Paul R. Armsworth,<sup>1,8</sup> Barbara J. Anderson,<sup>2</sup> Chris D. Thomas,<sup>2</sup> Andreas Heinemeyer,<sup>3</sup> Simon Gillings,<sup>4</sup> David B. Roy,<sup>5</sup> and Kevin J. Gaston<sup>1,9</sup>

<sup>1</sup>Biodiversity and Macroecology Group, Department of Animal and Plant Sciences, University of Sheffield, Sheffield S102TN United Kingdom

<sup>2</sup>Department of Biology, P.O. Box 373, University of York, York YO105YW United Kingdom

<sup>3</sup>Stockholm Environment Institute and Centre for Terrestrial Carbon Dynamics (York Centre), Department of Biology, Grimston House, University of York, York YO105DD United Kingdom

<sup>4</sup>British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP242PU United Kingdom

<sup>5</sup>NERC Centre for Ecology and Hydrology, Wallingford, Crowmarsh Gifford, Wallingford, Oxfordshire OX108BB United Kingdom

To inform the design and implementation of land-use policies that consider the variety of goods and services people derive from ecosystems, it is essential to understand spatial patterns of individual services, how multiple services relate to each other, and how these relationships vary across spatial scales and localities. Despite the importance of freshwater as a determinant of regional economic and human demographic patterns, there are surprisingly few studies that map the provision of a range of services associated with the quality of the aquatic environment. Here we examine relationships between indicators of riverine water and associated habitat quality, freshwater biodiversity, three terrestrial ecosystem services, and terrestrial biodiversity across England and Wales. The results indicate strong associations between our indicators of freshwater services. However, a comparison of these indicators of freshwater services with other ecosystem services (carbon storage, agricultural production, recreation) and biodiversity of species of conservation concern in the surrounding terrestrial landscape shows no clear relationships. While there are potential policy “win–wins” for the protection of multiple services shown by associations between indicators of freshwater services and carbon storage in upland areas of Britain, the other ecosystem services showed either negative or no relationships with the indicators of freshwater services. We also consider the influence that spatial scale has on these relationships using River Basin Districts. Our results indicate that relationships between indicators of services can change dramatically depending on the societal pressures and other regional conditions. Thus, the delivery of multiple ecosystem services requires the development of regional strategies, or of national strategies that take account of regional variation.

Key words: [biodiversity](#), [Britain](#), [catchments](#), [conservation strategies](#), [England and Wales](#), [ecosystem services](#), [freshwater](#), [land-use policies](#), [River Basin Districts](#)

Received: November 24, 2009; Revised: December 1, 2010; Accepted: December 6, 2010

<sup>6</sup>Present address: Freshwater Biodiversity Unit, IUCN Species Programme, 219c Huntingdon Road, Cambridge CB30DL United Kingdom.

<sup>7</sup>Present address: School of Biological Sciences, University of Southampton, Southampton SO167PX United Kingdom.

<sup>8</sup>Present address: Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee 37996-1601 USA.

<sup>9</sup>Corresponding author. Present address: Environment and Sustainability Institute, University of Exeter, Peter Lanyon Building, Treliether Road, Penryn, Cornwall, TR10 9EZ United Kingdom. E-mail: [k.j.gaston@sheffield.ac.uk](mailto:k.j.gaston@sheffield.ac.uk)

### Cited by

Hilary Ford, Angus Garbutt, Davey L. Jones, Laurence Jones. (2012) Impacts of grazing abandonment on ecosystem service provision: Coastal grassland as a model system. *Agriculture, Ecosystems & Environment* **162**, 108–115  
Online publication date: 1-Nov-2012.  
[CrossRef](#)

M. A. Palmer, C. M. Febria. (2012) The Heartbeat of Ecosystems. *Science* **336**:6087, 1393–1394  
Online publication date: 15-Jun-2012.  
[CrossRef](#)

ESA Publications Office | 127 W. State Street | Suite 301 | Ithaca, NY 14850-5427 | phone 607-255-3221 | email [esa\\_journals@cornell.edu](mailto:esa_journals@cornell.edu)

Frontiers Editorial Office | 1990 M Street, NW | Suite 700 | Washington, DC 20036 | phone 202-833-8773 | email [frontiers@esa.org](mailto:frontiers@esa.org)

ESA Headquarters | 1990 M Street, NW | Suite 700 | Washington, DC 20036 | phone 202-833-8773 | email [esahq@esa.org](mailto:esahq@esa.org)

Copyright Ecological Society of America. All rights reserved.

