

UC Riverside

UC Riverside Previously Published Works

Title

The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project

Permalink

<https://escholarship.org/uc/item/25c0k7hx>

Journal

Ecology and Evolution, 7(1)

ISSN

2045-7758

Authors

Hudson, Lawrence N
Newbold, Tim
Contu, Sara
et al.

Publication Date

2017

DOI

10.1002/ece3.2579

Peer reviewed

The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project

Lawrence N. Hudson^{1*}  | Tim Newbold^{2,3*} | Sara Contu¹ | Samantha L. L. Hill^{1,2} | Igor Lysenko⁴ | Adriana De Palma^{1,4} | Helen R. P. Phillips^{1,4} | Tamera I. Alhusseini⁵ | Felicity E. Bedford⁶ | Dominic J. Bennett⁴ | Hollie Booth^{2,7} | Victoria J. Burton^{1,8} | Charlotte W. T. Chng⁴ | Argyrios Choimes^{1,4}  | David L. P. Correia⁹ | Julie Day⁴ | Susy Echeverría-Londoño^{1,4} | Susan R. Emerson¹ | Di Gao¹ | Morgan Garon⁴ | Michelle L. K. Harrison⁴ | Daniel J. Ingram¹⁰ | Martin Jung¹⁰  | Victoria Kemp¹¹ | Lucinda Kirkpatrick¹² | Callum D. Martin¹³ | Yuan Pan¹⁴ | Gwilym D. Pask-Hale¹ | Edwin L. Pynegar¹⁵ | Alexandra N. Robinson⁵ | Katia Sanchez-Ortiz¹⁶ | Rebecca A. Senior¹⁴ | Benno I. Simmons⁴ | Hannah J. White¹⁷ | Hanbin Zhang¹⁶ | Job Aben^{18,19} | Stefan Abrahamczyk²⁰ | Gilbert B. Adum^{21,22} | Virginia Aguilar-Barquero²³ | Marcelo A. Aizen²⁴ | Belén Albertos²⁵ | E. L. Alcalá²⁶ | María del Mar Alguacil²⁷ | Audrey Alignier^{28,29} | Marc Ancrenaz^{30,31} | Alan N. Andersen³² | Enrique Arbeláez-Cortés^{33,34} | Inge Armbrecht³⁵ | Víctor Arroyo-Rodríguez³⁶ | Tom Aumann³⁷ | Jan C. Axmacher³⁸ | Badrul Azhar^{39,40} | Adrián B. Azpiroz⁴¹ | Lander Baeten^{42,43} | Adama Bakayoko^{44,45} | Andrés Báldi⁴⁶ | John E. Banks⁴⁷ | Sharad K. Baral⁴⁸ | Jos Barlow^{49,50} | Barbara I. P. Barratt⁵¹ | Lurdes Barrico⁵² | Paola Bartolommei⁵³ | Diane M. Barton⁵¹ | Yves Basset⁵⁴ | Péter Batáry⁵⁵ | Adam J. Bates^{56,57} | Bruno Baur⁵⁸ | Erin M. Bayne⁵⁹ | Pedro Beja⁶⁰ | Suzan Benedick⁶¹ | Åke Berg⁶² | Henry Bernard⁶³ | Nicholas J. Berry⁶⁴ | Dinesh Bhatt⁶⁵ | Jake E. Bicknell^{66,67} | Jochen H. Bihn⁶⁸ | Robin J. Blake^{69,70} | Kadiri S. Bobo^{71,72} | Roberto Bóçon⁷³ | Teun Boekhout⁷⁴ | Katrin Böhning-Gaese^{75,76} | Kevin J. Bonham⁷⁷ | Paulo A. V. Borges⁷⁸ | Sérgio H. Borges⁷⁹ | Céline Boutin⁸⁰ | Jérémy Bouyer^{81,82} | Cibele Bragagnolo⁸³ | Jodi S. Brandt⁸⁴ | Francis Q. Brearley⁸⁵ | Isabel Brito⁸⁶ | Vicenç Bros^{87,88} | Jörg Brunet⁸⁹ | Grzegorz Buczkowski⁹⁰ | Christopher M. Buddle⁹¹ | Rob Bugter⁹² | Erika Buscardo^{93,94,95} | Jörn Buse⁹⁶ | Jimmy Cabra-García^{97,98} | Nilton C. Cáceres⁹⁹ | Nicolette L. Cagle¹⁰⁰ | María Calviño-Cancela¹⁰¹ | Sydney A. Cameron^{102,103} | Eliana M. Canello¹⁰⁴ | Rut Caparrós^{25,105} | Pedro Cardoso^{78,106} | Dan Carpenter^{107,108} | Tiago F. Carrijo¹⁰⁹ | Anelena L. Carvalho⁷⁹ | Camila R. Cassano¹¹⁰ | Helena Castro⁵² |

*These authors contributed equally to this work.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2016 The Authors. *Ecology and Evolution* published by John Wiley & Sons Ltd.

Alejandro A. Castro-Luna¹¹¹ | Rolando Cerda B.¹¹² | Alexis Cerezo¹¹³ |
 Kim Alan Chapman¹¹⁴ | Matthieu Chauvat¹¹⁵ | Morten Christensen¹¹⁶ |
 Francis M. Clarke¹¹⁷ | Daniel F.R. Cleary¹¹⁸ | Giorgio Colombo¹¹⁹ | Stuart P. Connop¹²⁰ |
 Michael D. Craig^{121,122} | Leopoldo Cruz-López¹²³ | Saul A. Cunningham¹²⁴ |
 Biagio D'Aniello¹²⁵ | Neil D'Cruze¹²⁶ | Pedro Giovâni da Silva¹²⁷ | Martin Dallimer¹²⁸ |
 Emmanuel Danquah²¹ | Ben Darvill¹²⁹ | Jens Dauber¹³⁰ | Adrian L. V. Davis¹³¹ |
 Jeff Dawson¹³² | Claudio de Sassi¹³³ | Benoit de Thoisy¹³⁴ | Olivier Deheuvels^{135,136} |
 Alain Dejean^{137,138,139} | Jean-Louis Devineau¹⁴⁰ | Tim Diekötter^{141,142,143} |
 Jignasu V. Dolia^{144,145} | Erwin Domínguez¹⁴⁶ | Yamileth Dominguez-Haydar¹⁴⁷ |
 Silvia Dorn¹⁴⁸ | Isabel Draper¹⁰⁵ | Niels Dreber^{149,150} | Bertrand Dumont¹⁵¹ |
 Simon G. Dures^{4,152} | Mats Dynesius¹⁵³ | Lars Edenius¹⁵⁴ | Paul Eggleton¹ |
 Felix Eigenbrod¹⁵⁵ | Zoltán Elek^{156,157} | Martin H. Entling¹⁵⁸ | Karen J. Esler^{159,160} |
 Ricardo F. de Lima^{161,162} | Aisyah Faruk^{163,164} | Nina Farwig¹⁶⁵ | Tom M. Fayle^{4,166,167} |
 Antonio Felicioli¹⁶⁸ | Annika M. Felton¹⁶⁹ | Roderick J. Fensham^{170,171} |
 Ignacio C. Fernandez¹⁷² | Catarina C. Ferreira¹⁷³ | Gentile F. Ficetola¹⁷⁴ |
 Cristina Fiera¹⁷⁵ | Bruno K. C. Filgueiras¹⁷⁶ | Hüseyin K. Firincioğlu¹⁷⁷ |
 David Flaspohler¹⁷⁸ | Andreas Floren¹⁷⁹ | Steven J. Fonte^{180,181} | Anne Fournier¹⁸² |
 Robert E. Fowler¹⁰ | Markus Franzén¹⁸³ | Lauchlan H. Fraser¹⁸⁴ |
 Gabriella M. Fredriksson^{185,186} | Geraldo B. Freire-Jr¹⁸⁷ | Tiago L. M. Frizzo¹⁸⁷ |
 Daisuke Fukuda¹⁸⁸ | Dario Furlani¹¹⁹ | René Gaigher¹⁵⁹ | Jörg U. Ganzhorn¹⁸⁹ |
 Karla P. García^{190,191} | Juan C. Garcia-R¹⁹² | Jenni G. Garden^{193,194,195} |
 Ricardo Garilleti²⁵ | Bao-Ming Ge¹⁹⁶ | Benoit Gendreau-Berthiaume¹⁹⁷ |
 Philippa J. Gerard¹⁹⁸ | Carla Gheler-Costa¹⁹⁹ | Benjamin Gilbert²⁰⁰ | Paolo Giordani²⁰¹ |
 Simonetta Giordano¹²⁵ | Carly Golodets²⁰² | Laurens G. L. Gomes²⁰³ |
 Rachele K. Gould²⁰⁴ | Dave Goulson¹⁰ | Aaron D. Gove^{205,206} | Laurent Granjon²⁰⁷ |
 Ingo Grass^{55,165} | Claudia L. Gray^{10,208} | James Grogan²⁰⁹ | Weibin Gu²¹⁰ |
 Moisès Guardiola²¹¹ | Nihara R. Gunawardene²⁰⁶ | Alvaro G. Gutierrez²¹² |
 Doris L. Gutiérrez-Lamus²¹³ | Daniela H. Haarmeyer²¹⁴ | Mick E. Hanley²¹⁵ |
 Thor Hanson²¹⁶ | Nor R. Hashim²¹⁷ | Shombe N. Hassan²¹⁸ | Richard G. Hatfield²¹⁹ |
 Joseph E. Hawes²²⁰ | Matt W. Hayward^{221,222,223} | Christian Hébert²²⁴ |
 Alvin J. Helden²²⁰ | John-André Henden²²⁵ | Philipp Henschel²²⁶ | Lionel Hernández²²⁷ |
 James P. Herrera²²⁸ | Farina Herrmann⁵⁵ | Felix Herzog²²⁹ | Diego Higuera-Diaz²³⁰ |
 Branko Hilje²³¹ | Hubert Höfer²³² | Anke Hoffmann²³³ | Finbarr G. Horgan^{234,235} |
 Elisabeth Hornung²³⁶ | Roland Horváth²³⁷ | Kristoffer Hylander²³⁸ |
 Paola Isaacs-Cubides²³⁹ | Hiroaki Ishida²⁴⁰ | Masahiro Ishitani²⁴¹ | Carmen T. Jacobs¹³¹ |
 Víctor J. Jaramillo²⁴² | Birgit Jauker²⁴³ | F. Jiménez Hernández²⁴⁴ |
 McKenzie F. Johnson¹⁰⁰ | Virat Jolli^{245,246} | Mats Jonsell²⁴⁷ | S. Nur Juliani²⁴⁸ |
 Thomas S. Jung²⁴⁹ | Vena Kapoor²⁵⁰ | Heike Kappes²⁵¹ | Vassiliki Kati²⁵² |

Eric Katovai^{253,254} | Klaus Kellner²⁵⁵ | Michael Kessler²⁵⁶ | Kathryn R. Kirby²⁵⁷ |
 Andrew M. Kittle²⁵⁸ | Mairi E. Knight²⁵⁹ | Eva Knop²⁶⁰ | Florian Kohler²⁶¹ |
 Matti Koivula²⁶² | Annette Kolb²⁶³ | Mouhamadou Kone^{264,265} | *Ádám Kőrösi*^{156,266} |
 Jochen Krauss¹⁷⁹ | Ajith Kumar²⁶⁷ | Raman Kumar²⁶⁸ | David J. Kurz²⁶⁹ |
 Alex S. Kutt²⁷⁰ | Thibault Lachat^{271,272} | Victoria Lantschner²⁷³ | Francisco Lara¹⁰⁵ |
 Jesse R. Lasky²⁷⁴ | Steven C. Latta²⁷⁵ | William F. Laurance²⁷⁶ | Patrick Lavelle^{277,278} |
 Violette Le Féon²⁷⁹ | Gretchen LeBuhn²⁸⁰ | Jean-Philippe Légaré²⁸¹ |
 Valérie Lehouck²⁸² | María V. Lencinas²⁸³ | Pia E. Lentini²⁸⁴ | Susan G. Letcher²⁸⁵ |
 Qi Li²⁸⁶ | Simon A. Litchwark²⁸⁷ | Nick A. Littlewood²⁸⁸ | Yunhui Liu²⁸⁹ |
 Nancy Lo-Man-Hung²⁹⁰ | Carlos A. López-Quintero²⁹¹ | Mounir Louhaichi^{292,293} |
 Gabor L. Lövei²⁹⁴ | Manuel Esteban Lucas-Borja²⁹⁵ | Victor H. Luja²⁹⁶ |
 Matthew S. Luskin²⁶⁹ | M Cristina MacSwiney G²⁹⁷ | Kaoru Maeto²⁹⁸ | Tibor Magura²⁹⁹ |
 Neil Aldrin Mallari^{300,301} | Louise A. Malone³⁰² | Patrick K. Malonza³⁰³ |
 Jagoba Malumbres-Olarte³⁰⁴ | Salvador Mandujano³⁰⁵ | Inger E. Måren³⁰⁶ |
 Erika Marin-Spiotta³⁰⁷ | Charles J. Marsh³⁰⁸ | E. J. P. Marshall³⁰⁹ | Eliana Martínez³¹⁰ |
 Guillermo Martínez Pastur²⁸³ | David Moreno Mateos³¹¹ | Margaret M. Mayfield³¹² |
 Vicente Mazimpaka¹⁰⁵ | Jennifer L. McCarthy³¹³ | Kyle P. McCarthy³¹⁴ |
 Quinn S. McFrederick³¹⁵ | Sean McNamara³¹⁶ | Nagore G. Medina^{105,317} |
 Rafael Medina³¹⁸ | Jose L. Mena³¹⁹ | Estefania Mico³²⁰ | Grzegorz Mikusinski³²¹ |
 Jeffrey C. Milder^{322,323} | James R. Miller³²⁴ | Daniel R. Miranda-Esquivel³²⁵ |
 Melinda L. Moir^{284,326} | Carolina L. Morales³²⁷ | Mary N. Muchane³²⁸ |
 Muchai Muchane³²⁹ | Sonja Mudri-Stojnic³³⁰ | A. Nur Munira³³¹ |
 Antonio Muñoz-Alonso³³² | B. F. Munyekenye³³³ | Robin Naidoo³³⁴ | A. Naithani^{335,336} |
 Michiko Nakagawa³³⁷ | Akihiro Nakamura^{338,339} | Yoshihiro Nakashima³⁴⁰ |
 Shoji Naoe³⁴¹ | Guiomar Nates-Parra³⁴² | Dario A. Navarrete Gutierrez³⁴³ |
 Luis Navarro-Iriarte³⁴⁴ | Paul K. Ndong'ang'a^{345,346} | Eike L. Neuschulz⁷⁵ |
 Jacqueline T. Ngai³⁴⁷ | Violaine Nicolas³⁴⁸ | Sven G. Nilsson³⁴⁹ |
 Norbertas Noreika^{350,351} | Olivia Norfolk³⁵² | Jorge Ari Noriega³⁵³ |
 David A. Norton³⁵⁴ | Nicole M. Nöske³⁵⁵ | A. Justin Nowakowski³⁵⁶ |
 Catherine Numa³⁵⁷ | Niall O'Dea³⁵⁸ | Patrick J. O'Farrell^{359,360} | William Oduro^{21,361} |
 Sabine Oertli³⁶² | Caleb Ofori-Boateng^{363,364} | Christopher Omamoke Oke³⁶⁵ |
 Vicencio Oostra³⁶⁶ | Lynne M. Osgathorpe³⁶⁷ | Samuel Eduardo Otavo³⁶⁸ |
 Navendu V. Page³⁶⁹ | Juan Paritsis³⁷⁰ | Alejandro Parra-H³⁷¹ | Luke Parry^{372,373} |
 Guy Pe'er^{183,374} | Peter B. Pearman^{375,376} | Nicolás Pelegrin³⁷⁷ | Raphaël Pélissier^{378,379} |
 Carlos A. Peres³⁸⁰ | Pablo L. Peri^{381,382,383} | Anna S. Persson³⁴⁹ |
 Theodora Petanidou³⁸⁴ | Marcell K. Peters³⁸⁵ | Rohan S. Pethiyagoda³⁸⁶ | Ben Phalan³⁸⁷ |
 T. Keith Philips³⁸⁸ | Finn C. Pillsbury³⁸⁹ | Jimmy Pincheira-Ulbrich^{190,390} |
 Eduardo Pineda³⁹¹ | Joan Pino^{211,392} | Jaime Pizarro-Araya³⁹³ | A. J. Plumptre³⁹⁴ |

Santiago L. Poggio³⁹⁵ | Natalia Politi³⁹⁶ | Pere Pons³⁹⁷ | Katja Poveda³⁹⁸ |
 Eileen F. Power³⁹⁹ | Steven J. Presley⁴⁰⁰ | Vânia Proença⁴⁰¹ | Marino Quaranta⁴⁰² |
 Carolina Quintero³⁷⁰ | Romina Rader⁴⁰³ | B. R. Ramesh³⁷⁹ | Martha P. Ramirez-Pinilla⁴⁰⁴ |
 Jai Ranganathan⁴⁰⁵ | Claus Rasmussen⁴⁰⁶ | Nicola A. Redpath-Downing⁴⁰⁷ |
 J. Leighton Reid⁴⁰⁸ | Yana T. Reis⁴⁰⁹ | José M. Rey Benayas⁴¹⁰ | Juan Carlos Rey-Velasco⁴¹¹ |
 Chevonne Reynolds^{412,413} | Danilo Bandini Ribeiro⁴¹⁴ | Miriam H. Richards⁴¹⁵ |
 Barbara A. Richardson^{416,417} | Michael J. Richardson^{416,417} | Rodrigo Macip Ríos⁴¹⁸ |
 Richard Robinson⁴¹⁹ | Carolina A. Robles⁴²⁰ | Jörg Römbke^{421,422} |
 Luz Piedad Romero-Duque⁴²³ | Matthias Rös⁴²⁴ | Loreta Rosselli⁴²⁵ |
 Stephen J. Rossiter¹¹ | Dana S. Roth⁴²⁶ | T'ai H. Roulston^{427,428} | Laurent Rousseau⁴²⁹ |
 André V. Rubio⁴³⁰ | Jean-Claude Ruel⁹ | Jonathan P. Sadler⁴³¹ | Szabolcs Sáfián⁴³² |
 Romeo A. Saldaña-Vázquez⁴³³ | Katerina Sam^{194,434,435} | Ulrika Samnegård^{238,349} |
 Joana Santana⁶⁰ | Xavier Santos⁶⁰ | Jade Savage⁴³⁶ | Nancy A. Schellhorn⁴³⁷ |
 Menno Schilthuizen^{438,439} | Ute Schmiedel⁴⁴⁰ | Christine B. Schmitt^{441,442} |
 Nicole L. Schon⁴⁴³ | Christof Schüepp²⁶⁰ | Katharina Schumann⁴⁴⁴ | Oliver Schweiger¹⁸³ |
 Dawn M. Scott⁴⁴⁵ | Kenneth A. Scott⁴⁴⁶ | Jodi L. Sedlock⁴⁴⁷ | Steven S. Seefeldt⁴⁴⁸ |
 Ghazala Shahabuddin⁴⁴⁹ | Graeme Shannon^{223,450} | Douglas Sheil⁴⁵¹ |
 Frederick H. Sheldon^{452,453} | Eyal Shochat^{454,455} | Stefan J. Siebert²⁵⁵ |
 Fernando A. B. Silva⁴⁵⁶ | Javier A. Simonetti⁴³⁰ | Eleanor M. Slade²⁰⁸ | Jo Smith⁴⁵⁷ |
 Allan H. Smith-Pardo^{458,459} | Navjot S. Sodhi⁴⁶⁰ | Eduardo J. Somarriba¹¹² |
 Ramón A. Sosa⁴⁶¹ | Grimaldo Soto Quiroga^{112,462} | Martin-Hugues St-Laurent⁴⁶³ |
 Brian M. Starzomski⁴⁶⁴ | Constanti Stefanescu^{211,392,465} | Ingolf Steffan-Dewenter¹⁷⁹ |
 Philip C. Stouffer^{466,467} | Jane C. Stout³⁹⁹ | Ayrton M. Strauch⁴⁶⁸ | Matthew J. Struebig⁶⁶ |
 Zhimin Su^{469,470} | Marcela Suarez-Rubio⁴⁷¹ | Shinji Sugiura²⁹⁸ | Keith S. Summerville⁴⁷² |
 Yik-Hei Sung⁴⁷³ | Hari Sutrisno⁴⁷⁴ | Jens-Christian Svenning⁴⁷⁵ | Tiit Teder⁴⁷⁶ |
 Caragh G. Threlfall⁴⁷⁷ | Anu Tiitsaar⁴⁷⁶ | Jacqui H. Todd³⁰² | Rebecca K. Tonietto⁴⁷⁸ |
 Ignasi Torre⁴⁶⁵ | Béla Tóthmérész⁴⁷⁹ | Teja Tschardt⁵⁵ | Edgar C. Turner⁴⁸⁰ |
 Jason M. Tylman^{4,481} | Marcio Uehara-Prado⁴⁸² | Nicolas Urbina-Cardona⁴⁸³ |
 Denis Vallan⁴⁸⁴ | Adam J. Vanbergen⁴⁸⁵ | Heraldo L. Vasconcelos⁴⁸⁶ | Kiril Vassilev⁴⁸⁷ |
 Hans A. F. Verboven⁴⁸⁸ | Maria João Verdasca⁴⁸⁹ | José R. Verdú³²⁰ |
 Carlos H. Vergara⁴⁹⁰ | Pablo M. Vergara⁴⁹¹ | Jort Verhulst⁴⁹² | Massimiliano Virgilio⁴⁹³ |
 Lien Van Vu⁴⁹⁴ | Edward M. Waite⁴⁹⁵ | Tony R. Walker^{352,496} | Hua-Feng Wang⁴⁹⁷ |
 Yanping Wang⁴⁹⁸ | James I. Watling⁴⁹⁹ | Britta Weller¹⁸⁹ | Konstans Wells^{500,501} |
 Catrin Westphal⁵⁵ | Edward D. Wiawe⁵⁰² | Christopher D. Williams⁵⁰³ |
 Michael R. Willig^{504,505} | John C. Z. Woinarski⁴⁴⁶ | Jan H. D. Wolf⁵⁰⁶ |
 Volkmar Wolters²⁴³ | Ben A. Woodcock⁵⁰⁷ | Jihua Wu⁵⁰⁸ | Joseph M. Wunderle, Jr⁵⁰⁹ |
 Yuichi Yamaura³⁴¹ | Satoko Yoshikura⁵¹⁰ | Douglas W. Yu^{511,512} | Andrey S. Zaitsev^{243,513} |
 Juliane Zeidler⁵¹⁴ | Fasheng Zou⁵¹⁵ | Ben Collen³ | Rob M. Ewers⁴ |
 Georgina M. Mace³ | Drew W. Purves⁵¹⁶ | Jörn P. W. Scharlemann^{2,10} | Andy Purvis^{1,4}

- ¹Department of Life Sciences, Natural History Museum, London, UK
- ²United Nations Environment Programme World Conservation Monitoring Centre, Cambridge, UK
- ³Department of Genetics, Evolution and Environment, Centre for Biodiversity and Environment, Research, University College London, London, UK
- ⁴Department of Life Sciences, Imperial College London, Ascot, UK
- ⁵Imperial College London, South Kensington, London, UK
- ⁶Department of Zoology, Cambridge University, Cambridge, UK
- ⁷Frankfurt Zoological Society, Africa Regional Office, Arusha, Tanzania
- ⁸Science and Solutions for a Changing Planet DTP and the Department of Life Sciences, Imperial College London, South Kensington, London, UK
- ⁹Centre d'étude de la forêt., Université Laval, Laval, QC, Canada
- ¹⁰School of Life Sciences, University of Sussex, Brighton, UK
- ¹¹School of Biological and Chemical Sciences, Queen Mary University of London, London, UK
- ¹²School of Biological and Ecological Sciences, University of Stirling, Stirling, UK
- ¹³School of Biological Sciences, Royal Holloway University of London, Egham, Surrey, UK
- ¹⁴Department of Animal and Plant Sciences, University of Sheffield, Western Bank, Sheffield, UK
- ¹⁵School of Environment, Natural Resources and Geography, Bangor University, Bangor, Gwynedd, UK
- ¹⁶University College London, London, UK
- ¹⁷School of Biological Sciences, Queen's University Belfast, Belfast, UK
- ¹⁸Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, UK
- ¹⁹Evolutionary Ecology Group, University of Antwerp, Antwerp, Belgium
- ²⁰Nees Institute for Plant Biodiversity, University of Bonn, Bonn, Germany
- ²¹Wildlife and Range Management Department, Faculty of Renewable Natural Resources (FRNR), College of Agriculture and Natural Resources (CANR), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana
- ²²SAVE THE FROGS! Ghana, Adum-Kumasi, Ghana
- ²³Escuela de Biología, Universidad de Costa Rica, San José, Costa Rica
- ²⁴Laboratorio Ecotono-CRUB, Universidad Nacional del Comahue and INIBIOMA, Río Negro, Argentina
- ²⁵Departamento de Botánica, Facultad de Farmacia, Universidad de Valencia, Burjassot, Valencia, Spain
- ²⁶Marine Laboratory, Silliman University-Angelo King Center for Research and Environmental Management, Silliman University, Dumaguete City, Philippines
- ²⁷Department of Soil and Water Conservation, CSIC-Centro de Edafología y Biología Aplicada del Segura, Murcia, Spain
- ²⁸INRA, UR 0980 SAD-Paysage, Rennes Cedex, France
- ²⁹INRA, UMR 1201 DYNAFOR, Castanet Tolosan Cedex, France
- ³⁰HUTAN – Kinabatangan Orang-utan Conservation Programme, Kota Kinabalu, Malaysia
- ³¹Borneo Futures, Kota Kinabalu, Malaysia
- ³²CSIRO Land & Water Flagship, Winnellie, NT, Australia
- ³³Museo de Zoología, Facultad de Ciencias, Universidad Nacional Autónoma de México, México D.F., Mexico
- ³⁴Colección de Tejidos, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Valle del Cauca, Colombia
- ³⁵Biology Department, Universidad del Valle, Cali, Colombia
- ³⁶Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México, Morelia, Mexico
- ³⁷College of Science, Engineering & Health, RMIT University, Melbourne, Vic., Australia
- ³⁸UCL Department of Geography, University College London, London, UK
- ³⁹Biodiversity Unit, Institute of Bioscience, Universiti Putra Malaysia, Serdang, Malaysia
- ⁴⁰Faculty of Forestry, Universiti Putra Malaysia, Serdang, Malaysia
- ⁴¹Departamento de Biodiversidad y Genética, Instituto de Investigaciones Biológicas Clemente Estable, Montevideo, Uruguay
- ⁴²Forest & Nature Lab, Department of Forest and Water Management, Ghent University, Gontrode, Belgium
- ⁴³Terrestrial Ecology Unit, Department of Biology, Ghent University, Ghent, Belgium
- ⁴⁴UFR Science de la Nature, Université Naangui Abrogoua, Abidjan, Ivory Coast
- ⁴⁵Centre Suisse de Recherches Scientifiques en Côte d'Ivoire, Abidjan, Ivory Coast
- ⁴⁶MTA Centre for Ecological Research, Vácrátót, Hungary
- ⁴⁷University of Washington Tacoma, Tacoma, WA, USA
- ⁴⁸Northern Hardwoods Research Institute, Edmundston, NB, Canada
- ⁴⁹Lancaster Environment Centre, Lancaster University, Lancaster, UK
- ⁵⁰MCT/Museu Paraense Emílio Goeldi, Belém, Brazil

- ⁵¹AgResearch Limited, Invermay Agricultural Centre, Puddle Alley, Mosgiel, New Zealand
- ⁵²Centre for Functional Ecology, Department of Life Sciences, University of Coimbra, Coimbra, Portugal
- ⁵³COT (Tuscan Ornithological Society), Livorno, Italy
- ⁵⁴Smithsonian Tropical Research Institute, Balboa, Ancon, Panama City, Republic of Panama
- ⁵⁵Agroecology, Department of Crop Sciences, Georg-August University, Göttingen, Germany
- ⁵⁶Biosciences, School of Science & Technology, Nottingham Trent University, Clifton, Nottingham, UK
- ⁵⁷University of Birmingham, Edgbaston, Birmingham, UK
- ⁵⁸Section of Conservation Biology, Department of Environmental Sciences, University of Basel, Basel, Switzerland
- ⁵⁹Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada
- ⁶⁰CIBIO/InBio, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Vairão, Portugal
- ⁶¹Faculty of Sustainable Agriculture, Universiti Malaysia Sabah, Sandakan, Malaysia
- ⁶²The Swedish University of Agricultural Sciences, The Swedish Biodiversity Centre, Uppsala, Sweden
- ⁶³Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, Kota Kinabalu, Malaysia
- ⁶⁴School of Geosciences, University of Edinburgh, Edinburgh, UK
- ⁶⁵Department of Zoology & Environmental Science, Gurukula Kangri University, Haridwar, India
- ⁶⁶Durrell Institute of Conservation and Ecology (DICE), School of Anthropology and Conservation, University of Kent, Canterbury, UK
- ⁶⁷Iwokrama International Centre for Rainforest Conservation and Development, Georgetown, Guyana
- ⁶⁸Department of Ecology-Animal Ecology, Faculty of Biology, Philipps-Universität Marburg, Marburg, Germany
- ⁶⁹Compliance Services International, Pentlands Science Park, Penicuik, Edinburgh, UK
- ⁷⁰Centre for Agri-Environmental Research, School of Agriculture, Policy and Development, University of Reading, Reading, UK
- ⁷¹School for the Training of Wildlife Specialists Garoua, Garoua, Cameroon
- ⁷²Department of Forestry, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon
- ⁷³Mater Natura – Instituto de Estudos Ambientais, Curitiba, Brazil
- ⁷⁴CBS Fungal Biodiversity Centre (CBS-KNAW), Utrecht, The Netherlands
- ⁷⁵Senckenberg Biodiversity and Climate Research Centre (BiK-F), Frankfurt am Main, Germany
- ⁷⁶Institute for Ecology, Evolution & Diversity, Goethe University Frankfurt, Biologicum, Frankfurt am Main, Germany
- ⁷⁷School of Land and Food, University of Tasmania, Sandy Bay, Tas., Australia
- ⁷⁸Departamento de Ciências Agrárias, cE3c – Centre for Ecology, Evolution and Environmental Changes/Azorean Biodiversity Group and Universidade dos Açores, Angra do Heroísmo, Açores, Portugal
- ⁷⁹Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil
- ⁸⁰Environment and Climate Change Canada, Science & Technology Branch, Carleton University, Ottawa, ON, Canada
- ⁸¹Unité Mixte de Recherche Contrôle des Maladies Animales Exotiques et Emergentes, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France
- ⁸²Unité Mixte de Recherche 1309 Contrôle des Maladies Animales Exotiques et Emergentes, Institut national de la recherche agronomique (INRA), Montpellier, France
- ⁸³Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil
- ⁸⁴Human Environment Systems Center, Boise State University, Boise, ID, USA
- ⁸⁵School of Science and the Environment, Manchester Metropolitan University, Manchester, UK
- ⁸⁶Universidade de Évora – ICAAM, Évora, Portugal
- ⁸⁷Natural Parks Technical Office, Diputació de Barcelona, Barcelona, Spain
- ⁸⁸Natural History Museum of Barcelona, Barcelona, Catalonia, Spain
- ⁸⁹Swedish University of Agricultural Sciences, Southern Swedish Forest Research Centre, Alnarp, Sweden
- ⁹⁰Department of Entomology, Purdue University, West Lafayette, IN, USA
- ⁹¹Department of Natural Resource Sciences, McGill University, Ste-Ann-de-Bellevue, QC, Canada
- ⁹²Alterra, part of Wageningen University and Research, RB Wageningen, The Netherlands
- ⁹³Departamento de Ciências da Vida, Centro de Ecologia Funcional, Universidade de Coimbra, Coimbra, Portugal
- ⁹⁴Departamento de Biologia Vegetal, Instituto de Biologia, Universidade Estadual de Campinas, Campinas, Brazil
- ⁹⁵Department of Botany, School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland
- ⁹⁶Institute for Environmental Sciences, University Koblenz-Landau, Landau, Germany
- ⁹⁷Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, São Paulo, Brazil
- ⁹⁸Departamento de Biología, Grupo de investigación en Biología, Ecología y Manejo de Hormigas, Sección de Entomología, Universidad del Valle, Cali, Colombia

- ⁹⁹Department of Biology, Federal University of Santa Maria, CCNE, Santa Maria, Brazil
- ¹⁰⁰Nicholas School of the Environment, Duke University, Durham, NC, USA
- ¹⁰¹Department of Ecology and Animal Biology, Faculty of Sciences, University of Vigo, Vigo, Spain
- ¹⁰²Department of Entomology, University of Illinois, Urbana, IL, USA
- ¹⁰³Program in Ecology, Evolution and Conservation Biology, University of Illinois, Urbana, IL, USA
- ¹⁰⁴Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
- ¹⁰⁵Departamento de Biología (Botánica), Facultad de Ciencias, Universidad Autónoma de Madrid, Madrid, Spain
- ¹⁰⁶Finnish Museum of Natural History, University of Helsinki, Helsinki, Finland
- ¹⁰⁷Parks and Countryside, Bracknell Forest Council, Bracknell, UK
- ¹⁰⁸Soil Biodiversity Group, Life Sciences Department, Natural History Museum, London, UK
- ¹⁰⁹Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
- ¹¹⁰Laboratório de Ecologia Aplicada à Conservação, Universidade Estadual de Santa Cruz, Ilhéus, Brazil
- ¹¹¹Instituto de Biotecnología y Ecología Aplicada (INBIOTECA), Universidad Veracruzana, Xalapa, Mexico
- ¹¹²Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Tropical Agricultural Research and Higher Education Center, Turrialba, Costa Rica
- ¹¹³Department of Quantitative Methods and Information Systems, Faculty of Agronomy, University of Buenos Aires, Buenos Aires, Argentina
- ¹¹⁴Applied Ecological Services, Inc., Prior Lake, MN, USA
- ¹¹⁵Normandie Univ, EA 1293 ECODIV-Rouen, SFR SCALE, UFR Sciences et Techniques, Mont Saint Aignan Cedex, France
- ¹¹⁶MC-Consult, Sorø, Denmark
- ¹¹⁷Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, UK
- ¹¹⁸Department of Biology, CESAM, Universidade de Aveiro, Aveiro, Portugal
- ¹¹⁹Dipartimento di Biologia, Università degli Studi di Milano, Milano, Italy
- ¹²⁰Sustainability Research Institute, University of East London, London, UK
- ¹²¹Centre of Excellence for Environmental Decisions, School of Plant Biology, University of Western Australia, Nedlands, WA, Australia
- ¹²²School of Veterinary and Life Sciences, Murdoch University, Murdoch, WA, Australia
- ¹²³Grupo Ecología de Artrópodos y Manejo de Plagas, El Colegio de la Frontera Sur, Tapachula, Mexico
- ¹²⁴CSIRO Land and Water Flagship, Canberra, ACT, Australia
- ¹²⁵Dipartimento di Biologia, Università di Napoli Federico II, Napoli, Italy
- ¹²⁶Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, Recanati-Kaplan Centre, Tubney, UK
- ¹²⁷Programa de Pós-Graduação em Ecologia, Universidade Federal de Santa Catarina, Florianópolis, Brazil
- ¹²⁸Sustainability Research Institute, School of Earth and Environment, University of Leeds, Leeds, UK
- ¹²⁹British Trust for Ornithology, Stirling, UK
- ¹³⁰Thünen Institute of Biodiversity, Braunschweig, Germany
- ¹³¹Scarab Research Group, Department of Zoology & Entomology, University of Pretoria, Hatfield, South Africa
- ¹³²Durrell Wildlife Conservation Trust, Trinity, Jersey
- ¹³³Center for International Forestry Research, Bogor, Indonesia
- ¹³⁴Kwata NGO, Cayenne, French Guiana
- ¹³⁵CIRAD, UMR System, Montpellier, France
- ¹³⁶ICRAF, Regional Office for Latin America, Lima, Peru
- ¹³⁷UPS, INP, Laboratoire Écologie Fonctionnelle et Environnement, Université de Toulouse, Toulouse, France
- ¹³⁸CNRS – UMR 5245, Ecolab, Toulouse, France
- ¹³⁹CNRS – UMR 8172, Écologie des Forêts de Guyane, Kourou cedex, France
- ¹⁴⁰CNRS – UMR 7206 (retired) CNRS/MNHN, Paris, France
- ¹⁴¹Department of Landscape Ecology, Institute of Natural Resource Conservation, Kiel University, Kiel, Germany
- ¹⁴²Department of Biology, Nature Conservation, University Marburg, Marburg, Germany
- ¹⁴³Institute of Integrative Biology, ETH Zürich, Zürich, Switzerland
- ¹⁴⁴Post Graduate Program in Wildlife Biology and Conservation, National Centre for Biological Sciences, Bangalore, India
- ¹⁴⁵Wildlife Conservation Society (India Program), Centre for Wildlife Studies, Bangalore, India
- ¹⁴⁶Instituto de Investigaciones Agropecuarias – INIA – CRI – Kampenaiké, Punta Arenas, Chile
- ¹⁴⁷Programa de Biología, Universidad del Atlántico, Barranquilla, Colombia
- ¹⁴⁸Applied Entomology, ETH Zürich, Zürich, Switzerland
- ¹⁴⁹Unit for Environmental Sciences and Management, North-West University, Potchefstroom, South Africa

- ¹⁵⁰Department of Ecosystem Modelling, Büsgen-Institute, Georg-August-University of Göttingen, Göttingen, Germany
- ¹⁵¹INRA, UMR 1213 Herbivores, Saint-Genès Champanelle, France
- ¹⁵²Institute of Zoology, Zoological Society of London, Regents Park, London, UK
- ¹⁵³Department of Ecology and Environmental Science, Umeå University, Umeå, Sweden
- ¹⁵⁴Department of Wildlife, Fish and Environmental Studies, Swedish University of Agricultural Sciences, Umea, Sweden
- ¹⁵⁵Centre for Biological Sciences, University of Southampton, Southampton, UK
- ¹⁵⁶MTA-ELTE-MTM Ecology Research Group, Hungarian Academy of Sciences, c/o Biological Institute, Eötvös Lóránd University, Budapest, Hungary
- ¹⁵⁷Hungarian Natural History Museum, Budapest, Hungary
- ¹⁵⁸Institute for Environmental Sciences, University of Koblenz-Landau, Landau, Germany
- ¹⁵⁹Department of Conservation Ecology and Entomology, Stellenbosch University, Matieland, South Africa
- ¹⁶⁰Centre for Invasion Biology, Stellenbosch University, Matieland, South Africa
- ¹⁶¹CE3C – Centre for Ecology, Evolution and Environmental Changes, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal
- ¹⁶²Associação Monte Pico, Monte Café, Mé Zóchi, São Tomé and Príncipe
- ¹⁶³Kew Gardens, Wakehurst, Ardingly, Haywards Heath, Sussex, UK
- ¹⁶⁴Wild Asia, Upper Penthouse, Wisma RKT, Kuala Lumpur, Malaysia
- ¹⁶⁵Conservation Ecology, Faculty of Biology, Philipps-Universität Marburg, Marburg, Germany
- ¹⁶⁶Institute of Entomology, Biology Centre of Academy of Sciences Czech Republic, České Budějovice, Czech Republic
- ¹⁶⁷Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia
- ¹⁶⁸Dipartimento di Scienze Veterinarie, Università di Pisa, Pisa, Italy
- ¹⁶⁹Swedish University of Agricultural Sciences, Alnarp, Sweden
- ¹⁷⁰Department of Biological Sciences, University of Queensland, St Lucia, Qld, Australia
- ¹⁷¹Queensland Herbarium (DSITIA), Toowong, Qld, Australia
- ¹⁷²School of Sustainability, Arizona State University, Tempe, AZ, USA
- ¹⁷³Department of Biology, Trent University, Peterborough, ON, Canada
- ¹⁷⁴Laboratoire d'Ecologie Alpine (LECA), Université Grenoble Alpes, Grenoble, France
- ¹⁷⁵Institute of Biology Bucharest of Romanian Academy, Bucharest, Romania
- ¹⁷⁶Universidade Federal de Pernambuco – UFPE, Cidade Universitaria, Recife, Brazil
- ¹⁷⁷Tarla Bitkileri Merkez Araştırma Enstitüsü, Yenimahalle-Ankara, Turkey
- ¹⁷⁸School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI, USA
- ¹⁷⁹Department of Animal Ecology and Tropical Biology, Biocenter, University of Würzburg, Würzburg, Germany
- ¹⁸⁰Department of Plant Sciences, University of California, Davis, CA, USA
- ¹⁸¹Department of Soil and Crop Sciences, Colorado State University, Fort Collins, CO, USA
- ¹⁸²IRD-UMR 208 PALOC IRD/MNHN, Paris, France
- ¹⁸³Department of Community Ecology, UFZ, Helmholtz Centre for Environmental Research, Halle, Germany
- ¹⁸⁴Department of Natural Resource Sciences, Thompson Rivers University, Kamloops, BC, Canada
- ¹⁸⁵Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, GE Amsterdam, The Netherlands
- ¹⁸⁶PanEco/Yayasan Ekosistem Lestari, Sumatran Orangutan Conservation Programme, Medan, Indonesia
- ¹⁸⁷Programa de Pós Graduação em Ecologia, Universidade de Brasília, Brasília, Distrito Federal, Brazil
- ¹⁸⁸IDEA Consultants Inc., Okinawa Branch Office, Naha, Japan
- ¹⁸⁹Biocentre Grindel, University of Hamburg, Hamburg, Germany
- ¹⁹⁰Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile
- ¹⁹¹Departamento de Planificación Territorial, Facultad de Ciencias Ambientales, Centro EULA-Chile, Universidad de Concepción, Concepción, Chile
- ¹⁹²Hopkirk Institute, Massey University, Palmerston North, New Zealand
- ¹⁹³Seed Consulting Services, Adelaide, SA, Australia
- ¹⁹⁴Environmental Futures Research Institute, Griffith University, Brisbane, Qld, Australia
- ¹⁹⁵Barbara Hardy Institute, University of South Australia, Mawson Lakes, SA, Australia
- ¹⁹⁶Jiangsu Key Laboratory for Bioresources of Saline Soils, Yancheng Teachers University, Yancheng, China
- ¹⁹⁷Département des sciences biologiques, Centre d'études de la forêt Université du Québec à Montréal Succursale Centre-ville, Montréal, QC, Canada
- ¹⁹⁸AgResearch, Ruakura Research Centre, Hamilton, New Zealand
- ¹⁹⁹Ecologia Aplicada/Applied Ecology, Universidade Sagrado Coração (USC), Bauru, Brazil
- ²⁰⁰Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, ON, Canada

- ²⁰¹DIFAR, University of Genova, Genova, Italy
- ²⁰²Tel Aviv University, Tel Aviv, Israel
- ²⁰³World Wildlife Fund, Inc. (WWF) Guianas, Paramaribo, Suriname
- ²⁰⁴Rubenstein School of Natural Resources, University of Vermont, Burlington, VT, USA
- ²⁰⁵Astron Environmental Services, East Perth, WA, Australia
- ²⁰⁶Department of Environment and Agriculture, Curtin University, Perth, WA, Australia
- ²⁰⁷Centre de Biologie pour la Gestion des Populations (CBGP), INRA, IRD, CIRAD, SUPAGRO, Montferrier-sur-Lez cedex, France
- ²⁰⁸Department of Zoology, University of Oxford, Oxford, UK
- ²⁰⁹Department of Biological Sciences, Mount Holyoke College, South Hadley, MA, USA
- ²¹⁰China International Engineering Consulting Corporation, Haidian District, Beijing, China
- ²¹¹CREAF, Cerdanyola del Vallès, Catalonia, Spain
- ²¹²Departamento de Ciencias Ambientales y Recursos Naturales Renovables, Facultad de Ciencias Agronómicas, Universidad de Chile, La Pintana, Chile
- ²¹³Grupos de Fauna, Instituto amazónico de investigaciones científicas Sinchi., Bogotá, Colombia
- ²¹⁴Biodiversity, Evolution and Ecology of Plants (BEE), Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Hamburg, Germany
- ²¹⁵School of Biological Science, University of Plymouth, Plymouth, UK
- ²¹⁶Friday Harbor, WA, USA
- ²¹⁷International University of Malaya-Wales, Jalan Tun Ismail, Kuala Lumpur, Malaysia
- ²¹⁸Department of Wildlife Management, Sokoine University of Agriculture, Morogoro, Tanzania
- ²¹⁹The Xerces Society for Invertebrate Conservation, Portland, OR, USA
- ²²⁰Animal & Environment Research Group, Department of Life Sciences, Anglia Ruskin University, Cambridge, UK
- ²²¹Walter Sisulu University, Mthatha, Transkei, South Africa
- ²²²Centre for African Conservation Ecology, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa
- ²²³College of Natural Sciences, Bangor University, Bangor, Gwynedd, UK
- ²²⁴Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, Québec, QC, Canada
- ²²⁵Department of Arctic and Marine Biology, University of Tromsø, Tromsø, Norway
- ²²⁶Panthera, New York, NY, USA
- ²²⁷Universidad Nacional Experimental de Guayana, Puerto Ordaz, Venezuela
- ²²⁸Richard Gilder Graduate School, American Museum of Natural History, New York, NY, USA
- ²²⁹Agroscope, Zürich, Switzerland
- ²³⁰Corporación Sentido Natural, Bogotá, Colombia
- ²³¹Earth and Atmospheric Sciences Department, University of Alberta, Edmonton, AB, Canada
- ²³²State Museum of Natural History Karlsruhe (SMNK), Biosciences, Karlsruhe, Germany
- ²³³Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany
- ²³⁴University of Technology Sydney, Sydney, NSW, Australia
- ²³⁵University of New Brunswick, Fredericton, NB, Canada
- ²³⁶Department of Ecology, Faculty of Veterinary Science, SZIE University, Budapest, Hungary
- ²³⁷Department of Ecology, University of Debrecen, Debrecen, Hungary
- ²³⁸Department of Ecology, Environment and Plant Sciences, Stockholm University, Stockholm, Sweden
- ²³⁹Instituto de Investigaciones y Recursos Biológicos Alexander von Humboldt, Bogotá, Colombia
- ²⁴⁰Institute of Natural and Environmental Sciences, University of Hyogo, Hyogo, Japan
- ²⁴¹Hiroshima University Leading-program, Higashihiroshima, Kagamiyama, Japan
- ²⁴²Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México, Morelia, México C.P., Mexico
- ²⁴³Department of Animal Ecology, Justus-Liebig-University, Giessen, Germany
- ²⁴⁴Escuela de Biología, Universidad de Costa Rica, San Pedro, Costa Rica
- ²⁴⁵Biodiversity and Environmental Sustainability, Rohini, India
- ²⁴⁶Department of Environmental Studies, Shivaji College (University of Delhi), New Delhi, India
- ²⁴⁷Department of Ecology, Swedish University of Agricultural Sciences, Uppsala, Sweden
- ²⁴⁸School of Biological Sciences, Universiti Sains Malaysia, Minden, Malaysia
- ²⁴⁹Yukon Department of Environment, Whitehorse, YT, Canada
- ²⁵⁰Nature Conservation Foundation, Mysore, India
- ²⁵¹Cologne Biocenter, Zoological Institute, University of Cologne, Köln, Germany

- ²⁵²Department of Environmental & Natural Resources Management, University of Patras, Agrinio, Greece
- ²⁵³Centre for Tropical Environmental and Sustainability Science (TESS) & College of Marine and Environmental Sciences, James Cook University, Cairns, Qld, Australia
- ²⁵⁴School of Science and Technology, Pacific Adventist University, Port Moresby, Papua New Guinea
- ²⁵⁵Unit for Environmental Sciences and Management, North-West University, Potchefstroom, South Africa
- ²⁵⁶Department of Systematic and Evolutionary Botany, University of Zürich, Zürich, Switzerland
- ²⁵⁷Department of Ecology and Evolutionary Biology and Department of Geography and Planning, University of Toronto, Toronto, ON, Canada
- ²⁵⁸The Wilderness & Wildlife Conservation Trust, Colombo, Sri Lanka
- ²⁵⁹School of Biological Sciences, Plymouth University, Plymouth, UK
- ²⁶⁰Institute of Ecology and Evolution, University of Bern, Bern, Switzerland
- ²⁶¹Section Environnement, Développement durable et Territoire, Division Environnement et Territoire, Bundesamt für Statistik, Neuchâtel, Switzerland
- ²⁶²School of Forest Sciences, University of Eastern Finland, Joensuu, Finland
- ²⁶³Institute of Ecology, FB2, University of Bremen, Bremen, Germany
- ²⁶⁴Université Peleforo Gon Coulibaly, Korhogo, Ivory Coast
- ²⁶⁵Station d'Ecologie de Lamto, N'Douci, Ivory Coast
- ²⁶⁶Theoretical Evolutionary Ecology Group, Department of Animal Ecology and Tropical Biology, Biocenter, University of Würzburg, Würzburg, Germany
- ²⁶⁷Wildlife Conservation Society-India, National Centre for Biological Sciences, Bangalore, India
- ²⁶⁸Nature Science Initiative, Dehradun, India
- ²⁶⁹Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA, USA
- ²⁷⁰School of BioSciences, University of Melbourne, Melbourne, Vic., Australia
- ²⁷¹School of Agricultural, Forest and Food Sciences HAFL, Bern University of Applied Sciences, Zollikofen, Switzerland
- ²⁷²Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland
- ²⁷³Instituto Nacional de Tecnología Agropecuaria, EEA Bariloche, Bariloche, Argentina
- ²⁷⁴Department of Biology, Pennsylvania State University, University Park, PA, USA
- ²⁷⁵National Aviary, Allegheny Commons West, Pittsburgh, PA, USA
- ²⁷⁶Centre for Tropical Environmental and Sustainability Sciences, College of Marine and Environmental Science, James Cook University, Cairns, Qld, Australia
- ²⁷⁷Université Pierre-et-Marie-Curie, Paris, France
- ²⁷⁸Institute of Ecology and Environmental Sciences, Paris, France
- ²⁷⁹INRA, UR 406 Abeilles et Environnement, Avignon, France
- ²⁸⁰Department of Biology, San Francisco State University, San Francisco, CA, USA
- ²⁸¹Laboratoire de diagnostic en phytoprotection, Ministère de l'agriculture, des pêcheries et de l'alimentation du Québec, Ville de Québec, QC, Canada
- ²⁸²Research Unit Terrestrial Ecology, Ghent University, Ghent, Belgium
- ²⁸³Laboratorio de Recursos Agroforestales, Centro Austral de Investigaciones Científicas (CADIC), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Ushuaia, Argentina
- ²⁸⁴School of Biosciences, University of Melbourne, Parkville, Vic., Australia
- ²⁸⁵Purchase College (State University of New York), Purchase, NY, USA
- ²⁸⁶Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, China
- ²⁸⁷School of Biological Sciences, University of Canterbury, Christchurch, New Zealand
- ²⁸⁸The James Hutton Institute, Aberdeen, UK
- ²⁸⁹College of Resources and Environmental Sciences, China Agricultural University, Beijing, China
- ²⁹⁰Carste Ciência e Meio Ambiente, Floresta, Belo Horizonte, Brazil
- ²⁹¹TEHO Laboratory, Institute of Biology, University of Antioquia, Medellín, Colombia
- ²⁹²International Center for Agricultural Research in the Dry Areas (ICARDA), Amman Office, Amman, Jordan
- ²⁹³Animal and Rangeland Sciences Department, Oregon State University, Corvallis, OR, USA
- ²⁹⁴Department of Agroecology, Flakkebjerg Research Centre, Aarhus University, Slagelse, Denmark
- ²⁹⁵Department of Agroforestry Technology and Science and Genetics, School of Advanced Agricultural Engineering, Castilla La Mancha University, Albacete, Spain
- ²⁹⁶Unidad Académica de Turismo, Coordinación de Investigación y Posgrado, Universidad Autónoma de Nayarit, Tepic, Mexico
- ²⁹⁷Centro de Investigaciones Tropicales, Universidad Veracruzana, Xalapa, Mexico
- ²⁹⁸Graduate School of Agricultural Science, Kobe University, Kobe, Japan
- ²⁹⁹Department of Ecology, University of Debrecen, Debrecen, Hungary
- ³⁰⁰Center for Conservation Innovation, San Jose Tagaytay City, Philippines
- ³⁰¹Biology Department, De La Salle University, Manila, Philippines

- ³⁰²The New Zealand Institute for Plant & Food Research Limited, Auckland, New Zealand
- ³⁰³National Museums of Kenya, Nairobi, Kenya
- ³⁰⁴Center for Macroecology, Evolution and Climate, Natural History Museum of Denmark, University of Copenhagen, Copenhagen Ø, Denmark
- ³⁰⁵Red de Biología y Conservación de Vertebrados, Instituto de Ecología A.C., Xalapa, Mexico
- ³⁰⁶Department of Geography, University of Bergen, Bergen, Norway
- ³⁰⁷Department of Geography, University of Wisconsin-Madison, Madison, WI, USA
- ³⁰⁸School of Biology, University of Leeds, Leeds, West Yorkshire, UK
- ³⁰⁹Marshall Agroecology Ltd, Barton, Winscombe, UK
- ³¹⁰Universidad Nacional de Colombia, Ciudad Universitaria, Bogotá, Colombia
- ³¹¹Basque Centre for Climate Change – BC3, Bilbao, Spain
- ³¹²School of Biological Sciences, The University of Queensland, Brisbane, Qld, Australia
- ³¹³Associate of Arts Program, University of Delaware – Wilmington, Wilmington, DE, USA
- ³¹⁴Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE, USA
- ³¹⁵Department of Entomology, University of California, Riverside, CA, USA
- ³¹⁶Centre for Mined Land Rehabilitation, The University of Queensland, Brisbane, Qld, Australia
- ³¹⁷Departamento de Biogeografía y Cambio Global, Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain
- ³¹⁸Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT, USA
- ³¹⁹Museo de Historia Natural “Vera Alleman Haeghebaert”, Universidad Ricardo Palma, Lima 33, Peru
- ³²⁰Centro Iberoamericano de la Biodiversidad (CIBIO), Universidad de Alicante, Alicante, Spain
- ³²¹Department of Ecology, Swedish University of Agricultural Sciences, Grimsö Wildlife Research Station, Riddarhyttan, Sweden
- ³²²Rainforest Alliance, New York, NY, USA
- ³²³Department of Natural Resources, Cornell University, Ithaca, NY, USA
- ³²⁴Department of Natural Resources & Environmental Sciences, University of Illinois, Urbana, IL, USA
- ³²⁵Universidad Industrial de Santander, Bucaramanga, Colombia
- ³²⁶School of Plant Biology, University of Western Australia, Crawley, WA, Australia
- ³²⁷Lab. Ecotono, INIBIOMA (Universidad Nacional del Comahue-CONICET), Bariloche, Argentina
- ³²⁸Botany Department, National Museums of Kenya, Nairobi, Kenya
- ³²⁹Department of Wildlife Management, University of Eldoret, Eldoret, Kenya
- ³³⁰Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia
- ³³¹School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia
- ³³²El Colegio de la Frontera Sur, Ecología Evolutiva y Conservación, San Cristóbal de las Casas, Mexico
- ³³³Nature Kenya, Nairobi, Kenya
- ³³⁴WWF, Washington, DC, USA
- ³³⁵Independent Research Scholar, New Delhi, India
- ³³⁶Avian Diversity and Bioacoustic Lab, Department of Zoology, Gurukula Kangri University, Haridwar, India
- ³³⁷Graduate School of Bioagricultural Sciences, Nagoya University, Nagoya, Japan
- ³³⁸Key Laboratory of Tropical Forest Ecology, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Menglun, China
- ³³⁹Environmental Futures Research Institute, and Griffith School of Environment, Griffith University, Nathan, Brisbane, Qld, Australia
- ³⁴⁰College of Bioresource Science, Nihon University, Fujisawa, Japan
- ³⁴¹Forestry and Forest Products Research Institute, Tsukuba, Japan
- ³⁴²Laboratorio de Investigaciones en Abejas (Departamento de Biología), Universidad Nacional de Colombia, Bogotá, Colombia
- ³⁴³Laboratorio de Información Geográfica, El Colegio de la Frontera Sur (ECOSUR), San Cristóbal de las Casas, Mexico
- ³⁴⁴CMRPZ – I.E. Plaza Bonita, San Andrés de Sotavento (Córdoba), Colombia
- ³⁴⁵BirdLife International – Africa Partnership Secretariat, Nairobi, Kenya
- ³⁴⁶Ornithology Section, National Museums of Kenya, Nairobi, Kenya
- ³⁴⁷Department of Zoology, University of British Columbia, Vancouver, BC, Canada
- ³⁴⁸Institut de Systématique, Évolution, Biodiversité, ISYEB – UMR 7205 – CNRS, MNHN, UPMC, EPHE, Muséum national d'Histoire naturelle, Sorbonne Universités, Paris, France
- ³⁴⁹Department of Biology/Biodiversity, Lund University, Lund, Sweden
- ³⁵⁰Department of Biosciences, University of Helsinki, Helsinki, Finland
- ³⁵¹Department of Environmental Sciences, University of Helsinki, Helsinki, Finland

- ³⁵²School of Biology, The University of Nottingham, University Park, Nottingham, UK
- ³⁵³Laboratorio de Zoología y Ecología Acuática – LAZOE, Universidad de Los Andes, Bogotá, Colombia
- ³⁵⁴School of Forestry, University of Canterbury, Christchurch, New Zealand
- ³⁵⁵BIO-Diverse, Bonn, Germany
- ³⁵⁶Department of Wildlife, Fish and Conservation Biology, University of California, Davis, Davis, CA, USA
- ³⁵⁷IUCN-Centre for Mediterranean Cooperation, Campanillas, Málaga, Spain
- ³⁵⁸Oxford University Centre for the Environment, University of Oxford, Oxford, UK
- ³⁵⁹Natural Resources and the Environment, CSIR, Stellenbosch, South Africa
- ³⁶⁰Plant Conservation Unit, Biological Sciences, University of Cape Town, Rondebosch, South Africa
- ³⁶¹International Programme Office (IPO), Vice Chancellor's Office, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana
- ³⁶²Naturschutz – Planung und Beratung, Wiesendangen, Switzerland
- ³⁶³Department of Wildlife and Range Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
- ³⁶⁴Forestry Research Institute of Ghana, Kumasi, Ghana
- ³⁶⁵Department of Animal & Environmental Biology, University of Benin, Benin City, Nigeria
- ³⁶⁶Department of Genetics, Evolution and Environment, University College London, London, UK
- ³⁶⁷The Royal Society for the Protection of Birds (RSPB), Sandy, Bedfordshire, UK
- ³⁶⁸Laboratorio de Ecología del Paisaje, Facultad de Ciencias Forestales, Universidad de Concepción, Concepción, Chile
- ³⁶⁹Indian Institute of Science, Bangalore, India
- ³⁷⁰Laboratorio Ecotono, CONICET-INIBIOMA, Universidad Nacional del Comahue, Bariloche, Argentina
- ³⁷¹Laboratorio de Investigaciones en Abejas, LABUN, Universidad Nacional de Colombia, Bogotá D.C., Colombia
- ³⁷²Lancaster Environment Centre, Lancaster University, Lancaster, UK
- ³⁷³Universidade Federal do Pará (UFPA), Núcleo de Altos Estudos Amazonicos (NAEA), Belém, Brazil
- ³⁷⁴German Centre for Integrative Biodiversity Research (iDiv), Halle-Jena-Leipzig, Leipzig, Germany
- ³⁷⁵Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country, Leioa, Spain
- ³⁷⁶IKERBASQUE. Basque Foundation for Science, Bilbao, Spain
- ³⁷⁷Instituto de Diversidad y Ecología Animal (IDEA, CONICET-UNC) and Centro de Zoología Aplicada, FCEfYN, Universidad Nacional de Córdoba, Córdoba, Argentina
- ³⁷⁸IRD, UMR AMAP, TA A51/PS2, Montpellier cedex 05, France
- ³⁷⁹French Institute of Pondicherry, UMIFRE 21 CNRS-MAEE, Puducherry, India
- ³⁸⁰School of Environmental Sciences, University of East Anglia, Norwich, UK
- ³⁸¹National Institute of Agricultural Technology (INTA), Río Gallegos, Argentina
- ³⁸²National University of Southern Patagonia (UNPA), Río Gallegos, Argentina
- ³⁸³National Commission of Scientist Research and Technology (CONICET), Buenos Aires, Argentina
- ³⁸⁴Laboratory of Biogeography & Ecology, Department of Geography, University of the Aegean, Mytilene, Greece
- ³⁸⁵Department of Animal Ecology and Tropical Biology, Biocenter, University of Würzburg, Würzburg, Germany
- ³⁸⁶University of Cambridge, Cambridge, UK
- ³⁸⁷Conservation Science Group, Department of Zoology, University of Cambridge, Cambridge, UK
- ³⁸⁸Systematics and Evolution Laboratory, Department of Biology, Western Kentucky University, Bowling Green, KY, USA
- ³⁸⁹Department of Natural Resource Ecology and Management, Iowa State University, Ames, IA, USA
- ³⁹⁰Facultad de Recursos Naturales, Escuela de Ciencias Ambientales, Laboratorio de Planificación Territorial, Universidad Católica de Temuco, Temuco, Chile
- ³⁹¹Biología y Conservación de Vertebrados, Instituto de Ecología A.C., El Haya, Xalapa, Mexico
- ³⁹²Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain
- ³⁹³Laboratorio de Entomología Ecológica, Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, La Serena, Chile
- ³⁹⁴Albertine Rift Program, Wildlife Conservation Society, Kampala, Uganda
- ³⁹⁵IFEVA/Cátedra de Producción Vegetal, Departamento de Producción Vegetal, Facultad de Agronomía, Universidad de Buenos Aires/CONICET., Buenos Aires, Argentina
- ³⁹⁶Directora del Programa Conservación de Biodiversidad en Bosques Subtropicales, Cátedra de Desarrollo Sustentable y Biodiversidad, Facultad de Ciencias Agrarias, Universidad Nacional de Jujuy, CIT-Jujuy CONICET, Fundación CEBio, San Salvador de Jujuy, Argentina
- ³⁹⁷Departament de Ciències Ambientals, Universitat de Girona, Girona, Spain
- ³⁹⁸Entomology, Cornell University, Ithaca, NY, USA
- ³⁹⁹Botany, School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland

- ⁴⁰⁰Center for Environmental Sciences and Engineering & Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT, USA
- ⁴⁰¹MARETEC, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal
- ⁴⁰²CREA-ABP, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Centro di ricerca per l'agrobiologia e la pedologia, Firenze, Italy
- ⁴⁰³Ecosystem Management, School of Environment and Rural Science, University of New England, Armidale, NSW, Australia
- ⁴⁰⁴Escuela de Biología, Universidad Industrial de Santander, Bucaramanga, Colombia
- ⁴⁰⁵National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, Santa Barbara, CA, USA
- ⁴⁰⁶Department of Bioscience, Aarhus University, Aarhus C, Denmark
- ⁴⁰⁷The Royal Society for the Protection of Birds (RSPB), Edinburgh Park, Edinburgh, UK
- ⁴⁰⁸Center for Conservation and Sustainable Development, Missouri Botanical Garden, Saint Louis, MO, USA
- ⁴⁰⁹Departamento de Biologia, Universidade Federal de Sergipe, São Cristóvão/Se, Brazil
- ⁴¹⁰Life Sciences Department, University of Alcalá, Alcalá de Henares, Spain
- ⁴¹¹Entomology Collection, Systematics and Biogeography Laboratory, School of Biology, Industrial University of Santander, Bucaramanga, Colombia
- ⁴¹²Percy FitzPatrick Institute of African Ornithology, DST/NRF Centre of Excellence, University of Cape Town, Rondebosch, Cape Town, South Africa
- ⁴¹³School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Wits, South Africa
- ⁴¹⁴Centro de Ciências Biológicas e da Saúde, Universidade Federal de Mato Grosso do Sul, Campo Grande, Brazil
- ⁴¹⁵Department of Biological Sciences, Brock University, St. Catharines, ON, Canada
- ⁴¹⁶Edinburgh, UK
- ⁴¹⁷Luquillo LTER, Institute for Tropical Ecosystem Studies, College of Natural Sciences, University of Puerto Rico at Rio Piedras, San Juan, PR, USA
- ⁴¹⁸Escuela Nacional de Estudios Superiores, Universidad Nacional Autónoma de México, Morelia, Mexico
- ⁴¹⁹Science and Conservation Division, Department of Parks and Wildlife, Manjimup, WA, Australia
- ⁴²⁰PROPLAME-PRHIDEB-CONICET, Departamento de Biodiversidad y Biología Experimental, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Ciudad Universitaria, (CP1428EHA) Ciudad Autónoma de Buenos Aires, Argentina
- ⁴²¹ECT Oekotoxikologie GmbH, Flörsheim am Main, Germany
- ⁴²²LOEWE Biodiversity and Climate Research Centre BiK-F, Frankfurt/Main, Germany
- ⁴²³Facultad de Ciencias Ambientales, Universidad de Ciencias Aplicadas y Ambientales U.D.C.A, Bogotá, Colombia
- ⁴²⁴Catedras CONACYT, CIIDIR, Unidad Oaxaca, IPN, Santa Cruz Xoxocotlán, Mexico
- ⁴²⁵Universidad de Ciencias Aplicadas y Ambientales U.D.C.A., Bogotá, Colombia
- ⁴²⁶School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI, USA
- ⁴²⁷Department of Environmental Sciences, University of Virginia, Charlottesville, VA, USA
- ⁴²⁸Blandy Experimental Farm, Boyce, VA, USA
- ⁴²⁹Département des sciences biologiques (SB), Université du Québec à Montréal (UQÀM), Montréal, QC, Canada
- ⁴³⁰Facultad de Ciencias, Universidad de Chile, Santiago, Chile
- ⁴³¹School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK
- ⁴³²Institute of Silviculture and Forest Protection, University of West Hungary, Sopron, Hungary
- ⁴³³Red de Ecología Funcional, Instituto de Ecología A.C. Carretera antigua a Coatepec, El Haya, Xalapa, Mexico
- ⁴³⁴Biology Centre CAS, Institute of Entomology, Ceske Budejovice, Czech Republic
- ⁴³⁵Faculty of Science, University of South Bohemia, Ceske Budejovice, Czech Republic
- ⁴³⁶Bishop's University, Sherbrooke, QC, Canada
- ⁴³⁷CSIRO, Dutton Park, Qld, Australia
- ⁴³⁸Naturalis Biodiversity Center, CR Leiden, The Netherlands
- ⁴³⁹Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, Kota Kinabalu, Malaysia
- ⁴⁴⁰Biocentre Klein Flottbek & Botanical Garden, University of Hamburg, Hamburg, Germany
- ⁴⁴¹Center for Development Research (ZEF), University of Bonn, Bonn, Germany
- ⁴⁴²Chair for Landscape Management, University of Freiburg, Freiburg, Germany
- ⁴⁴³AgResearch Limited, Lincoln Research Centre, Christchurch, New Zealand
- ⁴⁴⁴Institute for Ecology, Evolution and Diversity, Goethe University Frankfurt, Frankfurt am Main, Germany
- ⁴⁴⁵Biology and Biomedical Sciences Division, University of Brighton, Brighton, UK
- ⁴⁴⁶Charles Darwin University, Brinkin, NT, Australia
- ⁴⁴⁷Lawrence University, Appleton, WI, USA
- ⁴⁴⁸School of Natural Resources and Extension, University of Alaska Fairbanks, Fairbanks, AK, USA
- ⁴⁴⁹Center for Ecology, Development and Research, Dehradun, India

- ⁴⁵⁰School of Life Sciences, University of KwaZulu-Natal, Durban, South Africa
- ⁴⁵¹Department of Ecology and Natural Resource Management (INA), Norwegian University of Life Sciences (NMBU), Ås, Norway
- ⁴⁵²Museum of Natural Science and Department of Biological Sciences, Louisiana State University, Baton Rouge, LA, USA
- ⁴⁵³Baton Rouge, LA, USA
- ⁴⁵⁴Department of Life Sciences, Ben-Gurion University of the Negev, Be'er Sheva, Israel
- ⁴⁵⁵The Yerucham Center of Ornithology and Ecology, Yerucham, Israel
- ⁴⁵⁶Instituto de Ciências Biológicas, Universidade Federal do Pará, Belém, Brazil
- ⁴⁵⁷Organic Research Centre, Elm Farm, Newbury, UK
- ⁴⁵⁸United States Department of Agriculture, South San Francisco, CA, USA
- ⁴⁵⁹Universidad Nacional de Colombia, Sede Medellín, Medellín, Colombia
- ⁴⁶⁰Department of Biological Sciences, National University of Singapore, Singapore, Singapore
- ⁴⁶¹Ecología de Comunidades Áridas y Semiaridas (EComAS), Departamento de Recursos, Facultad de Ciencias Exactas y Naturales, UNLPam., Santa rosa, La Pampa, Uruguay
- ⁴⁶²Gobierno Autónomo Departamental Santa Cruz, Santa Cruz de la Sierra, Bolivia
- ⁴⁶³Université du Québec à Rimouski, Centre for Northern Research, Centre for Forest Studies, Rimouski, QC, Canada
- ⁴⁶⁴School of Environmental Studies, University of Victoria, Victoria, BC, Canada
- ⁴⁶⁵Museu de Ciències Naturals de Granollers, Granollers, Barcelona, Spain
- ⁴⁶⁶School of Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, LA, USA
- ⁴⁶⁷Biological Dynamics of Forest Fragments Project, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil
- ⁴⁶⁸Department of Natural Resources and Environmental Management, University of Hawaii, Manoa, Honolulu, HI, USA
- ⁴⁶⁹Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Chaoyang District, Beijing, China
- ⁴⁷⁰State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Haidian District, Beijing, China
- ⁴⁷¹Institute of Zoology, University of Natural Resources and Life Sciences, Vienna, Austria
- ⁴⁷²Department of Environmental Science and Policy, Drake University, Des Moines, IA, USA
- ⁴⁷³Department of Biology, Hong Kong Baptist University, Kowloon Tong, Hong Kong SAR, China
- ⁴⁷⁴Zoological Division, Research Center For Biology, The Indonesian Institute of Sciences, Cibinong, Bogor, Indonesia
- ⁴⁷⁵Section for Ecoinformatics & Biodiversity, Department of Bioscience, Aarhus University, Aarhus C, Denmark
- ⁴⁷⁶Department of Zoology, Institute of Ecology and Earth Sciences, University of Tartu, Tartu, Estonia
- ⁴⁷⁷School of Ecosystem and Forest Science, Faculty of Science, The University of Melbourne, Richmond, Vic., Australia
- ⁴⁷⁸Department of Biology, Saint Louis University, St. Louis, MO, USA
- ⁴⁷⁹MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, Hungary
- ⁴⁸⁰Insect Ecology Group, Department of Zoology, University of Cambridge, Cambridge, UK
- ⁴⁸¹Centre for Integrative Ecology, School of Biological Sciences, University of Canterbury, Christchurch, New Zealand
- ⁴⁸²Instituto Neotropical: Pesquisa e Conservação, Curitiba, Brazil
- ⁴⁸³Department of Ecology and Territory, School of Environmental and Rural Studies, Pontificia Universidad Javeriana, Bogota, Colombia
- ⁴⁸⁴Naturhistorisches Museum Basel, Leiter Biowissenschaften, Basel, Switzerland
- ⁴⁸⁵NERC Centre for Ecology & Hydrology, Bush Estate, Penicuik, Edinburgh, UK
- ⁴⁸⁶Instituto de Biologia, Universidade Federal de Uberlândia (UFU), Uberlândia, Brazil
- ⁴⁸⁷Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Science, Sofia, Bulgaria
- ⁴⁸⁸Division Forest, Nature, and Landscape, Department of Earth & Environmental Sciences, KU Leuven, Leuven, Belgium
- ⁴⁸⁹Museu Nacional de História Natural e da Ciência, Borboletário – Depart. Zoologia, Lisboa, Portugal
- ⁴⁹⁰Departamento de Ciencias Químico-Biológicas, Universidad de las Américas Puebla, Cholula, Mexico
- ⁴⁹¹Departamento de Gestión Agraria, Universidad de Santiago de Chile, Santiago, Chile
- ⁴⁹²Den Haag, The Netherlands
- ⁴⁹³Royal Museum for Central Africa – Joint Experimental Molecular Unit, Tervuren, Belgium
- ⁴⁹⁴Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, Cau Giay, Hanoi, Vietnam
- ⁴⁹⁵Botany Department, University of Otago, Dunedin, New Zealand
- ⁴⁹⁶School for Resource and Environmental Studies, Faculty of Management, Dalhousie University, Halifax, NS, Canada
- ⁴⁹⁷Key Laboratory of Protection and Development Utilization of Tropical Crop Germplasm Resource, Ministry of Education, College of Horticulture and Landscape Agriculture, Hainan University, Haikou, China

⁴⁹⁸College of Life Sciences, Zhejiang University, Hangzhou, China

⁴⁹⁹Department of Biology, John Carroll University, University Heights, OH, USA

⁵⁰⁰The Environment Institute and School of Earth and Environmental Sciences, The University of Adelaide, Adelaide, SA, Australia

⁵⁰¹Environmental Futures Research Institute, Griffith University, Brisbane, Qld, Australia

⁵⁰²Department of Environmental and Natural Resources, Presbyterian University College, Akropong Akuapem, Ghana

⁵⁰³School of Natural Sciences and Psychology, Liverpool John Moores University, Liverpool, UK

⁵⁰⁴Center for Environmental Sciences & Engineering, University of Connecticut, Storrs, CT, USA

⁵⁰⁵Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA

⁵⁰⁶Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, GE Amsterdam, The Netherlands

⁵⁰⁷NERC Centre for Ecology & Hydrology, Crowmarsh Gifford, Wallingford, UK

⁵⁰⁸Institute of Biodiversity Science, School of Life Sciences, Fudan University, Shanghai, China

⁵⁰⁹International Institute of Tropical Forestry, USDA Forest Service, Sabana Field Research Station, Luquillo, PR, USA

⁵¹⁰Tsukuba University, Ibaraki, Japan

⁵¹¹School of Biological Sciences, University of East Anglia, Norwich Research Park, Norwich, UK

⁵¹²State Key Laboratory of Genetic Resources and Evolution, Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming, China

⁵¹³A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia

⁵¹⁴Integrated Environmental Consultants Namibia (IECN), Windhoek, Namibia

⁵¹⁵Guangdong Entomological Institute/South China Institute of Endangered Animals, Guangzhou, China

⁵¹⁶Computational Ecology and Environmental Science, Microsoft Research, Cambridge, UK

Correspondence

Lawrence N. Hudson, Department of Life Sciences, Natural History Museum, London, UK.

Email: l.hudson@nhm.ac.uk

Funding information

U.K. Natural Environment Research Council, Grant/Award Number: NE/J011193/2 and NE/L002515/1; United Nations Environment Program World Conservation Monitoring Centre; Biotechnology and Biological Sciences Research Council, Grant/Award Number: BB/F017324/1; Hans Rausing PhD Scholarship; COLCIENCIAS (Departamento Administrativo de Ciencia, Tecnología e Innovación de Colombia)

Abstract

The PREDICTS project—Projecting Responses of Ecological Diversity In Changing Terrestrial Systems (www.predicts.org.uk)—has collated from published studies a large, reasonably representative database of comparable samples of biodiversity from multiple sites that differ in the nature or intensity of human impacts relating to land use. We have used this evidence base to develop global and regional statistical models of how local biodiversity responds to these measures. We describe and make freely available this 2016 release of the database, containing more than 3.2 million records sampled at over 26,000 locations and representing over 47,000 species. We outline how the database can help in answering a range of questions in ecology and conservation biology. To our knowledge, this is the largest and most geographically and taxonomically representative database of spatial comparisons of biodiversity that has been collated to date; it will be useful to researchers and international efforts wishing to model and understand the global status of biodiversity.

KEYWORDS

data sharing, global biodiversity modeling, global change, habitat destruction, land use

1 | INTRODUCTION

Many indicators are available for tracking the state of biodiversity through time, for example, in order to assess progress toward goals such as the Convention on Biological Diversity's 2010 target or the newer Aichi Biodiversity Targets (Pereira et al., 2013; Tittensor et al., 2014). Most of the available indicators are taxonomically or ecologically narrow in scope, and many are based on the global status of species (e.g., Butchart et al., 2010; Tittensor et al., 2014), because of

the finality of extinction. However, using a more representative set of taxa and considering local biodiversity offers several advantages. First, average responses of species to human impacts typically vary among higher taxa and ecological guilds (Lawton et al., 1998; McKinney, 1997; Newbold et al., 2014; WWF International, 2014), meaning that indicators need to be broadly based and as representative as possible, if they are to be used as proxies for biodiversity as a whole. Second, the taxa for which most data on trends are available (typically, charismatic groups such as birds or butterflies) are not always the most

important for the continued functioning of ecosystems and delivery of ecosystem services (Norris, 2012). Third, although many of the ultimate drivers behind biodiversity loss are global, the most important pressure mechanisms usually act much more locally (Brook, Ellis, Perring, Mackay, & Blomqvist, 2013). Fourth, most ecosystem services and their underpinning processes are mediated by local rather than global biodiversity (Cardinale et al., 2012; Grime, 1998): It is local rather than global functional diversity, for example, that determines how ecosystems function in a given set of conditions (Steffen et al., 2015). Finally, presence/absence and especially abundance of species at a site respond more rapidly to disturbance than extent of geographic distribution or global/national extinction risk (Balmford, Green, & Jenkins, 2003; Collen et al., 2009; Hull, Darroch, & Erwin, 2015), so local changes are likely to be detected before large global changes or extinction.

For these reasons, there is a need to model the response of local biodiversity to human pressures and, thus, to estimate biodiversity changes at local scales, but across a wide spatial domain (ideally globally) and for a wide range of taxa. We therefore need comparable high-quality data on local biodiversity at different levels of human pressure, from many different taxa and regions. At present, spatial comparisons of how biodiversity responds to variation in pressures provide the only feasible way to collate a large, globally representative evidence base and to model responses to human impacts. Although large temporal datasets are available (e.g., Butchart et al., 2004; Collen et al., 2009; Dornelas et al., 2014; Vellend et al., 2013), they may not be sufficiently representative of anthropogenic pressures for the trends they show to be taken at face value (Gonzalez et al., 2016). Furthermore, in the absence of contemporaneous site-specific information about pressures, it is not straightforward to use these data to model how biodiversity responds to pressures or to project changes into the future (but see Visconti et al., 2015). Spatially extensive field data of suitable quality and resolution are time-consuming and expensive to collect. The most convenient and readily available source of suitable biodiversity data is the published literature: Thousands of published papers are based on datasets that would be of value to global modeling efforts. However, it has been rare for such papers to publish data in full, even as supporting information, meaning that many potentially valuable datasets are “dark data” (Hampton et al., 2013), effectively at risk of being lost to science if they have not been lost already.

Since 2012, the PREDICTS project has been collating data on local biodiversity at different levels of human pressure from published papers, where necessary contacting those papers' corresponding authors to request the underlying biodiversity data, species' identities, and precise sampling locations. We have enhanced the collated data by scoring site characteristics relating to human pressures such as the predominant land use and how intensively the land is used by humans. We also used the geographical coordinates of the sites to match them to a number of published spatially explicit datasets. The database has already been used to conduct global (e.g., Newbold et al., 2015; Newbold, Hudson, Arnell, et al., 2016), regional (De Palma et al., 2016) and national (Echeverría-Londoño et al., 2016) analyses of the responses of local biodiversity to land use and related human

pressures. The database was first described by Hudson et al. (2014) who published an interim version (March 2014) of the site-level meta-data along with a detailed description of how the database has been collated and validated. Since that time, the database has nearly doubled in size. Here, we describe the status of the database and make available the full species-level data themselves (not just the site meta-data previously released) to facilitate other research, especially into human impacts on ecological assemblages. We also include suggestions for how the database can be used.

2 | METHODS

We sought datasets describing the abundance or occurrence of species, or the diversity of ecological assemblages of species at multiple sites in different land uses or at different levels of other human pressures (e.g., differing levels of land-use intensity). Data were primarily collated through subprojects on particular regions, land uses, or taxa. We also made general requests for data at conferences and through published articles (Hudson, Newbold, et al., 2013; Hudson et al., 2014; Newbold et al., 2012). Through the course of the project, searches were increasingly targeted toward under- or unrepresented regions, biomes, or taxa, in order to mitigate biased coverage in the literature.

To be included in the database, data were required to meet the following criteria: (1) the dataset was part of a published work, or the sampling methods were published; (2) the same sampling procedure was carried out at each site within each study (sampling effort was permitted to vary so long as it was recorded for each site); and (3) we could acquire the geographical coordinates of each sampled site. Where the author of the original publication was unable to supply the geographical coordinates, sites were georeferenced from maps in the publication (Hudson et al., 2014). Sites' land use—primary vegetation, secondary vegetation (divided according to stage of recovery into mature, intermediate and young; or indeterminate where information on stage was unavailable), plantation forest, cropland, pasture and urban—and, within each land-use class, intensity—minimal, light and intense—were classified from the description given in the source publication or information subsequently provided by data contributors (see Hudson et al., 2014 for full details). These land-use categories were chosen to be as compatible as possible with those used in the harmonized land-use scenarios for 1500–2100 (Hurt et al., 2011) in order to facilitate spatial and temporal projections of modeled land-use effects on biodiversity (e.g., Newbold et al., 2015). For some sites, land use and/or use intensity could not be established, so were given missing values.

The data were arranged in a hierarchical structure. The data from an individual published work, typically a published paper, constituted a “DataSource.” Where different sampling methods were used within a DataSource, for example, because different taxonomic groups were collected, and the data were made available separately, the data were divided into separate “Studies.” Data from a given DataSource were also split into multiple Studies if they covered large geographic areas (e.g., several countries), to reduce the effect of biogeographic differences within Studies. Each Study contained a set of sampled “Sites”

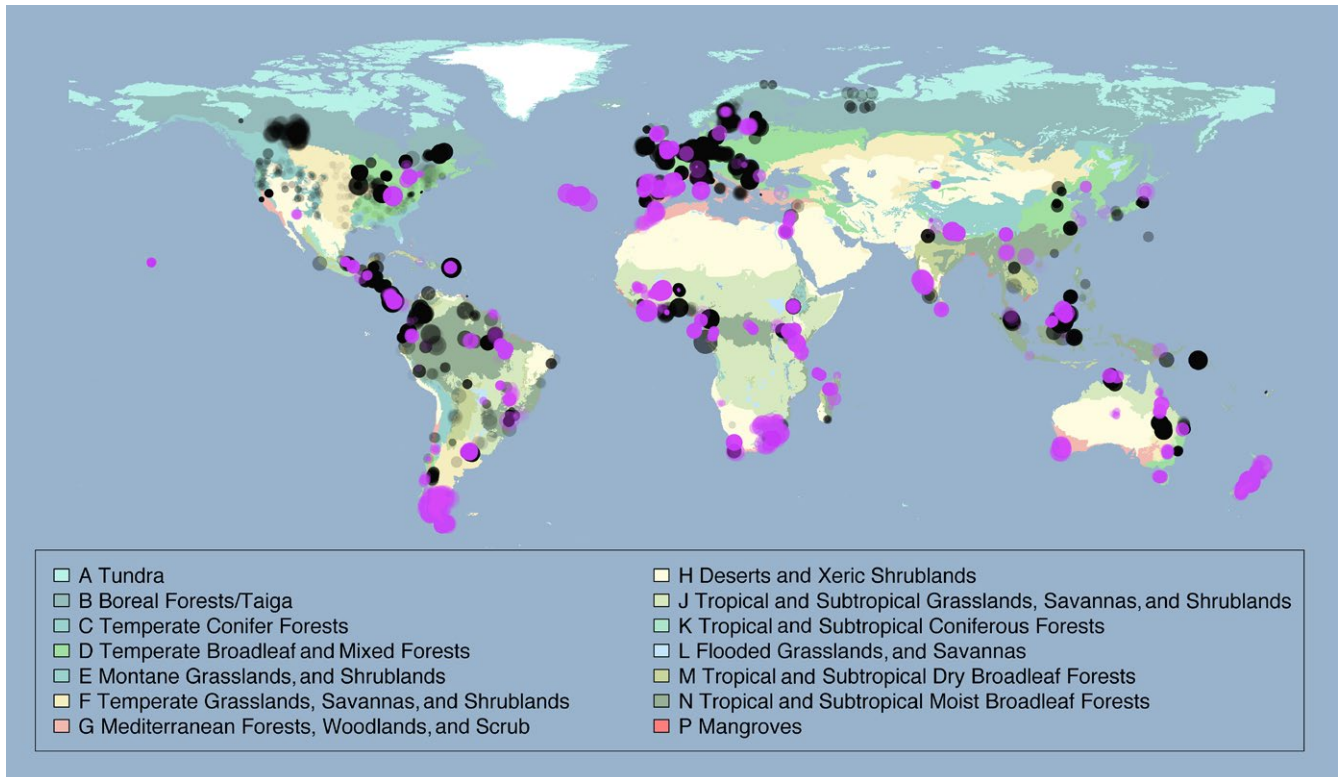


FIGURE 1 Sampling locations. Map colors indicate biomes, taken from the Terrestrial Ecoregions of the World dataset (The Nature Conservancy, 2009), shown in a geographic (WGS84) projection. Circle radii are proportional to \log_{10} of the number of samples at that Site. All circles have the same degree of partial transparency. Sites added to the database since Hudson et al. (2014) are shown in pink

and “Taxa”; at each Site a set of “Measurements” (typically the abundance or occurrence of a set of taxa) were taken. The provided database extracts contain, for each Site, the raw measurement values, the sampling efforts and, where relevant, the effort-corrected abundance values (corrected across Sites within a Study by dividing the abundance measurement by sampling effort, assuming that sampled abundances increase linearly with sampling effort, after first rescaling effort values within each Study to a maximum value of one). The measurements were not corrected for different detectability (Hayward et al., 2015; MacKenzie et al., 2002).

It is important to note that the data in the database are often not exactly the same as those used in the source papers. Numbers of sites may differ because datasets provided may have been partial or included extra sites, or because we have aggregated or disaggregated data differently. Likewise, numbers of taxa may differ because of curation or because more data were provided than had been used in the source paper. Because our focus was to make these data as useful as possible for PREDICTS analyses, rather than to act as a repository for datasets from previous publications, it will often not be possible to use these data to replicate the analyses presented in the source papers.

We were limited by the rate at which we could process new data because so many datasets were contributed. This led to the development of a backlog, which we had to clear by the end of the first phase of funding for PREDICTS. During this stage of the project, in order to process all the datasets in hand within the time available, we focused our

efforts on the fields shown to be most important in our models to that point (De Palma et al., 2015; Newbold et al., 2014, 2015). As a result, DataSources processed since early 2015 often lack data for some fields, including coordinate precision and maximum linear extent; details of the potentially affected fields are listed in Supporting Information.

Team members were trained in how to score datasets received, using written definitions and descriptions of fields and terms, as well as practice datasets. All data underwent basic validation checks to ensure values entered in each field were appropriate (Hudson et al., 2014). Geographical coordinates were visually inspected on a map after entry into the database, and our software automatically detected coordinates falling outside of the expected country (e.g., because latitude and longitude values were accidentally swapped). For the calculation of biodiversity metrics such as species richness, we accepted the identifications of species provided by the authors of the source publications; these were determined at the time of the original research, and so will not reflect subsequent taxonomic changes or re-identifications. We also matched taxonomic names to the Catalogue of Life 2013 checklist (COL; Roskov et al., 2013), allowing us to validate many of the names, assess taxonomic coverage and relate measurements to species-level datasets such as those describing ecological traits. We make available both the original species classifications and those from COL (field names are given in Supporting Information). We reviewed and corrected a number of potential error cases, such as names without a matching COL record, and names for which the higher taxonomic

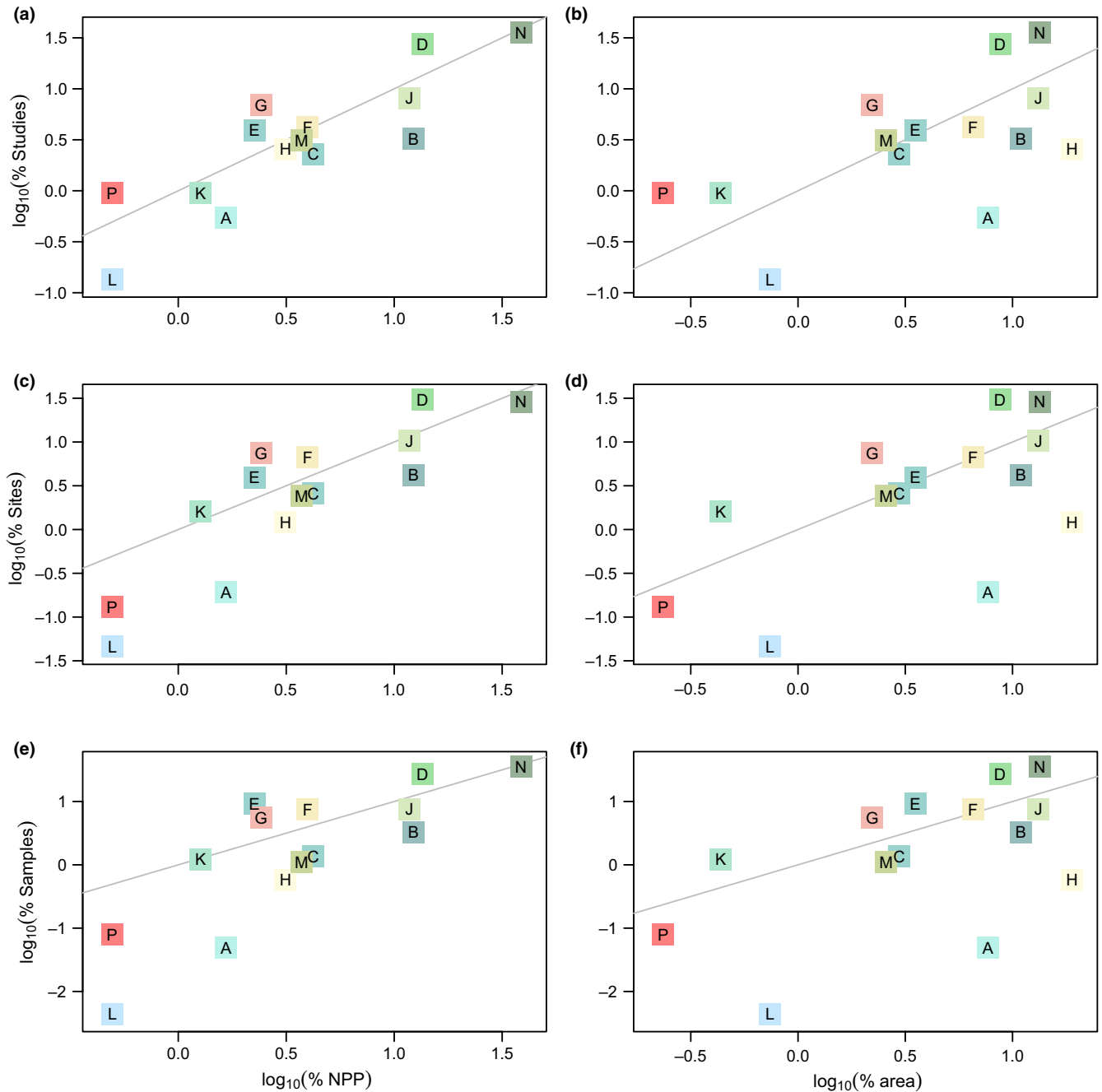


FIGURE 2 Coverage of biomes. The percentage of Studies (a and b), Sites (c and d), and samples (e and f) against percentages of terrestrial NPP (Net Primary Productivity, computed as in Hudson et al., 2014; a, c, and e) and terrestrial area (b, d, and f). Biome codes and colors are as in Figure 1

rank of the matching COL record was unexpected (e.g., a COL record for a true fly within a Study that examined birds). Many more validation checks were applied; a complete description is in Hudson et al. (2014).

3 | RESULTS

3.1 | Geographical coverage

This release of the PREDICTS database contains 3,250,404 records, from 26,114 sampled Sites (Figure 1), collated from 480 DataSources

and 666 Studies. The data represent all of the world's 14 terrestrial biomes, in approximate proportion to their contribution to global total primary productivity (Figure 2). The sampled Sites span 94 of the world's countries (including all 17 megadiverse countries; Mittermeier, Gil, & Mittermeier, 1997), 281 of the 814 terrestrial ecoregions (The Nature Conservancy 2009) and 32 of Conservation International's 35 biodiversity hotspots (Myers, Mittermeier, da Fonseca, & Kent, 2000; circles on Figure 3). Although the database focuses on land use, it also includes data from regions that have so far seen relatively little land-use change, such as some

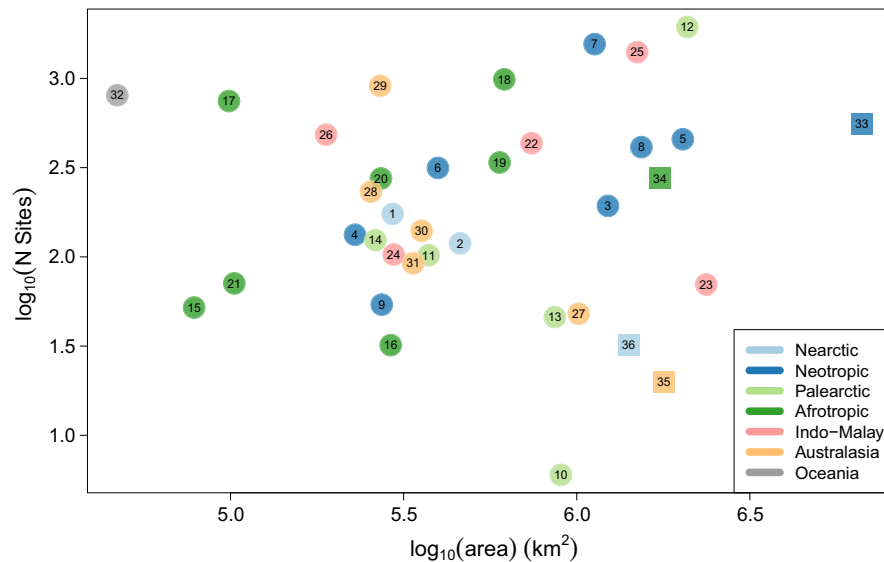


FIGURE 3 Numbers of Sites against the areas of biodiversity hotspots and of high biodiversity wilderness areas (HBWAs). Hotspots are shown by circles and HBWAs by squares; symbols are colored by the predominant biogeographic realm in which they fall. Hotspots are 1 California Floristic Province, 2 Madrean Pine-Oak Woodlands, 3 Atlantic Forest, 4 Caribbean Islands, 5 Cerrado, 6 Chilean Winter Rainfall and Valdivian Forests, 7 Mesoamerica, 8 Tropical Andes, 9 Tumbes-Choco-Magdalena, 10 Irano-Anatolian, 11 Japan, 12 Mediterranean Basin, 13 Mountains of Central Asia, 14 Mountains of Southwest China, 15 Cape Floristic Region, 16 Coastal Forests of Eastern Africa, 17 Eastern Afromontane, 18 Guinean Forests of West Africa, 19 Madagascar and the Indian Ocean Islands, 20 Moputaland-Pondoland-Albany, 21 Succulent Karoo, 22 Himalaya, 23 Indo-Burma, 24 Philippines, 25 Sundaland, 26 Western Ghats and Sri Lanka, 27 East Melanesian Islands, 28 Forests of East Australia, 29 New Zealand, 30 Southwest Australia, 31 Wallacea, 32 Polynesia-Micronesia and HBWAs are 33 Amazonia, 34 Congo Forests, 35 New Guinea, 36 North American Deserts. Unrepresented are the hotspots Caucasus, Horn of Africa, New Caledonia and the HBWA Miombo-Mopane Woodlands and Savannas

high biodiversity wilderness areas (Mittermeier et al., 2003; squares on Figure 3).

3.2 | Taxonomic coverage

Records in the PREDICTS database represent 47,044 species (see Hudson et al., 2014 for how species numbers are estimated in the face of imprecise taxon names), which is over 2% of the number thought to have been formally described (Chapman, 2009)—29,737 animals, 15,545 plants, 1,759 fungi, and three protists. The taxonomic distribution of taxa in the database is in rough proportion to the numbers of described species in major taxonomic groups of animals and plants (Figure 4), and the data represent more than 1% as many species as have been described in the following groups: Amphibia, Arachnida, Archaeognatha, Ascomycota, Aves, Basidiomycota, Bryophyta, Chilopoda, Coleoptera, Collembola, Dermaptera, Diptera, Embioptera, Ferns and allies, Glomeromycota, Gymnosperms, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Magnoliophyta, Mammalia, Mantodea, Mecoptera, Neuroptera, Odonata, Onychophora, Orthoptera, Reptilia, Symphyla and Zoraptera (Figure 4). Vertebrates—and especially birds—are overrepresented owing to biases in the published literature (Figure 4), but less so than in many other data compilations (e.g., over half of the records currently in the Global Biodiversity Information Facility [GBIF] are of birds; www.gbif.org, accessed in April 2016). Most Studies in the PREDICTS database sampled at least multiple families, if not multiple orders, classes, phyla,

or even kingdoms (Figure 5). However, some Studies sampled only a single family, genus, or even species (Figure 5).

3.3 | Temporal coverage

We focused primarily on data sampled since 2000 because most global layers describing human pressure are collected after this year and, in particular, to facilitate use of contemporaneous Moderate-resolution Imaging Spectroradiometer (MODIS) remotely sensed data (Justice et al., 1998; Tuck et al., 2014) in modeling. However, in filling certain taxonomic and geographic gaps, we also collated some data that were sampled before 2000 (Figure 6). Data are sparse after 2012 because of the natural time lags between data collection in the field, publication and then assimilation into the PREDICTS database (Figure 6).

3.4 | Data access and structure

This 2016 release of the database—the complete dataset and also site-level summaries—is available on the data portal of the Natural History Museum, London (doi: 10.5519/0066354) as comma-separated variable (CSV) files and as RDS files, the latter for use with the R statistical modeling language (R Core Team 2015; RDS files were generated using R 3.3.1). A complete description of the columns in the extracts, along with a visualization of the database schema, is given in Supporting Information. This paper makes all the data in this version of the database freely available to anyone wishing to use

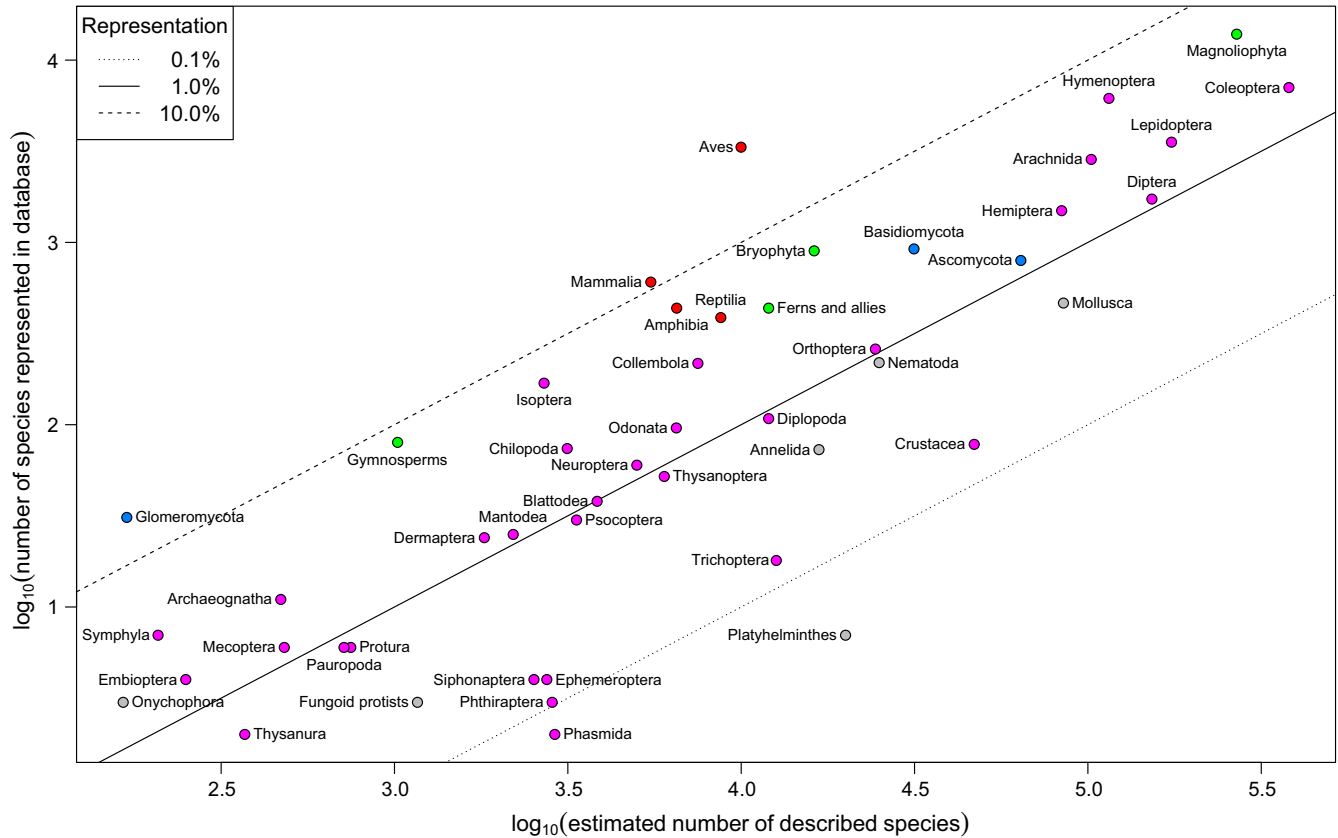


FIGURE 4 Taxonomic coverage. The numbers of species in our database against the numbers of described species within each of 59 higher taxa, as estimated by Chapman (2009), on logarithmic axes. Vertebrates are shown in red, arthropods in pink, other animals in gray, plants in green, and fungi in blue. The dashed, solid, and dotted lines indicate 10, 1, and 0.1% representation, respectively. Groups with just a single species represented (Diplura and Zoraptera) are not shown

them for any purpose. The terms of the license require that anyone publishing research based on these data should cite this paper and/or the original sources of the data used, as appropriate. The dataset at doi: 10.5519/0066354 contains bibliographic information for all DataSources in both CSV and BibTeX formats.

4 | DISCUSSION

The PREDICTS database is designed to be able to address a range of questions about how land use and related pressures have influenced the occurrence and abundance of species and the diversity of ecological assemblages. The highly structured nature of the data, with comparable surveys having been carried out at each Site within a Study, was chosen to facilitate such modeling. Table 1 identifies a range of long-standing general questions for which the PREDICTS data may be useful, referencing early papers addressing questions of each type. It also outlines the steps required to tackle each kind of question, in conjunction with other information about the Sites and species where necessary, and refers to papers that have performed so.

Changes in attitudes to—and the increasing ease of—data sharing have contributed to rapid growth in open compilations of structured biodiversity data and related pressure data targeted toward particular

kinds of research question. Examples of data types featured in such compilations include population time series (e.g., Inchausti & Halley, 2001), assemblage time series (e.g., Dornelas et al., 2014), assemblage inventories (e.g., Thibault, Supp, Giffin, White, & Ernest, 2011), and species traits (e.g., Madin et al., 2016). Other projects have collated or are collating large compilations of structured biodiversity data, such as BIOFRAG (Pfeifer et al., 2014; habitat fragmentation), BIOTIME (The BioTIME Research Group, 2016; detailed time-series data, still being compiled) and GLOBIO3 (Alkemade et al., 2009; pristine versus disturbed habitats, not publicly available).

The largest open compilation of biodiversity data is the Global Biodiversity Information Facility (GBIF; www.gbif.org), which aggregates mostly unstructured species occurrence data. The unstructured nature of most GBIF data limits the range of questions to which they can easily be put, although they are increasingly used in modeling species distributions (e.g., Pineda & Lobo, 2008) and habitat suitability (e.g., Ficetola, Rondinini, Bonardi, Baisero, & Padoa-Schioppa, 2015). As of April 2016, GBIF holds over 560 million georeferenced occurrence records of around 1.5 million species, although coverage is taxonomically uneven (e.g., most records are of birds) and patchy even among the best-recorded groups (Meyer, Kreft, Guralnick, & Jetz, 2015).

Databases of species traits continue to be collated and published, and many of them are relevant to taxa in the PREDICTS

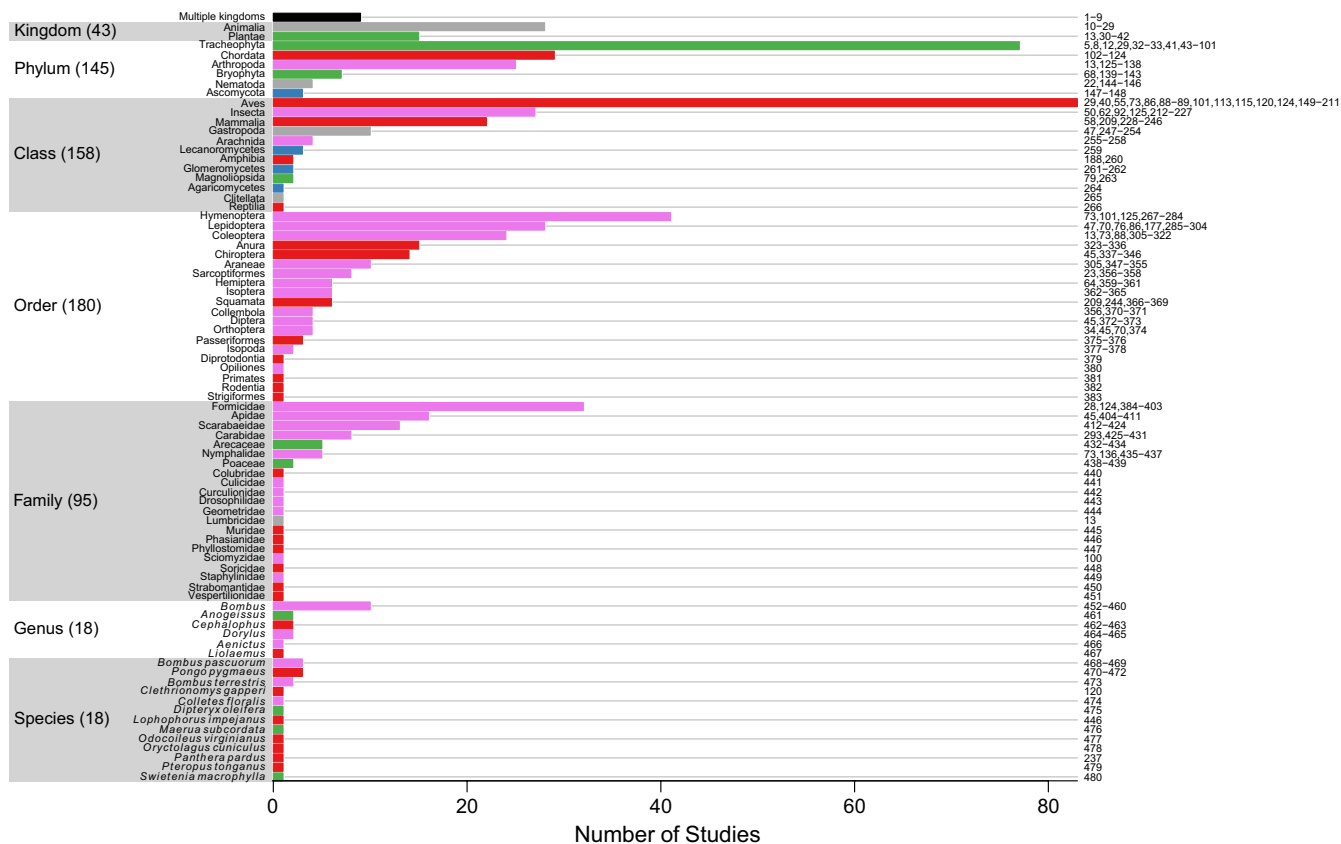


FIGURE 5 Number of Studies by lowest common taxonomic group. Bars show the number of Studies within each lowest common taxon (so, one Study examined the species *Swietenia macrophylla*, three Studies examined the species *Bombus pascuorum*, ten Studies examined multiple species within the genus *Bombus*, and so on). Colors are as in Figure 4. Numbers on the right are the primary references from which data were taken: 1 Basset et al. (2008), 2 Buscardo et al. (2008), 3 Christensen and Heilmann-Clausen (2009), 4 Dominguez, Bahamonde, and Muñoz-Escobar (2012), 5 López-Quintero, Straatsma, Franco-Molano, and Boekhout (2012), 6 Nöske et al. (2008), 7 Norton, Espie, Murray, and Murray (2006), 8 Peri, Lencinas, Martínez Pastur, Wardell-Johnson, and Lasagno (2013), 9 Robinson and Williams (2011), 10 Barratt et al. (2005), 11 Bonham, Mesibov, and Bashford (2002), 12 Boutin, Martin, and Baril (2009), 13 Carpenter et al. (2012), 14 Gaigher and Samways (2010), 15 Ge et al. (2012), 16 Hayward (2009), 17 Leighton-Goodall, Brown, Hammond, and Eggleton (2012), 18 Muchane et al. (2012), 19 Ngai et al. (2008), 20 Richardson, Richardson, and Soto-Adames (2005), 21 Schon, Mackay, Minor, Yeates, and Hedley (2008), 22 Schon, Mackay, Yeates, and Minor (2010), 23 Schon, Mackay, and Minor (2011), 24 Smith (2006), 25 Smith, Potts, Woodcock, and Eggleton (2008), 26 Smith, Potts, and Eggleton (2008), 27 Todd et al. (2011), 28 Vasconcelos et al. (2009), 29 Walker, Wilson, Norbury, Monks, and Tanentzap (2014), 30 Baeten, Velghe, et al. (2010), 31 Bakayoko, Martin, Chatelain, Traore, and Gautier (2011), 32 Center for International Forestry Research (CIFOR) (2013a), 33 Center for International Forestry Research (CIFOR) (2013b), 34 Dumont et al. (2009), 35 Firincioglu, Seefeldt, Sahin, and Vural (2009), 36 Haarmeyer, Schmiedel, Dengler, and Bosing (2010), 37 Joubert, Esler, and Privett (2009), 38 Norfolk, Eichhorn, and Gilbert (2013), 39 Page, Qureshi, Rawat, and Kushalappa (2010), 40 Proença, Pereira, Guilherme, and Vicente (2010), 41 Sheil et al. (2002), 42 Wang, Lencinas, Ross Friedman, Wang, and Qiu (2011), 43 Alignier and Deconhat (2013), 44 Baeten, Hermy, Van Daele, and Verheyen (2010), 45 Barlow, Gardner, et al. (2007), 46 Barrico et al. (2012), 47 Baur et al. (2006), 48 Bery et al. (2010), 49 Boutin, Baril, and Martin (2008), 50 Bouyer et al. (2007), 51 Brearley (2011), 52 Brunet et al. (2011), 53 Calviño-Cancela, Rubido-Bará, and van Etten (2012), 54 Castro, Lehsten, Lavorel, and Freitas (2010), 55 de Lima, Dallimer, Atkinson, and Barlow (2013), 56 Devineau, Fournier, and Nignan (2009), 57 Fensham, Dwyer, Eyre, Fairfax, and Wang (2012), 58 Fernandez and Simonetti (2013), 59 Fredriksson, Danielsen, and Swenson (2007), 60 Gendreau-Berthiaume, Kneeshaw, and Harvey (2012), 61 Golodets, Kigel, and Sternberg (2010), 62 Grass, Berens, Peter, and Farwig (2013), 63 Gutierrez et al. (2009), 64 Helden and Leather (2004), 65 Hernández, Delgado, Meier, and Duran (2012), 66 Hietz (2005), 67 Higuera and Wolf (2010), 68 Hylander and Nemomissa (2009), 69 Ishida, Hattori, and Takeda (2005), 70 Kati, Zografou, Tzirkalli, Chitos, and Willemse (2012), 71 Katovai, Burley, and Mayfield (2012), 72 Kessler et al. (2005), 73 Kessler et al. (2009), 74 Kolb and Diekmann (2004), 75 Krauss, Klein, Steffan-Dewenter, and Tschamtkke (2004), 76 Krauss et al. (2010), 77 Kumar and Shahabuddin (2005), 78 Letcher and Chazdon (2009), 79 Louhaichi, Salkini, and Petersen (2009), 80 Lucas-Borja et al. (2011), 81 Måren (2011), 82 Måren, Bhattarai, and Chaudhary (2013), 83 Marin-Spiotta, Ostertag, and Silver (2007), 84 Mayfield, Ackerly, and Daily (2006), 85 McNamara, Erskine, Lamb, Chantalangsy, and Boyle (2012), 86 Milder et al. (2010), 87 O'Connor (2005), 88 Paritsis and Aizen (2008), 89 Phalan, Onial, Balmford, and Green (2011), 90 Pincheira-Ulbrich, Rau, and Smith-Ramirez (2012), 91 Poggio, Chaneton, and Ghersa (2013), 92 Power and Stout (2011), 93 Power, Kelly, and Stout (2012), 94 Ramesh et al. (2010), 95 Romero-Duque, Jaramillo, and Perez-Jimenez (2007), 96 Schmitt, Senbeta, Denich, Preisinger, and Boehmer (2010), 97 Shannon et al. (2008), 98 Siebert (2011), 99 Vassilev, Pedashenko, Nikolov, Apostolova, and Dengler (2011), 100 Williams, Sheahan, and Gormally (2009), 101 Yamaura et al. (2012), 102 Alcalá, Alcalá, and Dolino (2004), 103 Bicknell and Peres (2010), 104 Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) (2010); Deheuvels, Avelino, Somarriba, and Malézieux (2012), Deheuvels et al. (2014); Rousseau, Deheuvels, Rodriguez Arias, and Somarriba (2012), 105 Craig et al. (2009),

(Continues)

FIGURE 5 (Continued)

106 Craig et al. (2012), 107 Craig, Grigg, Hobbs, and Hardy (2014), 108 Craig, Stokes, StJ. Hardy, and Hobbs (2015), 109 de Thoisy et al. (2010), 110 Endo et al. (2010), 111 Garden, McAlpine, and Possingham (2010), 112 Kurz, Nowakowski, Tingley, Donnelly, and Wilcove (2014), 113 Kutt and Woinarski (2007), 114 Kutt, Vanderduys, and O'Reagain (2012), 115 Lehouck et al. (2009), 116 Macip-Ríos and Muñoz-Alonso (2008), 117 McCarthy, McCarthy, Fuller, and McCarthy (2010), 118 Parry, Barlow, and Peres (2009), 119 Peres and Nascimento (2006), 120 St-Laurent, Ferron, Hins, and Gagnon (2007), 121 Sung, Karraker, and Hau (2012), 122 Urbina-Cardona, Olivares-Perez, and Reynoso (2006), 123 Woinarski and Ash (2002), 124 Woinarski et al. (2009), 125 Billeter et al. (2008); Le Féon et al. (2010), 126 Borges et al. (2006), 127 Cabra-García, Bermúdez-Rivas, Osorio, and Chacón (2012), 128 Hanley (2011), 129 Lachat et al. (2006), 130 Cardoso et al. (2009); Meijer, Whittaker, and Borges (2011), 131 Nakamura, Proctor, and Catterall (2003), 132 Norfolk, Abdel-Dayem, and Gilbert (2012), 133 Poveda, Martínez, Kersch-Becker, Bonilla, and Tscharntke (2012), 134 Rousseau, Fonte, Tellez, van der Hoek, and Lavelle (2013), 135 Turner and Foster (2009), 136 Uehara-Prado et al. (2009), 137 Waite (2012); Waite, Closs, Van Heezik, Berry, and Dickinson (2012), 138 Woodcock et al. (2007), 139 Albertos, Lara, Garilleti, and Mazimpaka (2005), 140 Draper, Lara, Albertos, Garilleti, and Mazimpaka (2006), 141 Giordano et al. (2004), 142 Hylander and Weibull (2012), 143 Medina et al. (2010), 144 Hu and Cao (2008), 145 Wu, Fu, Chen, and Chen (2002), 146 Zhang, Li, and Liang (2010), 147 Giordani et al. (2010), 148 Giordani (2012), 149 Aben, Dorenbosch, Herzog, Smolders, and Van Der Velde (2008), 150 Arbeláez-Cortés, Rodríguez-Correa, and Restrepo-Chica (2011), 151 Aumann (2001), 152 Azhar et al. (2013), 153 Azman et al. (2011), 154 Azpiroz and Blake (2009), 155 Báldi, Batáry, and Erdos (2005), 156 Barlow, Mestre, Gardner, and Peres (2007), 157 Bóçon (2010), 158 Borges (2007), 159 Brandt et al. (2013), 160 Cerezo, Conde, and Poggio (2011), 161 Chapman and Reich (2007), 162 Cockle, Leonard, and Bodrati (2005), 163 Dallimer, Parnell, Bicknell, and Melo (2012), 164 Dawson et al. (2011), 165 Dures and Cumming (2010), 166 Edenius, Mikusinski, and Bergh (2011), 167 Farwig, Sajita, and Boehning-Gaese (2008), 168 Flaspohler et al. (2010), 169 Gomes, Oostra, Nijman, Cleef, and Kappelle (2008); Oostra, Gomes, and Nijman (2008), 170 Hassan et al. (2013), 171 Ims and Henden (2012), 172 Lantschner, Rusch, and Peyrou (2008), 173 Lasky and Keitt (2010), 174 Latta, Tinoco, Astudillo, and Graham (2011), 175 Mallari et al. (2011), 176 Doulton, Marsh, Newman, Bird, and Bell (2007), 177 Marsh, Lewis, Said, and Ewers (2010), 178 Miranda, Politi, and Rivera (2010), 179 Moreno-Mateos et al. (2011), 180 Munyekenye, Mwangi, and Gichuki (2008), 181 Naidoo (2004), 182 Naithani and Bhatt (2012), 183 Naoe, Sakai, and Masaki (2012), 184 Ndag'ang'a, Njoroge, and Githiru (2013), 185 Neuschulz, Botzat, and Farwig (2011), 186 O'Dea and Whittaker (2007), 187 Owiunji and Plumtre (1998), 188 Pearman (2002), 189 Politi, Hunter Jr. and Rivera (2012), 190 Pons and Wendenburg (2005), 191 Ranganathan, Chan, and Daily (2007), 192 Ranganathan, Daniels, Chandran, Ehrlich, and Daily (2008), 193 Reid, Harris, and Zahawi (2012), 194 Rey-Benayas, Galvan, and Carrascal (2010), 195 Reynolds and Symes (2013), 196 Rosselli (2011), 197 Sam, Koane, Jeppy, and Novotny (2014), 198 Santana, Porto, Gordinho, Reino, and Beja (2012), 199 Shahabuddin and Kumar (2006, 2007), 200 Sheldon, Styring, and Hosner (2010), 201 Sodhi et al. (2010), 202 Soh, Sodhi, and Lim (2006), 203 Sosa, Benz, Galea, and Poggio Herrero (2010), 204 Stouffer, Johnson, Bierregaard, Richard, and Lovejoy (2011), 205 Suarez-Rubio and Thomlinson (2009), 206 Vergara and Simonetti (2004), 207 Verhulst, Báldi, and Kleijn (2004), 208 Waite, Closs, van Heezik, and Dickinson (2013), 209 Wang, Bao, Yu, Xu, and Ding (2010), 210 Wunderle, Henriques, and Willig (2006), 211 Li, Zou, Zhang, and Sheldon (2013), 212 Bates et al. (2011), 213 Blake, Westbury, Woodcock, Sutton, and Potts (2011), 214 Blanche, Ludwig, and Cunningham (2006), 215 Cleary et al. (2004), 216 Farwig et al. (2009), 217 Franzén and Nilsson (2008), 218 Kohler, Verhulst, van Klink, and Kleijn (2008), 219 Litchwark (2013), 220 Meyer, Gaebele, and Steffan-Dewenter (2007), 221 Jauker, Krauss, Jauker, and Steffan-Dewenter (2013); Meyer, Jauker, and Steffan-Dewenter (2009), 222 Mudri-Stojnic, Andric, Jozan, and Vujic (2012), 223 Quintero, Morales, and Aizen (2010), 224 Rader, Bartomeus, Tylianakis, and Laliberte (2014), 225 Schüepp, Herrmann, Herzog, and Schmidt-Entling (2011), 226 Summerville (2011), 227 Vergara and Badano (2009), 228 Bernard, Fjeldsa, and Mohamed (2009), 229 Cáceres, Nápoli, Casella, and Hannibal (2010), 230 Cassano, Barlow, and Pardini (2014), 231 Danquah, Oppong, and Nutsuakor (2012), 232 Garmendia, Arroyo-Rodríguez, Estrada, Naranjo, and Stoner (2013), 233 Gheler-Costa, Vettorazzi, Pardini, and Verdade (2012), 234 Granjon and Duplantier (2011), 235 Henschel (2008), 236 Hoffmann and Zeller (2005), 237 Kittle, Watson, Chanaka Kumara, and Nimalka Sanjeevani (2012), 238 Lantschner, Rusch, and Hayes (2012), 239 Martin, Gheler-Costa, Lopes, Rosalino, and Verdade (2012), 240 McShea et al. (2009), 241 Mena and Medellín (2010), 242 Nakagawa, Miguchi, and Nakashizuka (2006), 243 O'Farrell, Donaldson, Hoffman, and Mader (2008), 244 Scott et al. (2006), 245 Sridhar, Raman, and Mudappa (2008), 246 Wells, Kalko, Lakim, and Pfeiffer (2007), 247 Hylander, Nilsson, and Gothner (2004), 248 Kappes, Katschner, and Nowak (2012), 249 Oke and Chokor (2009), 250 Oke (2013), 251 Schilthuizen, Liew, Bin Elahan, and Lackman-Ancrenaz (2005), 252 Ström, Hylander, and Dynesius (2009), 253 Torre, Bros, and Santos (2014), 254 Wronski et al. (2014), 255 Freire and Motta (2011), 256 Lo-Man-Hung, Gardner, Ribeiro-Júnior, Barlow, and Bonaldo (2008), 257 Shochat, Stefanov, Whitehouse, and Faeth (2004), 258 Zaitsev, Chauvat, Pug, and Wolters (2002), 259 Walker, Crittenden, Young, and Prystina (2006), 260 Malonza and Veith (2012), 261 Alguacil, Torrecillas, Hernandez, and Roldan (2012), 262 Brito, Goss, de Carvalho, Chatagnier, and van Tuinen (2012), 263 Baral and Katzensteiner (2009), 264 Robles, Carmaran, and Lopez (2011), 265 Römbke, Schmidt, and Höfer (2009), 266 Luja, Herrando-Perez, Gonzalez-Solis, and Luiselli (2008), 267 Cameron et al. (2011), 268 Cunningham, Schellhorn, Marcora, and Batley (2013), 269 Fowler (2014), 270 Gould et al. (2013), 271 Lentini, Martin, Gibbons, Fischer, and Cunningham (2012), 272 Malone et al. (2010), 273 Marshall, West, and Kleijn (2006), 274 Oertli, Muller, and Dorn (2005), 275 Osgathorpe, Park, and Goulson (2012), 276 Quaranta et al. (2004), 277 Richards et al. (2011), 278 Samnegård, Persson, and Smith (2011), 279 Schüepp, Rittiner, and Entling (2012), 280 Shuler, Roulston, and Farris (2005), 281 Smith-Pardo and Gonzalez (2007), 282 Toniotto, Fant, Ascher, Ellis, and Larkin (2011), 283 Tylianakis, Klein, and Tscharntke (2005), 284 Verboven, Brys, and Hermy (2012), 285 Barlow, Overal, Araujo, Gardner, and Peres (2007), 286 Berg, Ahrné, Öckinger, Svensson, and Söderström (2011), 287 Bobo, Waltert, Fermon, Njokagbor, and Muhlenberg (2006), 288 Cleary and Mooers (2006), 289 D'Aniello, Stanislao, Bonelli, and Balletto (2011), 290 de Sassi, Lewis, and Tylianakis (2012), 291 Dolia, Devy, Aravind, and Kumar (2008), 292 Hawes et al. (2009), 293 Ishitani, Kotze, and Niemela (2003), 294 Krauss, Steffan-Dewenter, and Tscharntke (2003), 295 Littlewood (2008), 296 Pe'er, Maanen, Turbe, Matsinos, and Kark (2011), 297 Safian, Csontos, and Winkler (2011), 298 Summerville and Crist (2002), 299 Summerville, Conoan, and Steichen (2006), 300 Sutrisno (2010), 301 Uehara-Prado, Brown, Spalding, and Lucci Freitas (2007), 302 Verdasca et al. (2012), 303 Vu (2005), 304 Vu (2009), 305 Banks, Sandvik, and Keesecker (2007), 306 Barratt et al. (2012), 307 Blanche and Cunningham (2005), 308 Buse, Levanony, Timm, Dayan, and Assmann (2008), 309 Elek and Lovei (2007), 310 Ewers, Thorpe, and Didham (2007), 311 Gaubloimme, Hendrickx, Dhuyvetter, and Desender (2008), 312 Gray, Slade, Mann, and Lewis (2014), 313 Jonsell (2012), 314 Légraré, Hébert, and Ruel (2011), 315 Mico,

(Continues)

FIGURE 5 (Continued)

García-Lopez, Brustel, Padilla, and Galante (2013), 316 Noreika (2009), 317 Numa, Verdu, Rueda, and Galante (2012), 318 Nyeko (2009), 319 Otavo, Parrado-Rosselli, and Noriega (2013), 320 Rodrigues, Uchoa, and Ide (2013), 321 Sugiura, Tsuru, Yamaura, and Makihara (2009), 322 Verdú et al. (2007), 323 Adum, Eichhorn, Oduro, Ofori-Boateng, and Rodel (2013), 324 de Souza, de Souza, and Morato (2008), 325 Eigenbrod, Hecnar, and Fahrig (2008), 326 Faruk, Belabut, Ahmad, Knell, and Garner (2013), 327 Furlani, Ficetola, Colombo, Ugurlucan, and De Bernardi (2009), 328 Gutierrez-Lamus (2004), 329 Hilje and Aide (2012), 330 Isaacs-Cubides and Urbina-Cardona (2011), 331 Ofori-Boateng et al. (2013), 332 Pethiyagoda and Manamendra-Arachchi (2012), 333 Pillsbury and Miller (2008), 334 Pineda and Halffter (2004), 335 Vallan (2002), 336 Watling, Gerow, and Donnelly (2009), 337 Castro-Luna, Sosa, and Castillo-Campos (2007), 338 Clarke, Rostant, and Racey (2005), 339 Fukuda, Tisen, Momose, and Sakai (2009), 340 MacSwiney, Vilchis, Clarke, and Racey (2007), 341 Presley, Willig, Wunderle, Joseph, and Saldanha (2008), 342 Sedlock et al. (2008), 343 Shafie, Sah, Latip, Azman, and Khairuddin (2011), 344 Struebig, Kingston, Zubaid, Mohd-Adnan, and Rossiter (2008), 345 Threlfall, Law, and Banks (2012), 346 Willig et al. (2007), 347 Alcayaga, Pizarro-Araya, Alfaro, and Cepeda-Pizarro (2013), 348 Buddle and Shorthouse (2008), 349 Clark, Gerard, and Mellsop (2004), 350 Kapoor (2008), 351 Lo-Man-Hung et al. (2011), 352 Magura, Horvath, and Tothmeresz (2010), 353 Malumbres-Olarte et al. (2014), 354 Paradis and Work (2011), 355 Raub, Hoefer, Scheuermann, and Brandl (2014), 356 Alberta Biodiversity Monitoring Institute (ABMI) (2013), 357 Arroyo, Iturrondobeitia, Rad, and Gonzalez-Carcedo (2005), 358 Zaitsev, Wolters, Waldhardt, and Dauber (2006), 359 Kőrösi, Batáry, Orosz, Rédei, and Báldi (2012), 360 Littlewood, Pakeman, and Pozsgai (2012), 361 Moir, Brennan, Koch, Majer, and Fletcher (2005), 362 Carrijo, Brandao, de Oliveira, Costa, and Santos (2009), 363 Oliveira, Carrijo, and Brandão (2013), 364 Reis and Canello (2007), 365 Zeidler, Hanrahan, and Scholes (2002), 366 D'Cruze and Kumar (2011), 367 Fabricius, Burger, and Hockey (2003), 368 Pelegrin and Bucher (2012), 369 Urbina-Cardona, Londoño-Murcia, and García-Ávila (2008), 370 Chauvat, Wolters, and Dauber (2007), 371 Fiera (2008), 372 Savage, Wheeler, Moores, and Taillefer (2011), 373 Virgilio, Bäckeljaug, Emeleme, Juakali, and De Meyer (2011), 374 Andersen, Ludwig, Lowe, and Rentz (2001), 375 Otto and Roloff (2012), 376 Zimmerman, Bell, Woodcock, Palmer, and Paloniemi (2011), 377 Hornung, Tothmeresz, Magura, and Vilisics (2007), 378 Magrini, Freitas, and Uehara-Prado (2011), 379 Laurance and Laurance (1996), 380 Bragagnolo, Nogueira, Pinto-da-Rocha, and Pardini (2007), 381 Herrera, Wright, Lauterbur, Ratovonjanahary, and Taylor (2011), 382 Jung and Powell (2011), 383 Bartolommei, Mortelliti, Pezzo, and Puglisi (2013), 384 Andersen and Hoffmann (2011), 385 Armbrrecht, Perfecto, and Silverman (2006), 386 Bihn, Verhaagh, Braendle, and Brandl (2008), 387 Buczkowski (2010), 388 Buczkowski and Richmond (2012), 389 Delabie et al. (2009), 390 Dominguez-Haydar and Armbrrecht (2010), 391 Fayle et al. (2010), 392 Floren, Freking, Biehl, and Linsenmair (2001), 393 Frizzo and Vasconcelos (2013), 394 Gove, Majer, and Rico-Gray (2005), 395 Gunawardene, Majer, and Edirisinghe (2010), 396 Hashim, Akmal, Jusoh, and Nasir (2010), 397 Kone, Konate, Yeo, Kouassi, and Linsenmair (2010), 398 Maeto and Sato (2004), 399 Roth, Perfecto, and Rathcke (1994), 400 Schmidt, Fraser, Carlyle, and Bassett (2012), 401 Uehara-Prado (2005), 402 Vasconcelos (1999), 403 Vasconcelos, Vilhena, and Caliri (2000), 404 Fierro, Cruz-Lopez, Sanchez, Villanueva-Gutierrez, and Vandame (2012), 405 Hanley (2005), 406 Julier and Roulston (2009), 407 Liow, Sodhi, and Elmquist (2001), 408 Nielsen et al. (2011), 409 Parra-H and Nates-Parra (2007), 410 Rasmussen (2009), 411 Winfree, Griswold, and Kremen (2007), 412 da Silva (2011), 413 Davis and Phillips (2005), 414 Filgueiras, Iannuzzi, and Leal (2011), 415 Gardner, Hernandez, Barlow, and Peres (2008), 416 Horgan (2009), 417 Jacobs, Scholtz, Escobar, and Davis (2010), 418 Navarrete and Halffter (2008), 419 Navarro, Roman, Gomez, and Perez (2011), 420 Noriega, Realpe, and Fagua (2007), 421 Noriega, Palacio, Monroy-G, and Valencia (2012), 422 Rös, Escobar, and Halffter (2012), 423 Silva, Costa, Moura, and Farias (2010), 424 Slade, Mann, and Lewis (2011), 425 Gu, Zhen-Rong, and Dun-Xiao (2004), 426 Koivula, Hyyrylainen, and Soininen (2004), 427 Liu, Axmacher, Wang, Li, and Yu (2012), 428 Noreika and Kotze (2012), 429 Rey-Velasco and Miranda-Esquivel (2012), 430 Vanbergen, Woodcock, Watt, and Niemela (2005), 431 Weller and Ganzhorn (2004), 432 Aguilar-Barquero and Jiménez-Hernández (2009), 433 Carvalho, Ferreira, Lima, and de Carvalho (2010), 434 Svenning (1998), 435 Benedict et al. (2006), 436 Fermon, Waltert, Vane-Wright, and Muhlenberg (2005), 437 Ribeiro and Freitas (2012), 438 Breedt, Dreber, and Kellner (2013), 439 Scott, Setterfield, Douglas, and Andersen (2010), 440 Cagle (2008), 441 Johnson, Gómez, and Pinedo-Vasquez (2008), 442 Su, Zhang, and Qiu (2011), 443 Gottschalk, De Toni, Valente, and Hofmann (2007), 444 Axmacher et al. (2009), 445 García, Ortiz Zapata, Aguayo, and D'Elia (2013), 446 Jolli and Pandit (2011), 447 Saldaña-Vázquez, Sosa, Hernández-Montero, and López-Barrera (2010), 448 Nicolas, Barriere, Tapiero, and Colyn (2009), 449 Sakchoowong, Nomura, Ogata, and Chanpaisaeng (2008), 450 García-R, Cárdenas-H, and Castro-H (2007), 451 Yoshikura, Yasui, and Kamijo (2011), 452 Connop, Hill, Steer, and Shaw (2011), 453 Darvill, Knight, and Goulson (2004), 454 Diekötter, Walther-Hellwig, Conradi, Suter, and Frankl (2006), 455 Goulson, Lye, and Darvill (2008), 456 Goulson et al. (2010), 457 Hanley et al. (2011), 458 Hatfield and LeBuhn (2007), 459 McFrederick and LeBuhn (2006), 460 Redpath, Osgathorpe, Park, and Goulson (2010), 461 Schumann, Wittig, Thiombiano, Becker, and Hahn (2011), 462 Nakashima, Inoue, and Akomo-Okoue (2013), 463 Wiafe and Amfo-Otu (2012), 464 Peters, Fischer, Schaab, and Kraemer (2009), 465 Peters, Lung, Schaab, and Waegele (2011), 466 Matsumoto, Itioka, Yamane, and Momose (2009), 467 Rubio and Simonetti (2011), 468 Herrmann, Westphal, Moritz, and Steffan-Dewenter (2007), 469 Knight et al. (2009), 470 Ancrenaz, Goossens, Gimenez, Sawang, and Lackman-Ancrenaz (2004), 471 Felton, Engstrom, Felton, and Knott (2003), 472 Knop, Ward, and Wich (2004), 473 Ewers, Bartlam, and Didham (2013), 474 Davis, Murray, Fitzpatrick, Brown, and Paxton (2010), 475 Hanson, Brunsfeld, Finegan, and Waits (2008), 476 Strauch and Eby (2012), 477 Ramos-Robles, Gallina, and Mandujano (2013), 478 Ferreira and Alves (2005, 2009), 479 Luskin (2010), 480 Grogan et al. (2008)

database. Recent examples include mammalian generation time (Pacifci et al., 2013), a variety of mammalian traits (Jones et al., 2009), foraging attributes of birds and mammals (Wilman et al., 2014), field metabolic rates of birds and mammals (Hudson, Isaac, & Reuman, 2013) and functional traits of vascular plants (Kattge et al., 2011). Additional databases provide more abstract concepts such as species' threat status (International Union for Conservation of Nature, 2016) and estimates of the degrees of protection required

(Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2016). Relating such data with measurements in the PREDICTS database makes possible investigation into how traits mediate species' responses to changes in land use and land-use intensity. Examples of published analyses have examined habitat specialization and geographical range size of birds and mammals (Newbold et al., 2014), functional traits of vascular plants (Bernhardt-Römermann et al., 2011) and a range of morphometric,

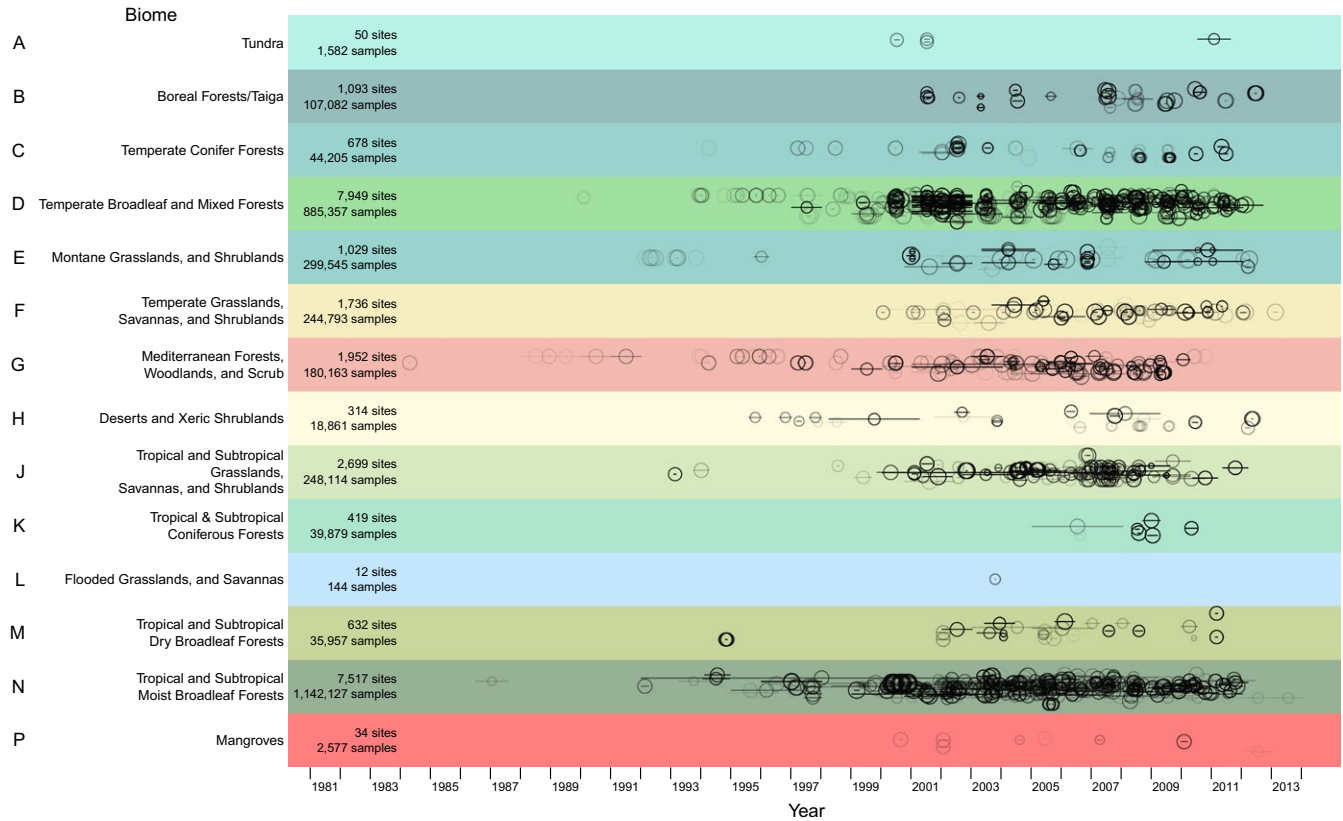


FIGURE 6 Spatiotemporal sampling coverage. Site sampling dates are shown by biome. Each Site is represented by a circle and line. Circle radii are proportional to \log_{10} of the number of samples at that Site. Circle centers are at the midpoints of Site sampling dates; lines indicate the start and end dates of sampling. Y-values have been jittered at the Study level. Circles and lines have the same degree of partial transparency. Biome colors and letters are as in Figure 1

physiological, and functional traits of bees (De Palma et al., 2015); see Table 1, Q. 3.

Although our targeting of data from underrepresented biomes and taxa (Hudson et al., 2014) reduces the effects of geographic and taxonomic biases in available data, the PREDICTS database nonetheless has many limitations, of which four are particularly important to note. First, our individual datasets seldom take a whole-ecosystem perspective, being instead taxonomically or ecologically restricted; consequently, our data shed little light on how trophic webs or other interactions are affected by human pressures. Second, even within the groups sampled, our data do not provide complete inventories of the species that would be found with comprehensive sampling; thus, failure to record a species from a Site does not provide strong evidence of absence. Third, Latin binomials were not available for a sizeable fraction of the species in our DataSources, limiting the prospects for linking the observations of occurrence and abundance to other information about the species (e.g., functional traits; Kattge et al., 2011). Last, because our database was designed to test hypotheses about local-scale variation in biodiversity, it is not particularly informative about large-scale biodiversity patterns such as the latitudinal gradient in species richness or how pressures with a coarse spatial grain (e.g., atmospheric nitrogen deposition; Simkin et al., 2016) influence Site-level diversity.

When using the PREDICTS database, or indeed any database, to model biodiversity responses, it is important to be aware of potential

mismatches in scale between Site-level data and pressure data such as MODIS remotely sensed data (Justice et al., 1998) and the harmonized land-use scenarios (Hurtt et al., 2011) and also between Site-level response variables and the scales of interest. The PREDICTS database contains some structural features that help with these issues. First, we assigned the Site-level land use and land-use intensity classifications based on the authors' descriptions of the habitats so these classifications do not suffer from the problem of scale mismatch. Second, Sites are represented as precisely as possible: Sites often represent individual quadrats, traps, or other points within a broader sampling regime (such as a transect), and we recorded (as latitude and longitude) the coordinates of each Site rather than aggregating them into coarser summaries across the broader sampling regime. Third, where the relevant information was available, we also recorded the maximum extent of sampling as a linear value in meters (for 22,199 Sites, see Hudson et al. (2014) for details). Users of the database therefore have flexibility in deciding how measurements in the PREDICTS database are related to available pressure data. Possible solutions to scale mismatches between biodiversity data and pressure data would be (1) to exclude from analyses any Sites where the extent of sampling is substantially greater than the grain size of the pressure data or (2) to conduct some sort of spatial averaging of the pressure data. Novel methods have been published both for downscaling pressure data (e.g., Hoskins et al., 2016) and for upscaling local biodiversity

TABLE 1 Questions that could be answered using the PREDICTS database

Question	Early example references	Approach	Example using PREDICTS database	
<i>Questions about taxa</i>				
Q 1.	What factors influence the occurrence and/or abundance of a particular focal species?	Austin, Nicholls, and Margules (1990)	Filter to remove species not of interest. Merge PREDICTS data with data on any additional site-level characteristics of interest. One possible analytical approach is to model effects of site characteristics on presence-absence and log (abundance when present) separately, the first with binomial errors and the second with Gaussian errors, while accounting for among-Study differences (e.g., using mixed-effects models).	-
Q 2.	Do changes in land-use facilitate success of invasive species?	Dukes and Mooney (1999), Theoharides and Dukes (2007)	Obtain lists of invasive species for the regions of interest and model presence-absence and/or abundance of invasives as above.	-
Q 3.	Which ecological attributes of species make them more or less sensitive to human pressures?	McKinney (1997), Davies, Margules, and Lawrence (2000), Cardillo et al. (2005)	Merge PREDICTS data with species-level data on traits of interest. Model how site and species characteristics affect presence-absence and log (abundance when present) separately as above, accounting for Study-level and taxon-level differences (e.g., using mixed-effects models).	Newbold et al. (2014), De Palma et al. (2015)
Q 4.	Which taxa have species that are more sensitive to human pressures, and which have less sensitive species?	Lawton et al. (1998), Mace and Balmford (2000), Gibson et al. (2011)	Add taxonomic group into models above as a fixed effect interacting with other fixed effects.	-
Q 5.	Are phylogenetically distinct species particularly sensitive?	Gaston and Blackburn (1997), Purvis, Agapow, Gittleman, and Mace (2000)	Analyze phylogenetic distinctiveness or unique evolutionary history in the same way as ecological attributes.	-
Q 6.	What are the relationships between geographic range size or occupancy and abundance?	Brown (1984)	Merge PREDICTS data with species-level data on range sizes or occupancy. Filter to the land uses of interest (e.g., primary vegetation if the focus is on natural systems), and examine within-Study relationship between abundance and relative range size or occupancy.	-
Q 7.	Do suitability estimates from environmental niche models predict abundance?	VanDerWal, Shoo, Johnson, and Williams (2009)	Use other data on occurrences of species to fit niche models for all species in within selected Studies and thereby estimate suitability of each Site. Various modeling options are then possible depending on the precise question: for example, fit land use interacting with suitability when modeling abundance in order to test whether any correlation depends on land use.	-
<i>Questions about sites</i>				
Q 8.	Which land uses and other Site-level pressures have the strongest net impact on levels of local biodiversity?	Lawton et al. (1998), Gibson et al. (2011)	Aggregate biodiversity data within a site to estimate relevant diversity metric (e.g., within-sample species richness, total abundance, rarefaction-based richness, species evenness). Merge Site-level biodiversity data with any additional data on Site-level characteristics of interest (e.g., from remotely sensed data) if required. Model Site-level diversity as a function of Site characteristics while accounting for among-Study differences (e.g., using mixed-effects models).	fig 1b,c in Newbold et al. (2015)

(Continues)

TABLE 1 (Continued)

Question	Early example references	Approach	Example using PREDICTS database
Q 9. How do land use and other pressures reduce compositional intactness?	Scholes and Biggs (2005)	Because net changes are affected by gains of non-native species as well as losses of those originally present, modeling compositional intactness gives a more sensitive indication of human impacts. Model Site-level abundance as a function of pressures as above, and how compositional similarity to assemblages in primary vegetation differs among land uses. Combine these models to estimate the Biodiversity Intactness Index (Scholes & Biggs, 2005)—the average abundance of a diverse set of species, relative to their abundance in an unimpacted assemblage.	Newbold, Hudson, Arnell, et al. (2016)
Q 10. Do land use and related pressures influence community trait values?	Garnier et al. (2007)	Combine data on species' occurrences or abundance with trait data to obtain average or community-weighted mean trait values, which can then be modeled like the Site-level response variables above.	fig 1d in Newbold et al. (2015)
Q 11. Does the biotic response to a given pressure vary regionally?	Gibson et al. (2011)	Add region as a fixed effect and test for interaction with other fixed effects.	–
Q 12. Which characteristics of Sites (e.g., duration of human impact and rate of climate change) mean that given land-use changes have particularly severe effects on biodiversity?	Balmford (1996), Travis (2003)	Merge Site-level diversity data with Site-level data on characteristics to be tested and assess the interaction of these variables with land use.	Gray et al. (2016)
Q 13. How accurate are global land-use data?	Giri, Zhu, and Reed (2005)	Use Site-level land-use data to calculate the receiver operating characteristic curve (i.e., sensitivity versus false-positive rate), using the area under the curve to quantify agreement. An extension of this could be to use the PREDICTS Site-level land use data as input into land use/land cover classification procedures, for example, by the remote sensing community, or at least use PREDICTS data to cross-check and validate land use and land cover maps with independent PREDICTS data.	Hoskins et al. (2016)
<i>Questions above the site level</i>			
Q 14. Is beta diversity lower in human-dominated than more natural land uses?	Tylianakis et al. (2005)	Estimate desired measures of similarity among Sites within studies. Model how biotic similarity among Sites depends on similarity of other attributes (including characteristics from remote sensing or Dynamic Global Ecosystem Models if required), accounting for among-Study differences (e.g., using mixed-effects models).	Newbold, Hudson, Hill, et al. (2016)
Q 15. Are land-sparing or land-sharing strategies optimal for local biodiversity?	Green, Cornell, Scharlemann, and Balmford (2005)	Analyze species by Sites and by Study and relate back to Q. 1. The overarching question about sparing versus sharing can be addressed by looking at the individual responses of species to land-use intensity, as measured by yield suggested by Green et al. (2005); this requires data on agricultural yields at relevant Sites in the PREDICTS database.	–

(Continues)

TABLE 1 (Continued)

Question	Early example references	Approach	Example using PREDICTS database	
<i>Other questions</i>				
Q 16.	How accurate are current extent of occurrence/range maps, for example, those produced by International Union for Conservation of Nature (2016)?	–	Cross-check existing extents of occurrence and ranges with PREDICTS data.	–
Q 17.	How representative are species catalogues?	–	Query clade-level (e.g., The Plant List, World List of Mammalian Species, Platnick's Spider Catalogue) and aggregated (e.g., Encyclopedia of Life and Catalogue of Life) lists with the Latin binomials and trinomials that were provided to PREDICTS by the data collectors. Subquestions include <ul style="list-style-type: none"> • How does coverage vary among taxonomic groups? • How does coverage depend on region? • Are there substantial differences among the aggregated services? • How well are synonyms and homonyms represented and resolved? 	–

measurements to estimate changes in gamma diversity over broader areas (e.g., Azaele et al., 2015); both approaches offer potential solutions to mismatches in scale.

The PREDICTS database continues to increase in size and currently contains a further 22 Studies with embargo dates that prevent their inclusion in this release. We intend to publish occasional updates to make these data freely available. We have also received a number of further offers of datasets that we hope to incorporate into the database and include in future releases. There are three priority categories of data that we are still seeking actively: bees from outside Western Europe; soil invertebrates and fungi; and geographic islands. The current database focuses entirely on spatial “control–impact” comparisons. A follow-on project that has recently begun focuses instead on temporal comparisons, collating data from “before–after” and (especially) “before–after–control–impact” studies of the effects of land-use change on terrestrial assemblages. We are therefore seeking datasets, linked to peer-reviewed publications, of comparable species-level surveys conducted at each sampling location, with temporal changes in land use and/or land-use intensity. If corresponding authors of such papers wish to offer their data, please complete our online form, available at www.predicts.org.uk/pages/contribute.html. As with PREDICTS, the new project will seek to make its data freely available.

ACKNOWLEDGMENTS

PREDICTS has been supported by U.K. Natural Environment Research Council grants (NE/J011193/2 and NE/L002515/1), the United Nations Environment Program World Conservation Monitoring

Centre, Biotechnology and Biological Sciences Research Council grant (BB/F017324/1), a Hans Rausing PhD Scholarship and COLCIENCIAS (Departamento Administrativo de Ciencia, Tecnología e Innovación de Colombia). We thank the many researchers who generously contributed their data to the PREDICTS project; including The Nature Conservation Foundation, Ros Blanche, Zhi Ping Cao, Kristina Cockle, Emily Davis, Moisés Barbosa de Souza, Carsten F Dormann, Christo Fabricius, Colin Ferguson, Heleen Fermon, Toby Gardner, Eva Gaublumme, Marco S Gottschalk, Peter Hietz, Juan Carlos Iturrondobeitia, Daniel L Kelly, Lee Hsiang Liow, Takashi Matsumoto, William McShea, Elder F Morato, Andreas Müller, Philip Nyeko, Tim O'Connor, Clint Otto, Simon Paradis, Marino Rodrigues, Watana Sakchoowong, Hari Sridhar, Susan Walker, Rachael Winfree, Timothy T Work, Torsten Wronski, Gregory Zimmerman and all the field assistants, parataxonomists and taxonomists who collected and identified the animals, plants and fungi in the database. We thank all the many funding agencies and other organizations that have supported the original research that produced these data; these include Natural Sciences and Engineering Research Council of Canada and Tembec, the University of Miami Beyond the Book Research Scholarship, the NSF Graduate Research Fellowship and the National Science Foundation Research Experience for Undergraduates Supplemental Award. We thank Technical Solutions and Informatics staff at the Natural History Museum, London, especially Srinivas Patlola, Simon Rycroft, Ben Scott and Chris Sleep.

CONFLICT OF INTEREST

None declared.

REFERENCES

- Aben, J., Dorenbosch, M., Herzog, S. K., Smolders, A. J. P., & Van Der Velde, G. (2008). Human disturbance affects a deciduous forest bird community in the Andean foothills of central Bolivia. *Bird Conservation International*, 18(4), 363–380. doi:10.1017/s0959270908007326
- Adum, G. B., Eichhorn, M. P., Oduro, W., Ofori-Boateng, C., & Rodel, M. O. (2013). Two-stage recovery of amphibian assemblages following selective logging of tropical forests. *Conservation Biology*, 27(2), 354–363. doi:10.1111/cobi.12006
- Aguiar-Barquero, V., & Jiménez-Hernández, F. (2009). Diversidad y distribución de palmas (Arecaceae) en tres fragmentos de bosque muy húmedo en Costa Rica. *Revista de Biología Tropical*, 57(Suppl. 1), 83–92.
- Alberta Biodiversity Monitoring Institute (ABMI). (2013). The raw soil arthropods dataset and the raw trees & snags dataset from Prototype Phase (2003–2006) and Rotation 1 (2007–2012). <http://www.abmi.ca>
- Albertos, B., Lara, F., Garilleti, R., & Mazimpaka, V. (2005). A survey of the epiphytic bryophyte flora in the northwest of the Iberian Peninsula. *Cryptogamie*, 26(3), 263–289.
- Alcala, E. L., Alcala, A. C., & Dolino, C. N. (2004). Amphibians and reptiles in tropical rainforest fragments on Negros Island, the Philippines. *Environmental Conservation*, 31(3), 254–261. doi:10.1017/s0376892904001407
- Alcayaga, O. E., Pizarro-Araya, J., Alfaro, F. M., & Cepeda-Pizarro, J. (2013). Spiders (Arachnida, Araneae) associated to agroecosystems in the Elqui Valley (Coquimbo Region, Chile). *Revista Colombiana de Entomología*, 39(1), 150–154.
- Alguacil, M. D. M., Torrecillas, E., Hernandez, G., & Roldan, A. (2012). Changes in the diversity of soil arbuscular mycorrhizal fungi after cultivation for biofuel production in a Guantánamo (Cuba) tropical system. *PLoS One*, 7(4), 1–8. doi:10.1371/journal.pone.0034887
- Alignier, A., & Deconchat, M. (2013). Patterns of forest vegetation responses to edge effect as revealed by a continuous approach. *Annals of Forest Science*, 70(6), 601–609. doi:10.1007/s13595-013-0301-0
- Alkemade, R., van Oorschot, M., Miles, L., Nellemann, C., Bakkenes, M., & ten Brink, B. (2009). GLOBIO3: A framework to investigate options for reducing global terrestrial biodiversity loss. *Ecosystems*, 12(3), 374–390. doi:10.1007/s10021-009-9229-5
- Ancrenaz, M., Goossens, B., Gimenez, O., Sawang, A., & Lackman-Ancrenaz, I. (2004). Determination of ape distribution and population size using ground and aerial surveys: A case study with orang-utans in lower Kinabatangan, Sabah, Malaysia. *Animal Conservation*, 7, 375–385. doi:10.1017/s136794300400157x
- Andersen, A. N., & Hoffmann, B. D. (2011). Conservation value of low fire frequency in tropical savannas: Ants in monsoonal northern Australia. *Austral Ecology*, 36(5), 497–503. doi:10.1111/j.1442-9993.2010.02151.x
- Andersen, A. N., Ludwig, J. A., Lowe, L. M., & Rentz, D. C. F. (2001). Grasshopper biodiversity and bioindicators in Australian tropical savannas: Responses to disturbance in Kakadu National Park. *Austral Ecology*, 26(3), 213–222. doi:10.1046/j.1442-9993.2001.01106.x
- Arbeláez-Cortés, E., Rodríguez-Correa, H. A., & Restrepo-Chica, M. (2011). Mixed bird flocks: Patterns of activity and species composition in a region of the Central Andes of Colombia. *Revista Mexicana de Biodiversidad*, 82(2), 639–651.
- Armbrecht, I., Perfecto, I., & Silverman, E. (2006). Limitation of nesting resources for ants in Colombian forests and coffee plantations. *Ecological Entomology*, 31(5), 403–410. doi:10.1111/j.1365-2311.2006.00802.x
- Arroyo, J., Iturrondobeitia, J. C., Rad, C., & Gonzalez-Carcedo, S. (2005). Oribatid mite (Acari) community structure in steppic habitats of Burgos Province, central northern Spain. *Journal of Natural History*, 39(39), 3453–3470. doi:10.1080/00222930500240346
- Aumann, T. (2001). The structure of raptor assemblages in riparian environments in the south-west of the Northern Territory, Australia. *Emu*, 101(4), 293–304. doi:10.1071/mu00072
- Austin, M. P., Nicholls, A. O., & Margules, C. R. (1990). Measurement of the realized qualitative niche: Environmental niches of five *Eucalyptus* species. *Ecological Monographs*, 60(2), 161–177. doi:10.2307/1943043
- Axmacher, J., Brehm, G., Hemp, A., Tunte, H., Lyaruu, H., Muller-Hohenstein, K., & Fiedler, K. (2009). Determinants of diversity in afrotropical herbivorous insects (Lepidoptera: Geometridae): Plant diversity, vegetation structure or abiotic factors? *Journal of Biogeography*, 36(2), 337–349. doi:10.1111/j.1365-2699.2008.01997.x
- Azalee, S., Maritan, A., Cornell, S. J., Suweis, S., Banavar, J. R., Gabriel, D., & Kunin, W. E. (2015). Towards a unified descriptive theory for spatial ecology: Predicting biodiversity patterns across spatial scales. *Methods in Ecology and Evolution*, 6(3), 324–332. doi:10.1111/2041-210X.12319
- Azhar, B., Lindenmayer, D. B., Wood, J., Fischer, J., Manning, A., McElhinny, C., & Zakaria, M. (2013). The influence of agricultural system, stand structural complexity and landscape context on foraging birds in oil palm landscapes. *Ibis*, 155(2), 297–312. doi:10.1111/ibi.12025
- Azman, N. M., Latip, N. S. A., Sah, S. A. M., Akil, M. A. M. M., Shafie, N. J., & Khairuddin, N. L. (2011). Avian diversity and feeding guilds in a secondary forest, an oil palm plantation and a paddy field in Riparian areas of the Kerian River Basin, Perak, Malaysia. *Tropical Life Sciences Research*, 22(2), 45–64.
- Azpiroz, A. B., & Blake, J. G. (2009). Avian assemblages in altered and natural grasslands in the northern Campos of Uruguay. *Condor*, 111(1), 21–35. doi:10.1525/cond.2009.080111
- Baeten, L., Hermy, M., Van Daele, S., & Verheyen, K. (2010). Unexpected understorey community development after 30 years in ancient and post-agricultural forests. *Journal of Ecology*, 98(6), 1447–1453. doi:10.1111/j.1365-2745.2010.01711.x
- Baeten, L., Velghe, D., Vanhellemont, M., De Frenne, P., Hermy, M., & Verheyen, K. (2010). Early trajectories of spontaneous vegetation recovery after intensive agricultural land use. *Restoration Ecology*, 18, 379–386. doi:10.1111/j.1526-100x.2009.00627.x
- Bakayoko, A., Martin, P., Chatelain, C., Traore, D., & Gautier, L. (2011). Diversity, family dominance, life forms and ecological strategies of forest fragments compared to continuous forest in southwestern Côte d'Ivoire. *Candollea*, 66(2), 255–262. doi:10.15553/c2011v662a2
- Báldi, A., Batáry, P., & Erdős, S. (2005). Effects of grazing intensity on bird assemblages and populations of Hungarian grasslands. *Agriculture Ecosystems & Environment*, 108(3), 251–263. doi:10.1016/j.agee.2005.02.006
- Balmford, A. (1996). Extinction filters and current resilience: The significance of past selection pressures for conservation biology. *Trends in Ecology & Evolution*, 11(5), 193–196. doi:10.1016/0169-5347(96)10026-4
- Balmford, A., Green, R. E., & Jenkins, M. (2003). Measuring the changing state of nature. *Trends in Ecology & Evolution*, 18(7), 326–330. doi:10.1016/S0169-5347(03)00067-3
- Banks, J. E., Sandvik, P., & Keesecker, L. (2007). Beetle (Coleoptera) and spider (Araneae) diversity in a mosaic of farmland, edge, and tropical forest habitats in western Costa Rica. *Pan-Pacific Entomologist*, 83(2), 152–160. doi:10.3956/0031-0603-83.2.152
- Baral, S. K., & Katzensteiner, K. (2009). Diversity of vascular plant communities along a disturbance gradient in a central mid-hill community forest of Nepal. *Banko Janakari*, 19(1), 3–7. doi:10.3126/banko.v19i1.2176
- Barlow, J., Gardner, T. A., Araujo, I. S., Avila-Pires, T. C., Bonaldo, A. B., Costa, J. E., ... Peres, C. A. (2007). Quantifying the biodiversity value of tropical primary, secondary, and plantation forests. *Proceedings of the National Academy of Sciences of the United States of America*, 104(47), 18555–18560. doi:10.1073/pnas.0703333104
- Barlow, J., Mestre, L. A. M., Gardner, T. A., & Peres, C. A. (2007). The value of primary, secondary and plantation forests for Amazonian birds. *Biological Conservation*, 136(2), 212–231. doi:10.1016/j.biocon.2006.11.021
- Barlow, J., Overal, W. L., Araujo, I. S., Gardner, T. A., & Peres, C. A. (2007). The value of primary, secondary and plantation forests for fruit-feeding

- butterflies in the Brazilian Amazon. *Journal of Applied Ecology*, 44(5), 1001–1012. doi:10.1111/j.1365-2664.2007.01347.x
- Barratt, B. I. P., Ferguson, C. M., Logan, R. A. S., Barton, D., Bell, N. L., Sarathchandra, S. U., & Townsend, R. J. (2005). Biodiversity of indigenous tussock grassland sites in Otago, Canterbury and the central North Island of New Zealand I. The macro-invertebrate fauna. *Journal of the Royal Society of New Zealand*, 35(3), 287–301. doi:10.1080/03014223.2005.9517785
- Barratt, B. I. P., Worner, S. P., Affeld, K., Ferguson, C. M., Barton, D. M., Bell, N. L., & Townsend, R. J. (2012). Biodiversity of indigenous tussock grassland sites in Otago, Canterbury and the central North Island of New Zealand VI. Coleoptera biodiversity, community structure, exotic species invasion, and the effect of disturbance by agricultural development. *Journal of the Royal Society of New Zealand*, 42(4), 217–239. doi:10.1080/03036758.2011.559664
- Barrico, L., Azul, A. M., Morais, M. C., Coutinho, A. P., Freitas, H., & Castro, P. (2012). Biodiversity in urban ecosystems: Plants and macromycetes as indicators for conservation planning in the city of Coimbra (Portugal). *Landscape and Urban Planning*, 106(1), 88–102. doi:10.1016/j.landurbplan.2012.02.011
- Bartolommei, P., Mortelletti, A., Pezzo, F., & Puglisi, L. (2013). Distribution of nocturnal birds (Strigiformes and Caprimulgidae) in relation to land-use types, extent and configuration in agricultural landscapes of Central Italy. *Rendiconti Lincei-Scienze Fisiche E Naturali*, 24(1), 13–21. doi:10.1007/s12210-012-0211-3
- Basset, Y., Missa, O., Alonso, A., Miller, S. E., Curletti, G., De Meyer, M., ... Wagner, T. (2008). Changes in arthropod assemblages along a wide gradient of disturbance in Gabon. *Conservation Biology*, 22(6), 1552–1563. doi:10.1111/j.1523-1739.2008.01017.x
- Bates, A. J., Sadler, J. P., Fairbrass, A. J., Falk, S. J., Hale, J. D., & Matthews, T. J. (2011). Changing bee and hoverfly pollinator assemblages along an urban-rural gradient. *PLoS One*, 6(8), doi:10.1371/journal.pone.0023459
- Baur, B., Cremene, C., Groza, G., Rakosy, L., Schileyko, A. A., Baur, A., ... Erhardt, A. (2006). Effects of abandonment of subalpine hay meadows on plant and invertebrate diversity in Transylvania, Romania. *Biological Conservation*, 132(2), 261–273. doi:10.1016/j.biocon.2006.04.018
- Benedick, S., Hill, J. K., Mustafa, N., Chey, V. K., Maryati, M., Searle, J. B., ... Hamer, K. C. (2006). Impacts of rain forest fragmentation on butterflies in northern Borneo: Species richness, turnover and the value of small fragments. *Journal of Applied Ecology*, 43(5), 967–977. doi:10.1111/j.1365-2664.2006.01209.x
- Berg, Å., Ahrné, K., Öckinger, E., Svensson, R., & Söderström, B. (2011). Butterfly distribution and abundance is affected by variation in the Swedish forest-farmland landscape. *Biological Conservation*, 144(12), 2819–2831. doi:10.1016/j.biocon.2011.07.035
- Bernard, H., Fjeldsa, J., & Mohamed, M. (2009). A case study on the effects of disturbance and conversion of tropical lowland rain forest on the non-volant small mammals in north Borneo: Management implications. *Mammal Study*, 34(2), 85–96. doi:10.3106/041.034.0204
- Bernhardt-Römermann, M., Gray, A., Vanbergen, A. J., Bergès, L., Bohner, A., Brooker, R. W., ... Stadler, J. (2011). Functional traits and local environment predict vegetation responses to disturbance: A pan-European multi-site experiment. *Journal of Ecology*, 99(3), 777–787. doi:10.1111/j.1365-2745.2011.01794.x
- Berry, N. J., Phillips, O. L., Lewis, S. L., Hill, J. K., Edwards, D. P., Tawatao, N. B., ... Hamer, K. C. (2010). The high value of logged tropical forests: Lessons from northern Borneo. *Biodiversity and Conservation*, 19(4), 985–997. doi:10.1007/s10531-010-9779-z
- Bicknell, J., & Peres, C. A. (2010). Vertebrate population responses to reduced-impact logging in a neotropical forest. *Forest Ecology and Management*, 259(12), 2267–2275. doi:10.1016/j.foreco.2010.02.027
- Bihn, J. H., Verhaagh, M., Braendle, M., & Brandl, R. (2008). Do secondary forests act as refuges for old growth forest animals? Recovery of ant diversity in the Atlantic forest of Brazil. *Biological Conservation*, 141(3), 733–743. doi:10.1016/j.biocon.2007.12.028
- Billeter, R., Liira, J., Bailey, D., Bugter, R., Arens, P., Augenstein, I., ... Edwards, P. J. (2008). Indicators for biodiversity in agricultural landscapes: A pan-European study. *Journal of Applied Ecology*, 45(1), 141–150. doi:10.1111/j.1365-2664.2007.01393.x
- Blake, R. J., Westbury, D. B., Woodcock, B. A., Sutton, P., & Potts, S. G. (2011). Enhancing habitat to help the plight of the bumblebee. *Pest Management Science*, 67(4), 377–379. doi:10.1002/ps.2136
- Blanche, R., & Cunningham, S. A. (2005). Rain forest provides pollinating beetles for atemoya crops. *Journal of Economic Entomology*, 98(4), 1193–1201.
- Blanche, K. R., Ludwig, J. A., & Cunningham, S. A. (2006). Proximity to rain-forest enhances pollination and fruit set in orchards. *Journal of Applied Ecology*, 43(6), 1182–1187. doi:10.1111/j.1365-2664.2006.01230.x
- Bobo, K. S., Waltert, M., Fermon, H., Njokagbor, J., & Muhlenberg, M. (2006). From forest to farmland: Butterfly diversity and habitat associations along a gradient of forest conversion in Southwestern Cameroon. *Journal of Insect Conservation*, 10(1), 29–42. doi:10.1007/s10841-005-8564-x
- Bóçon, R. (2010). *Riqueza e abundância de aves em três estágios sucessionais da floresta ombrófila densa submontana, Antonina, Paraná*. PhD thesis, Universidade Federal do Paraná, Curitiba, Brazil.
- Bonham, K. J., Mesibov, R., & Bashford, R. (2002). Diversity and abundance of some ground-dwelling invertebrates in plantation vs. native forests in Tasmania, Australia. *Forest Ecology and Management*, 158(1–3), 237–247. doi:10.1016/s0378-1127(00)00717-9
- Borges, S. H. (2007). Bird assemblages in secondary forests developing after slash-and-burn agriculture in the Brazilian Amazon. *Journal of Tropical Ecology*, 23, 469–477. doi:10.1017/s0266467407004105
- Borges, P. A. V., Lobo, J. M., de Azevedo, E. B., Gaspar, C. S., Melo, C., & Nunes, L. V. (2006). Invasibility and species richness of island endemic arthropods: A general model of endemic vs. exotic species. *Journal of Biogeography*, 33(1), 169–187. doi:10.1111/j.1365-2699.2005.01324.x
- Boutin, C., Baril, A., & Martin, P. A. (2008). Plant diversity in crop fields and woody hedgerows of organic and conventional farms in contrasting landscapes. *Agriculture, Ecosystems & Environment*, 123(1–3), 185–193. doi:10.1016/j.agee.2007.05.010
- Boutin, C., Martin, P. A., & Baril, A. (2009). Arthropod diversity as affected by agricultural management (organic and conventional farming), plant species, and landscape context. *Ecoscience*, 16(4), 492–501. doi:10.2980/16-4-3250
- Bouyer, J., Sana, Y., Samandoulgou, Y., Cesar, J., Guerrini, L., Kabore-Zougrana, C., & Dulieu, D. (2007). Identification of ecological indicators for monitoring ecosystem health in the trans-boundary W Regional park: A pilot study. *Biological Conservation*, 138(1–2), 73–88. doi:10.1016/j.biocon.2007.04.001
- Bragagnolo, C., Nogueira, A. A., Pinto-da-Rocha, R., & Pardini, R. (2007). Harvestmen in an Atlantic forest fragmented landscape: Evaluating assemblage response to habitat quality and quantity. *Biological Conservation*, 139(3–4), 389–400. doi:10.1016/j.biocon.2007.07.008
- Brandt, J. S., Wood, E. M., Pidgeon, A. M., Han, L., Fang, Z., & Radeloff, V. C. (2013). Sacred forests are keystone structures for forest bird conservation in southwest China's Himalayan Mountains. *Biological Conservation*, 166, 34–42. doi:10.1016/j.biocon.2013.06.014
- Brearley, F. Q. (2011). Below-ground secondary succession in tropical forests of Borneo. *Journal of Tropical Ecology*, 27, 413–420. doi:10.1017/s0266467411000149
- Breedt, J. A. D., Dreber, N., & Kellner, K. (2013). Post-wildfire regeneration of rangeland productivity and functionality - observations across three semi-arid vegetation types in South Africa. *African Journal of Range & Forage Science*, 30(3), 161–167. doi:10.2989/10220119.2013.816367
- Brito, I., Goss, M. J., de Carvalho, M., Chatagnier, O., & van Tuinen, D. (2012). Impact of tillage system on arbuscular mycorrhiza fungal communities in the soil under Mediterranean conditions. *Soil & Tillage Research*, 121, 63–67. doi:10.1016/j.still.2012.01.012

- Brook, B. W., Ellis, E. C., Perring, M. P., Mackay, A. W., & Blomqvist, L. (2013). Does the terrestrial biosphere have planetary tipping points? *Trends in Ecology & Evolution*, 28(7), 396–401. doi:10.1016/j.tree.2013.01.016
- Brown, J. H. (1984). On the relationship between abundance and distribution of species. *The American Naturalist*, 124(2), 255–279.
- Brunet, J., Valtinat, K., Mayr, M. L., Felton, A., Lindbladh, M., & Bruun, H. H. (2011). Understorey succession in post-agricultural oak forests: Habitat fragmentation affects forest specialists and generalists differently. *Forest Ecology and Management*, 262(9), 1863–1871. doi:10.1016/j.foreco.2011.08.007
- Buczkowski, G. (2010). Extreme life history plasticity and the evolution of invasive characteristics in a native ant. *Biological Invasions*, 12(9), 3343–3349. doi:10.1007/s10530-010-9727-6
- Buczkowski, G., & Richmond, D. S. (2012). The effect of urbanization on ant abundance and diversity: A temporal examination of factors affecting biodiversity. *PLoS One*, 7(8), doi:10.1371/journal.pone.0041729
- Buddle, C. M., & Shorthouse, D. P. (2008). Effects of experimental harvesting on spider (Araneae) assemblages in boreal deciduous forests. *Canadian Entomologist*, 140(4), 437–452. doi:10.4039/n07-ls01
- Buscardo, E., Smith, G. F., Kelly, D. L., Freitas, H., Iremonger, S., Mitchell, F. J. G., ... McKee, A. (2008). The early effects of afforestation on biodiversity of grasslands in Ireland. *Biodiversity and Conservation*, 17(5), 1057–1072. doi:10.1007/s10531-007-9275-2
- Buse, J., Levanony, T., Timm, A., Dayan, T., & Assmann, T. (2008). Saproxyllic beetle assemblages of three managed oak woodlands in the Eastern Mediterranean. *Zoology in the Middle East*, 45, 55–66. doi:10.1080/09397140.2008.10638307
- Butchart, S. H. M., Stattersfield, A. J., Bennun, L. A., Shutes, S. M., Akçakaya, H. R., Baillie, J. E. M., ... Mace, G. M. (2004). Measuring global trends in the status of biodiversity: Red list indices for birds. *PLOS Biology*, 2(12), e383. doi:10.1371/journal.pbio.0020383
- Butchart, S. H. M., Walpole, M., Collen, B., van Strien, A., Scharlemann, J. P. W., Almond, R. E. A., ... Morcillo, M. H. (2010). Global biodiversity: Indicators of recent declines. *Science*, 328, 1164–1168. doi:10.1126/science.1187512
- Cabra-García, J., Bermúdez-Rivas, C., Osorio, A. M., & Chacón, P. (2012). Cross-taxon congruence of alpha and beta diversity among five leaf litter arthropod groups in Colombia. *Biodiversity and Conservation*, 21(6), 1493–1508. doi:10.1007/s10531-012-0259-5
- Cáceres, N. C., Nápoli, R. P., Casella, J., & Hannibal, W. (2010). Mammals in a fragmented savannah landscape in south-western Brazil. *Journal of Natural History*, 44(7–8), 491–512. doi:10.1080/00222930903477768
- Cagle, N. L. (2008). Snake species distributions and temperate grasslands: A case study from the American tallgrass prairie. *Biological Conservation*, 141(3), 744–755. doi:10.1016/j.biocon.2008.01.003
- Calviño-Cancela, M., Rubido-Bará, M., & van Etten, E. J. (2012). Do eucalypt plantations provide habitat for native forest biodiversity? *Forest Ecology and Management*, 270, 153–162. doi:10.1016/j.foreco.2012.01.019
- Cameron, S. A., Lozier, J. D., Strange, J. P., Koch, J. B., Cordes, N., Solter, L. F., & Griswold, T. L. (2011). Patterns of widespread decline in North American bumble bees. *Proceedings of the National Academy of Sciences of the United States of America*, 108(2), 662–667. doi:10.1073/pnas.1014743108
- Cardillo, M., Mace, G. M., Jones, K. E., Bielby, J., Bininda-Emonds, O. R. P., Sechrest, W., ... Purvis, A. (2005). Multiple causes of high extinction risk in large mammal species. *Science*, 309(5738), 1239–1241. doi:10.1126/science.1116030
- Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., ... Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, 486, 59–67. doi:10.1038/nature11148
- Cardoso, P., Lobo, J., Aranda, S., Dinis, F., Gaspar, C., & Borges, P. (2009). A spatial scale assessment of habitat effects on arthropod communities of an oceanic island. *Acta Oecologica*, 35(5), 590–597. doi:10.1016/j.actao.2009.05.005
- Carpenter, D., Hammond, P. M., Sherlock, E., Lidgett, A., Leigh, K., & Eggleton, P. (2012). Biodiversity of soil macrofauna in the New Forest: A benchmark study across a national park landscape. *Biodiversity and Conservation*, 21(13), 3385–3410. doi:10.1007/s10531-012-0369-0
- Carrijo, T. F., Brandao, D., de Oliveira, D. E., Costa, D. A., & Santos, T. (2009). Effects of pasture implantation on the termite (Isoptera) fauna in the Central Brazilian Savanna (Cerrado). *Journal of Insect Conservation*, 13(6), 575–581. doi:10.1007/s10841-008-9205-y
- Carvalho, A. L. D., Ferreira, E. J. L., Lima, J. M. T., & de Carvalho, A. L. (2010). Floristic and structural comparisons among palm communities in primary and secondary forest fragments of the Raimundo Irineu Serra Environmental Protection Area – Rio Branco, Acre, Brazil. *Acta Amazonica*, 40(4), 657–666. doi:10.1590/s0044-59672010000400004
- Cassano, C., Barlow, J., & Pardini, R. (2014). Forest loss or management intensification? Identifying causes of mammal decline in cacao agroforests. *Biological Conservation*, 169, 14–22. doi:10.1016/j.biocon.2013.10.006
- Castro, H., Lehsten, V., Lavorel, S., & Freitas, H. (2010). Functional response traits in relation to land use change in the Montado. *Agriculture Ecosystems & Environment*, 137(1–2), 183–191. doi:10.1016/j.agee.2010.02.002
- Castro-Luna, A. A., Sosa, V. J., & Castillo-Campos, G. (2007). Bat diversity and abundance associated with the degree of secondary succession in a tropical forest mosaic in south-eastern Mexico. *Animal Conservation*, 10(2), 219–228. doi:10.1111/j.1469-1795.2007.00097.x
- Center for International Forestry Research (CIFOR). (2013a). Multidisciplinary Landscape Assessment – Cameroon. <http://www.cifor.org/mla/ref/method/index.htm>
- Center for International Forestry Research (CIFOR). (2013b). Multidisciplinary Landscape Assessment – Philippines. <http://www.cifor.org/mla/ref/method/index.htm>
- Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). (2010). Unpublished data of reptilian and amphibian diversity in six countries in Central America.
- Cerezo, A., Conde, M. C., & Poggio, S. L. (2011). Pasture area and landscape heterogeneity are key determinants of bird diversity in intensively managed farmland. *Biodiversity and Conservation*, 20(12), 2649–2667. doi:10.1007/s10531-011-0096-y
- Chapman, A. D. (2009). *Numbers of living species in Australia and the world*, 2nd edition. <https://www.environment.gov.au/node/13876>
- Chapman, K. A., & Reich, P. B. (2007). Land use and habitat gradients determine bird community diversity and abundance in suburban, rural and reserve landscapes of Minnesota, USA. *Biological Conservation*, 135(4), 527–541. doi:10.1016/j.biocon.2006.10.050
- Chauvat, M., Wolters, V., & Dauber, J. (2007). Response of collembolan communities to land-use change and grassland succession. *Ecography*, 30(2), 183–192. doi:10.1111/j.2007.0906-7590.04888.x
- Christensen, M., & Heilmann-Clausen, J. (2009). Forest biodiversity gradients and the human impact in Annapurna Conservation Area, Nepal. *Biodiversity and Conservation*, 18(8), 2205–2221. doi:10.1007/s10531-009-9583-9
- Clark, R. J., Gerard, P. J., & Mellsop, J. M. (2004). Spider biodiversity and density following cultivation in pastures in the Waikato, New Zealand. *New Zealand Journal of Agricultural Research*, 47(2), 247–259. doi:10.1080/00288233.2004.9513592
- Clarke, F. M., Rostant, L. V., & Racey, P. A. (2005). Life after logging: Post-logging recovery of a neotropical bat community. *Journal of Applied Ecology*, 42(2), 409–420. doi:10.1111/j.1365-2664.2005.01024.x
- Cleary, D. F. R., & Mooers, A. O. (2006). Burning and logging differentially affect endemic vs. widely distributed butterfly species in Borneo. *Diversity and Distributions*, 12(4), 409–416. doi:10.1111/j.1366-9516.2006.00256.x
- Cleary, D. F. R., Mooers, A. O., Eichhorn, K. A. O., van Tol, J., de Jong, R., & Menken, S. B. J. (2004). Diversity and community composition of butterflies and odonates in an ENSO-induced fire affected habitat mosaic:

- A case study from East Kalimantan, Indonesia. *Oikos*, 105(2), 426–446. doi:10.1111/j.0030-1299.2004.12219.x
- Cockle, K. L., Leonard, M. L., & Bodrati, A. A. (2005). Presence and abundance of birds in an Atlantic forest reserve and adjacent plantation of shade-grown yerba mate, in Paraguay. *Biodiversity and Conservation*, 14(13), 3265–3288. doi:10.1007/s10531-004-0446-0
- Collen, B., Loh, J., Whitmee, S., McRae, L., Amin, R., & Baillie, J. E. M. (2009). Monitoring change in vertebrate abundance: The Living Planet Index. *Conservation Biology*, 23(2), 317–327. doi:10.1111/j.1523-1739.2008.01117.x
- Connop, S., Hill, T., Steer, J., & Shaw, P. (2011). Microsatellite analysis reveals the spatial dynamics of *Bombus humilis* and *Bombus sylvarum*. *Insect Conservation and Diversity*, 4(3), 212–221. doi:10.1111/j.1752-4598.2010.00116.x
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (2016). Appendices I, II and III to the Convention. <https://cites.org/eng/app/appendices.php>
- Craig, M. D., Grigg, A. H., Garkaklis, M. J., Hobbs, R. J., Grant, C. D., Fleming, P. A., & Hardy, G. E. S. J. (2009). Does habitat structure influence capture probabilities? A study of reptiles in a eucalypt forest. *Wildlife Research*, 36(6), 509–515. doi:10.1071/wr09014
- Craig, M. D., Grigg, A. H., Hobbs, R. J., & Hardy, G. E. S. J. (2014). Does coarse woody debris density and volume influence the terrestrial vertebrate community in restored bauxite mines? *Forest Ecology and Management*, 318, 142–150. doi:10.1016/j.foreco.2014.01.011
- Craig, M. D., Hardy, G. E. S. J., Fontaine, J. B., Garkaklis, M. J., Grigg, A. H., Grant, C. D., ... Hobbs, R. J. (2012). Identifying unidirectional and dynamic habitat filters to faunal recolonisation in restored mine-pits. *Journal of Applied Ecology*, 49(4), 919–928. doi:10.1111/j.1365-2664.2012.02152.x
- Craig, M. D., Stokes, V. L., StJ. Hardy, G. E., & Hobbs, R. J. (2015). Edge effects across boundaries between natural and restored jarrah (*Eucalyptus marginata*) forests in south-western Australia. *Austral Ecology*, 40(2), 186–197. doi:10.1111/aec.12193
- Cunningham, S. A., Schellhorn, N. A., Marcora, A., & Batley, M. (2013). Movement and phenology of bees in a subtropical Australian agricultural landscape. *Austral Ecology*, 38(4), 456–464. doi:10.1111/j.1442-9993.2012.02432.x
- Dallimer, M., Parnell, M., Bicknell, J. E., & Melo, M. (2012). The importance of novel and agricultural habitats for the avifauna of an oceanic island. *Journal for Nature Conservation*, 20(4), 191–199. doi:10.1016/j.jnc.2012.04.001
- D'Aniello, B., Stanislao, I., Bonelli, S., & Balletto, E. (2011). Haying and grazing effects on the butterfly communities of two Mediterranean-area grasslands. *Biodiversity and Conservation*, 20(8), 1731–1744. doi:10.1007/s10531-011-0058-4
- Danquah, E., Oppong, S. K., & Nutsuakor, M. E. (2012). Effect of protected area category on mammal abundance in Western Ghana. *Journal of Biodiversity and Environmental Sciences*, 2(8), 50–57.
- Darvill, B., Knight, M. E., & Goulson, D. (2004). Use of genetic markers to quantify bumblebee foraging range and nest density. *Oikos*, 107(3), 471–478. doi:10.1111/j.0030-1299.2004.13510.x
- Davies, K. F., Margules, C. R., & Lawrence, J. F. (2000). Which traits of species predict population declines in experimental forest fragments? *Ecology*, 81(5), 1450–146. doi:10.1890/0012-9658(2000)081[1450:WTOSPP]2.0.CO;2
- Davis, E. S., Murray, T. E., Fitzpatrick, U., Brown, M. J. F., & Paxton, R. J. (2010). Landscape effects on extremely fragmented populations of a rare solitary bee, *Colletes floralis*. *Molecular Ecology*, 19(22), 4922–4935. doi:10.1111/j.1365-294x.2010.04868.x
- Davis, A. L. V., & Phillips, T. K. (2005). Effect of deforestation on a southwest Ghana dung beetle assemblage (Coleoptera: Scarabaeidae) at the periphery of Ankasa conservation area. *Environmental Entomology*, 34(5), 1081–1088. doi:10.1603/0046-225x(2005)034[1081:eodoas]2.0.co;2
- Dawson, J., Turner, C., Pileng, O., Farmer, A., McGary, C., Walsh, C., ... Yosi, C. (2011). Bird communities of the lower Waria Valley, Morobe Province, Papua New Guinea: A comparison between habitat types. *Tropical Conservation Science*, 4(3), 317–348.
- D'Cruze, N., & Kumar, S. (2011). Effects of anthropogenic activities on lizard communities in northern Madagascar. *Animal Conservation*, 14(5), 542–552. doi:10.1111/j.1469-1795.2011.00459.x
- De Palma, A., Abrahamczyk, S., Aizen, M. A., Albrecht, M., Basset, Y., Bates, A., ... Purvis, A. (2016). Predicting bee community responses to land-use changes: Effects of geographic and taxonomic biases. *Scientific Reports*, 6(31153), 1–14. doi:10.1038/srep31153
- De Palma, A., Kuhlmann, M., Roberts, S. P. M., Potts, S. G., Börger, L., Hudson, L. N., ... Purvis, A. (2015). Ecological traits affect the sensitivity of bees to land-use pressures in European agricultural landscapes. *Journal of Applied Ecology*, 52(6), 1567–1577. doi:10.1111/1365-2664.12524
- Deheuvels, O., Avelino, J., Somarriba, E., & Malézieux, E. (2012). Vegetation structure and productivity in cocoa-based agroforestry systems in Talamanca, Costa Rica. *Agriculture, Ecosystems and Environment*, 149(1), 181–188. doi:10.1016/j.agee.2011.03.003
- Deheuvels, O., Rousseau, G., Soto Quiroga, G., Decker Franco, M., Cerda, R., Vilchez Mendoza, S., & Somarriba, E. (2014). Biodiversity is affected by changes in management intensity of cocoa-based agroforests. *Agroforestry Systems*, 88(6), 1081–1099. doi:10.1007/s10457-014-9710-9
- Delabie, J. H. C., Cereghino, R., Groc, S., Dejean, A., Gibernau, M., Corbara, B., & Dejean, A. (2009). Ants as biological indicators of Wayana Amerindian land use in French Guiana. *Comptes Rendus Biologies*, 332(7), 673–684. doi:10.1016/j.crvi.2009.01.006
- Devineau, J. L., Fournier, A., & Nignan, S. (2009). "Ordinary biodiversity" in western Burkina Faso (West Africa): What vegetation do the state forests conserve? *Biodiversity and Conservation*, 18(8), 2075–2099. doi:10.1007/s10531-008-9574-2
- Diekötter, T., Walther-Hellwig, K., Conradi, M., Suter, M., & Frankl, R. (2006). Effects of landscape elements on the distribution of the rare bumblebee species *Bombus muscorum* in an agricultural landscape. *Biodiversity and Conservation*, 15(1), 57–68. doi:10.1007/s10531-004-2932-9
- Dolia, J., Devy, M. S., Aravind, N. A., & Kumar, A. (2008). Adult butterfly communities in coffee plantations around a protected area in the Western Ghats, India. *Animal Conservation*, 11(1), 26–34. doi:10.1111/j.1469-1795.2007.00143.x
- Domínguez, E., Bahamonde, N., & Muñoz-Escobar, C. (2012). Efectos de la extracción de turba sobre la composición y estructura de una turbera de Sphagnum explotada y abandonada hace 20 años, Chile. *Anales Instituto Patagonia (Chile)*, 40(2), 37–45. doi:10.4067/s0718-686x2012000200003
- Domínguez-Haydar, Y., & Armbrrecht, I. (2010). Response of ants and their seed removal in rehabilitation areas and forests at El Cerrejon coal mine in Colombia. *Restoration Ecology*, 19(201), 178–184. doi:10.1111/j.1526-100x.2010.00735.x
- Dornelas, M., Gotelli, N. J., McGill, B., Shimadzu, H., Moyes, F., Sievers, C., & Magurran, A. E. (2014). Assemblage time series reveal biodiversity change but not systematic loss. *Science*, 344(6181), 296–299. doi:10.1126/science.1248484
- Doulton, H., Marsh, C., Newman, A., Bird, K., & Bell, M. (2007) Conservation Comores 2005: Biodiversity and resource-use assessment and environmental awareness. Technical report, University of Oxford, the Comorian Centre National de Documentation et Recherche Scientifique, and the Comorian NGOs Action Comores Anjouan and the Association d'Intervention pour le Développement et l'Environnement; with the support of the Direction National de l'Environnement et des Forêts and the United Nations Development Programme, University of Oxford, U.K.
- Draper, I., Lara, F., Albertos, B., Garilleti, R., & Mazimpaka, V. (2006). Epiphytic bryoflora of the Atlas and AntiAtlas Mountains, including a synthesis of the distribution of epiphytic bryophytes in Morocco. *Journal of Bryology*, 28, 312–330. doi:10.1179/174328206x136313

- Dukes, J. S., & Mooney, H. A. (1999). Does global change increase the success of biological invaders? *Trends in Ecology & Evolution*, 14(4), 135–139. doi:10.1016/S0169-5347(98)01554-7
- Dumont, B., Farruggia, A., Garel, J. P., Bachelard, P., Boitier, E., & Frain, M. (2009). How does grazing intensity influence the diversity of plants and insects in a species-rich upland grassland on basalt soils? *Grass and Forage Science*, 64(1), 92–105. doi:10.1111/j.1365-2494.2008.00674.x
- Dures, S. G., & Cumming, G. S. (2010). The confounding influence of homogenising invasive species in a globally endangered and largely urban biome: Does habitat quality dominate avian biodiversity? *Biological Conservation*, 143(3), 768–777. doi:10.1016/j.biocon.2009.12.019
- Echeverría-Londoño, S., Newbold, T., Hudson, L. N., Contu, S., Hill, S., Lysenko, I., ... Purvis, A. (2016). Modelling and projecting the response of Colombian biodiversity to land-use change. *Diversity and Distributions*, early view, doi:10.1111/ddi.12478
- Edenius, L., Mikusinski, G., & Bergh, J. (2011). Can repeated fertilizer applications to young Norway spruce enhance avian diversity in intensively managed forests? *Ambio*, 40(5), 521–527. doi:10.1007/s13280-011-0137-5
- Eigenbrod, F., Hecnar, S. J., & Fahrig, L. (2008). Accessible habitat: An improved measure of the effects of habitat loss and roads on wildlife populations. *Landscape Ecology*, 23(2), 159–168. doi:10.1007/s10980-007-9174-7
- Elek, Z., & Lovei, G. L. (2007). Patterns in ground beetle (Coleoptera: Carabidae) assemblages along an urbanisation gradient in Denmark. *Acta Oecologica-International Journal of Ecology*, 32(1), 104–111. doi:10.1016/j.actao.2007.03.008
- Endo, W., Peres, C., Salas, E., Mori, S., Sanchez-Vega, J., Shepard, G., ... Yu, D. (2010). Game vertebrate densities in hunted and nonhunted forest sites in Manu National Park, Peru. *Biotropica*, 42(2), 251–261. doi:10.1111/j.1744-7429.2009.00546.x
- Ewers, R. M., Bartlam, S., & Didham, R. K. (2013). Altered species interactions at forest edges: Contrasting edge effects on bumble bees and their phoretic mite loads in temperate forest remnants. *Insect Conservation and Diversity*, 6(5), 598–606. doi:10.1111/icad.12014
- Ewers, R. M., Thorpe, S., & Didham, R. K. (2007). Synergistic interactions between edge and area effects in a heavily fragmented landscape. *Ecology*, 88(1), 96–106. doi:10.1890/0012-9658(2007)88[96:sibea]2.0.co;2
- Fabricius, C., Burger, M., & Hockey, P. A. R. (2003). Comparing biodiversity between protected areas and adjacent rangeland in xeric succulent thicket, South Africa: Arthropods and reptiles. *Journal of Applied Ecology*, 40(2), 392–403. doi:10.1046/j.1365-2664.2003.00793.x
- Faruk, A., Belabut, D., Ahmad, N., Knell, R. J., & Garner, T. W. J. (2013). Effects of oil-palm plantations on diversity of tropical anurans. *Conservation Biology*, 27(3), 615–624. doi:10.1111/cobi.12062
- Farwig, N., Bailey, D., Bochud, E., Herrmann, J. D., Kindler, E., Reusser, N., ... Schmidt-Entling, M. H. (2009). Isolation from forest reduces pollination, seed predation and insect scavenging in Swiss farmland. *Landscape Ecology*, 24(7), 919–927. doi:10.1007/s10980-009-9376-2
- Farwig, N., Sajita, N., & Boehning-Gaese, K. (2008). Conservation value of forest plantations for bird communities in western Kenya. *Forest Ecology and Management*, 255(11), 3885–3892. doi:10.1016/j.foreco.2008.03.042
- Fayle, T. M., Turner, E. C., Snaddon, J. L., Chey, V. K., Chung, A. Y. C., Eggleton, P., & Foster, W. A. (2010). Oil palm expansion into rain forest greatly reduces ant biodiversity in canopy, epiphytes and leaf-litter. *Basic and Applied Ecology*, 11(4), 337–345. doi:10.1016/j.baae.2009.12.009
- Felton, A. M., Engstrom, L. M., Felton, A., & Knott, C. D. (2003). Orangutan population density, forest structure and fruit availability in hand-logged and unlogged peat swamp forests in West Kalimantan, Indonesia. *Biological Conservation*, 114(1), 91–101. doi:10.1016/S0006-3207(03)00013-2
- Fensham, R., Dwyer, J., Eyre, T., Fairfax, R., & Wang, J. (2012). The effect of clearing on plant composition in mulga (*Acacia aneura*) dry forest, Australia. *Austral Ecology*, 37(2), 183–192. doi:10.1111/j.1442-9993.2011.02261.x
- Fermon, H., Waltert, M., Vane-Wright, R. I., & Muhlenberg, M. (2005). Forest use and vertical stratification in fruit-feeding butterflies of Sulawesi, Indonesia: Impacts for conservation. *Biodiversity and Conservation*, 14(2), 333–350. doi:10.1007/s10531-004-5054-9
- Fernandez, I. C., & Simonetti, J. A. (2013). Small mammal assemblages in fragmented shrublands of urban areas of Central Chile. *Urban Ecosystems*, 16(2), 377–387. doi:10.1007/s11252-012-0272-1
- Ferreira, C., & Alves, P. (2005). Impacto da implementação de medidas de gestão do habitat nas populações de coelho-bravo (*Oryctolagus cuniculus algirus*) no Parque Natural do Sudoeste Alentejano e Costa Vicentina. Technical report, Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO), Vairão, Portugal.
- Ferreira, C., & Alves, P. C. (2009). Influence of habitat management on the abundance and diet of wild rabbit (*Oryctolagus cuniculus algirus*) populations in Mediterranean ecosystems. *European Journal of Wildlife Research*, 55(5), 487–496. doi:10.1007/s10344-009-0257-4
- Ficetola, G. F., Rondinini, C., Bonardi, A., Baisero, D., & Padoa-Schioppa, E. (2015). Habitat availability for amphibians and extinction threat: A global analysis. *Diversity and Distributions*, 21(3), 302–311. doi:10.1111/ddi.12296
- Fiera, C. (2008). Preliminary data on the species diversity of Collembola (Hexapoda: Collembola) along an urban gradient in București. *Travaux du Museum National d'Histoire Naturelle "Grigore Antipa"*, 51, 363–367.
- Fierro, M. M., Cruz-Lopez, L., Sanchez, D., Villanueva-Gutierrez, R., & Vandame, R. (2012). Effect of biotic factors on the spatial distribution of stingless bees (Hymenoptera: Apidae, Meliponini) in fragmented neotropical habitats. *Neotropical Entomology*, 41(2), 95–104. doi:10.1007/s13744-011-0009-5
- Filgueiras, B., Iannuzzi, L., & Leal, I. (2011). Habitat fragmentation alters the structure of dung beetle communities in the Atlantic forest. *Biological Conservation*, 144(1), 362–369. doi:10.1016/j.biocon.2010.09.013
- Firincioglu, H. K., Seefeldt, S. S., Sahin, B., & Vural, M. (2009). Assessment of grazing effect on sheep fescue (*Festuca valesiaca*) dominated steppe rangelands, in the semi-arid Central Anatolian region of Turkey. *Journal of Arid Environments*, 73(12), 1149–1157. doi:10.1016/j.jaridenv.2009.05.012
- Flaspohler, D. J., Giardina, C. P., Asner, G. P., Hart, P., Price, J., Lyons, C. K., & Castaneda, X. (2010). Long-term effects of fragmentation and fragment properties on bird species richness in Hawaiian forests. *Biological Conservation*, 143(2), 280–288. doi:10.1016/j.biocon.2009.10.009
- Floren, A., Freking, A., Biehl, M., & Linsenmair, K. E. (2001). Anthropogenic disturbance changes the structure of arboreal tropical ant communities. *Ecography*, 24(5), 547–554. doi:10.1111/j.1600-0587.2001.tb00489.x
- Fowler, R. E. (2014). *An investigation into bee assemblage change along an urban-rural gradient*. PhD thesis, University of Birmingham, Birmingham, UK.
- Franzén, M., & Nilsson, S. G. (2008). How can we preserve and restore species richness of pollinating insects on agricultural land? *Ecography*, 31(6), 698–708. doi:10.1111/j.1600-0587.2008.05110.x
- Fredriksson, G. M., Danielsen, L. S., & Swenson, J. E. (2007). Impacts of El Niño related drought and forest fires on sun bear fruit resources in lowland dipterocarp forest of East Borneo. *Biodiversity and Conservation*, 16(6), 1823–1838. doi:10.1007/s10531-006-9075-0
- Freire, G. D., & Motta, P. C. (2011). Effects of experimental fire regimes on the abundance and diversity of cursorial arachnids of Brazilian savannah (cerrado biome). *Journal of Arachnology*, 39(2), 263–272. doi:10.1636/cp10-85.1
- Frizzo, T. L. M., & Vasconcelos, H. L. (2013). The potential role of scattered trees for ant conservation in an agriculturally dominated neotropical landscape. *Biotropica*, 45(5), 644–651. doi:10.1111/btp.12045
- Fukuda, D., Tisen, O. B., Momose, K., & Sakai, S. (2009). Bat diversity in the vegetation mosaic around a lowland dipterocarp forest of Borneo. *Raffles Bulletin of Zoology*, 57(1), 213–221.
- Furlani, D., Ficetola, G. F., Colombo, G., Ugurlucan, M., & De Bernardi, F. (2009). Deforestation and the structure of frog communities in the

- Humedale Terraba-Sierpe, Costa Rica. *Zoological Science*, 26(3), 197–202. doi:10.2108/zsj.26.197
- Gaigher, R., & Samways, M. J. (2010). Surface-active arthropods in organic vineyards, integrated vineyards and natural habitat in the Cape Floristic Region. *Journal of Insect Conservation*, 14(6), 595–605. doi:10.1007/s10841-010-9286-2
- García, K. P., Ortiz Zapata, J. C., Aguayo, M., & D'Elia, G. (2013). Assessing rodent community responses in disturbed environments of the Chilean Patagonia. *Mammalia*, 77(2), 195–204. doi:10.1515/mammalia-2011-0134
- García-R, J. C., Cárdenas-H, H., & Castro-H, F. (2007). Relationship between anurans diversity and successional stages of a very humid low montane forest in Valle del Cauca, southwestern of Colombia. *Caldasia*, 29(2), 363–374.
- Garden, J. G., McAlpine, C. A., & Possingham, H. P. (2010). Multi-scaled habitat considerations for conserving urban biodiversity: Native reptiles and small mammals in Brisbane, Australia. *Landscape Ecology*, 25(7), 1013–1028. doi:10.1007/s10980-010-9476-z
- Gardner, T. A., Hernandez, M. I. M., Barlow, J., & Peres, C. A. (2008). Understanding the biodiversity consequences of habitat change: The value of secondary and plantation forests for neotropical dung beetles. *Journal of Applied Ecology*, 45(3), 883–893. doi:10.1111/j.1365-2664.2008.01454.x
- Garmendia, A., Arroyo-Rodriguez, V., Estrada, A., Naranjo, E. J., & Stoner, K. E. (2013). Landscape and patch attributes impacting medium- and large-sized terrestrial mammals in a fragmented rain forest. *Journal of Tropical Ecology*, 29, 331–344. doi:10.1017/s0266467413000370
- Garnier, E., Lavorel, S., Ansquer, P., Castro, H., Cruz, P., Dolezal, J. ... Zarovali, M. P. (2007). Assessing the effects of land-use change on plant traits, communities and ecosystem functioning in grasslands: A standardized methodology and lessons from an application to 11 European sites. *Annals of Botany*, 99(5), 967–985. doi:10.1093/aob/mcl125
- Gaston, K. J., & Blackburn, T. M. (1997). Evolutionary age and risk of extinction in the global avifauna. *Ecology and Evolution*, 11(5), 557–565. doi:10.1007/s10682-997-1511-4
- Gaublomme, E., Hendrickx, F., Dhuyvetter, H., & Desender, K. (2008). The effects of forest patch size and matrix type on changes in carabid beetle assemblages in an urbanized landscape. *Biological Conservation*, 141(10), 2585–2596. doi:10.1016/j.biocon.2008.07.022
- Ge, B. M., Li, Z. X., Zhang, D. Z., Zhang, H. B., Liu, Z. T., Zhou, C. L., & Tang, B. P. (2012). Communities of soil macrofauna in green spaces of an urbanizing city at east China. *Revista Chilena De Historia Natural*, 85(2), 219–226.
- Gendreau-Berthiaume, B., Kneeshaw, D. D., & Harvey, B. D. (2012). Effects of partial cutting and partial disturbance by wind and insects on stand composition, structure and growth in boreal mixedwoods. *Forestry*, 85(4), 551–565. doi:10.1093/forestry/cps051
- Gheler-Costa, C., Vettorazzi, C. A., Pardini, R., & Verdade, L. M. (2012). The distribution and abundance of small mammals in agroecosystems of southeastern Brazil. *Mammalia*, 76(2), 185–191. doi:10.1515/mammalia-2011-0109
- Gibson, L., Lee, T. M., Koh, L. P., Brook, B. W., Gardner, T. A., Barlow, J., ... & Sodhi, N. S. (2011). Primary forests are irreplaceable for sustaining tropical biodiversity. *Nature*, 478(7369), 378–381. doi:10.1038/nature10425
- Giordani, P. (2012). Assessing the effects of forest management on epiphytic lichens in coppiced forests using different indicators. *Plant Biosystems*, 146(3), 628–637. doi:10.1080/11263504.2011.654136
- Giordani, P., Incerti, G., Rizzi, G., Ginaldi, F., Viglione, S., Rellini, I., ... Modenesi, P. (2010). Land use intensity drives the local variation of lichen diversity in Mediterranean ecosystems sensitive to desertification. *Bibliotheca Lichenologica*, 105, 139–148.
- Giordano, S., Sorbo, S., Adamo, P., Basile, A., Spagnuolo, V., & Cobianchi, R. C. (2004). Biodiversity and trace element content of epiphytic bryophytes in urban and extraurban sites of southern Italy. *Plant Ecology*, 170(1), 1–14. doi:10.1023/b:vege.0000019025.36121.5d
- Giri, C., Zhu, Z., & Reed, B. (2005). A comparative analysis of the Global Land Cover 2000 and MODIS land cover data sets. *Remote Sensing of Environment*, 94(1), 123–132. doi:10.1016/j.rse.2004.09.005
- Golodets, C., Kigel, J., & Sternberg, M. (2010). Recovery of plant species composition and ecosystem function after cessation of grazing in a Mediterranean grassland. *Plant and Soil*, 329(1–2), 365–378. doi:10.1007/s11104-009-0164-1
- Gomes, L. G. L., Oostra, V., Nijman, V., Cleef, A. M., & Kappelle, M. (2008). Tolerance of frugivorous birds to habitat disturbance in a tropical cloud forest. *Biological Conservation*, 141(3), 860–871. doi:10.1016/j.biocon.2008.01.007
- Gonzalez, A., Cardinale, B. J., Allington, G. R. H., Byrnes, J., Endsley, K. A., Brown, D. G., ... Loreau, M. (2016). Estimating local biodiversity change: A critique of papers claiming no net loss of local diversity. *Ecology*, 97(8), 1949–1960. doi:10.1890/15-1759.1
- Gottschalk, M. S., De Toni, D. C., Valente, V. L. S., & Hofmann, P. R. P. (2007). Changes in Brazilian Drosophilidae (Diptera) assemblages across an urbanisation gradient. *Neotropical Entomology*, 36(6), 848–862. doi:10.1590/s1519-566x200700600005
- Gould, R. K., Pejchar, L., Bothwell, S. G., Brosi, B., Wolny, S., Mendenhall, C. D., & Daily, G. (2013). Forest restoration and parasitoid wasp communities in montane Hawai'i. *PLoS One*, 8(3), doi:10.1371/journal.pone.0059356
- Goulson, D., Lepais, O., O'Connor, S., Osborne, J. L., Sanderson, R. A., Cussans, J., ... Darvill, B. (2010). Effects of land use at a landscape scale on bumblebee nest density and survival. *Journal of Applied Ecology*, 47(6), 1207–1215. doi:10.1111/j.1365-2664.2010.01872.x
- Goulson, D., Lye, G. C., & Darvill, B. (2008). Diet breadth, coexistence and rarity in bumblebees. *Biodiversity and Conservation*, 17(13), 3269–3288. doi:10.1007/s10531-008-9428-y
- Gove, A. D., Majer, J. D., & Rico-Gray, V. (2005). Methods for conservation outside of formal reserve systems: The case of ants in the seasonally dry tropics of Veracruz, Mexico. *Biological Conservation*, 126(3), 328–338. doi:10.1016/j.biocon.2005.06.008
- Granjon, L., & Duplantier, J. (2011). Guinean biodiversity at the edge: Rodents in forest patches of southern Mali. *Mammalian Biology*, 76(5), 583–591. doi:10.1016/j.mambio.2011.06.003
- Grass, I., Berens, D. G., Peter, F., & Farwig, N. (2013). Additive effects of exotic plant abundance and land-use intensity on plant-pollinator interactions. *Oecologia*, 173(3), 913–923. doi:10.1007/s00442-013-2688-6
- Gray, C. L., Hill, S. L. L., Newbold, T., Hudson, L. N., Börger, L., Contu, S., ... Scharlemann, J. P. W. (2016). Local biodiversity is higher inside than outside terrestrial protected areas worldwide. *Nature Communications*, 7, 12306. doi:10.1038/ncomms12306
- Gray, C. L., Slade, E. M., Mann, D. J., & Lewis, O. T. (2014). Do riparian reserves support dung beetle biodiversity and ecosystem services in oil palm-dominated tropical landscapes? *Ecology and Evolution*, 4(7), 1049–1060. doi:10.1002/ece3.1003
- Green, R. E., Cornell, S. J., Scharlemann, J. P. W., & Balmford, A. (2005). Farming and the fate of wild nature. *Science*, 307(5709), 550–555. doi:10.1126/science.1106049
- Grime, J. P. (1998). Benefits of plant diversity to ecosystems: Immediate, filter and founder effects. *Journal of Ecology*, 86(6), 902–910. doi:10.1046/j.1365-2745.1998.00306.x
- Grogan, J., Jennings, S. B., Landis, R. M., Schulze, M., Baima, A. M. V., Lopes, J. D. C. A., ... Zimmerman, B. L. (2008). What loggers leave behind: Impacts on big-leaf mahogany (*Swietenia macrophylla*) commercial populations and potential for post-logging recovery in the Brazilian Amazon. *Forest Ecology and Management*, 255 (2), 269–281. doi:10.1016/j.foreco.2007.09.048
- Gu, W., Zhen-Rong, Y., & Dun-Xiao, H. (2004). Carabid community and its fluctuation in farmland of salinity transforming area in the North China Plain: A case study in Quzhou County, Hebei Province. *Biodiversity Science*, 12(2), 262–268.

- Gunawardene, N. R., Majer, J. D., & Edirisinghe, J. P. (2010). Investigating residual effects of selective logging on ant species assemblages in Sinharaja Forest Reserve, Sri Lanka. *Forest Ecology and Management*, 259(3), 555–562. doi:10.1016/j.foreco.2009.11.012
- Gutierrez, A. G., Armesto, J. J., Aravena, J. C., Carmona, M., Carrasco, N. V., Christie, D. A., ... Huth, A. (2009). Structural and environmental characterization of old-growth temperate rainforests of northern Chiloe Island, Chile: Regional and global relevance. *Forest Ecology and Management*, 258(4), 376–388. doi:10.1016/j.foreco.2009.03.011
- Gutierrez-Lamus, D. L. (2004). Composition and abundance of Anura in two forest types (natural and planted) in the eastern Cordillera of Colombia. *Caldasia*, 26(1), 245–264.
- Haarmeyer, D., Schmiedel, U., Dengler, J., & Bosing, B. (2010). How does grazing intensity affect different vegetation types in arid Succulent Karoo, South Africa? Implications for conservation management. *Biological Conservation*, 143(3), 588–596. doi:10.1016/j.biocon.2009.11.008
- Hampton, S. E., Strasser, C. A., Tewksbury, J. J., Gram, W. K., Budden, A. E., Batcheller, A. L., ... Porter, J. H. (2013). Big data and the future of ecology. *Frontiers in Ecology and the Environment*, 11(3), 156–162. doi:10.1890/120103
- Hanley, M. E. (2005). Unpublished data of bee diversity in UK croplands.
- Hanley, M. E. (2011). Unpublished data of bee diversity in UK croplands and urban habitats.
- Hanley, M. E., Franco, M., Dean, C. E., Franklin, E. L., Harris, H. R., Haynes, A. G., ... Knight, M. E. (2011). Increased bumblebee abundance along the margins of a mass flowering crop: Evidence for pollinator spill-over. *Oikos*, 120(11), 1618–1624. doi:10.1111/j.1600-0706.2011.19233.x
- Hanson, T. R., Brunsfeld, S. J., Finegan, B., & Waits, L. P. (2008). Pollen dispersal and genetic structure of the tropical tree *Dipteryx panamensis* in a fragmented Costa Rican landscape. *Molecular Ecology*, 17(8), 2060–2073. doi:10.1111/j.1365-294x.2008.03726.x
- Hashim, N., Akmal, W., Jusoh, W., & Nasir, M. (2010). Ant diversity in a peninsular Malaysian mangrove forest and oil palm plantation. *Asian Myrmecology*, 3, 5–8.
- Hassan, S. N., Salum, A. R., Rija, A. A., Modest, R., Kideghesho, J. R., & Malata, P. F. (2013). Human-induced disturbances influence on bird communities of coastal forests in eastern Tanzania. *British Journal of Applied Science & Technology*, 3(1), 48–64. doi:10.9734/bjast/2014/2200
- Hatfield, R. G., & LeBuhn, G. (2007). Patch and landscape factors shape community assemblage of bumble bees, *Bombus* spp. (Hymenoptera: Apidae), in montane meadows. *Biological Conservation*, 139(1–2), 150–158. doi:10.1016/j.biocon.2007.06.019
- Hawes, J., Motta, C. D. S., Overal, W. L., Barlow, J., Gardner, T. A., & Peres, C. A. (2009). Diversity and composition of Amazonian moths in primary, secondary and plantation forests. *Journal of Tropical Ecology*, 25, 281–300. doi:10.1017/s0266467409006038
- Hayward, M. W. (2009). Bushmeat hunting in Dwesa and Cwebe nature reserves, Eastern Cape, South Africa. *South African Journal of Wildlife Research*, 39(1), 70–84. doi:10.3957/056.039.0108
- Hayward, M. W., Boitani, L., Burrows, N. D., Funston, P. J., Karanth, K. U., MacKenzie, D. I., ... Yarnell, R. W. (2015). Ecologists need robust survey designs, sampling and analytical methods. *Journal of Applied Ecology*, 52(2), 286–290. doi:10.1111/1365-2664.12408
- Helden, A. J., & Leather, S. R. (2004). Biodiversity on urban roundabouts – Hymenoptera, management and the species-area relationship. *Basic and Applied Ecology*, 5(4), 367–377. doi:10.1016/j.baae.2004.06.004
- Henschel, P. (2008) *The conservation biology of the Leopard Panthera pardus in Gabon: Status, threats and strategies for conservation*. PhD thesis, Georg-August-Universität Göttingen, Göttingen, Germany.
- Hernández, L., Delgado, L., Meier, W., & Duran, C. (2012). Empobrecimiento de bosques fragmentados en el norte de la Gran Sabana, Venezuela. *Interiencia*, 37(12), 891–898.
- Herrera, J. P., Wright, P. C., Lauterbur, E., Ratovonjanahary, L., & Taylor, L. L. (2011). The effects of habitat disturbance on lemurs at Ranomafana National Park, Madagascar. *International Journal of Primatology*, 32(5), 1091–1108. doi:10.1007/s10764-011-9525-8
- Herrmann, F., Westphal, C., Moritz, R. F. A., & Steffan-Dewenter, I. (2007). Genetic diversity and mass resources promote colony size and forager densities of a social bee (*Bombus pascuorum*) in agricultural landscapes. *Molecular Ecology*, 16(6), 1167–1178. doi:10.1111/j.1365-294x.2007.03226.x
- Hietz, P. (2005). Conservation of vascular epiphyte diversity in Mexican coffee plantations. *Conservation Biology*, 19(2), 391–399. doi:10.1111/j.1523-1739.2005.00145.x
- Higuera, D., & Wolf, J. H. D. (2010). Vascular epiphytes in dry oak forests show resilience to anthropogenic disturbance, Cordillera Oriental, Colombia. *Caldasia*, 32(1), 161–174.
- Hilje, B., & Aide, T. M. (2012). Recovery of amphibian species richness and composition in a chronosequence of secondary forests, northeastern Costa Rica. *Biological Conservation*, 146(1), 170–176. doi:10.1016/j.biocon.2011.12.007
- Hoffmann, A., & Zeller, U. (2005). Influence of variations in land use intensity on species diversity and abundance of small mammals in the Nama Karoo, Namibia. *Belgian Journal of Zoology*, 135, 91–96.
- Horgan, F. G. (2009). Invasion and retreat: Shifting assemblages of dung beetles amidst changing agricultural landscapes in central Peru. *Biodiversity and Conservation*, 18(13), 3519–3541. doi:10.1007/s10531-009-9658-7
- Hornung, E., Tothmeresz, B., Magura, T., & Vilisics, F. (2007). Changes of isopod assemblages along an urban-suburban-rural gradient in Hungary. *European Journal of Soil Biology*, 43(3), 158–165. doi:10.1016/j.ejsobi.2007.01.001
- Hoskins, A. J., Bush, A., Gilmore, J., Harwood, T., Hudson, L. N., Ware, C., ... Ferrier, S. (2016). Downscaling land-use data to provide global 30'' estimates of five land-use classes. *Ecology and Evolution*, 6(9), 3040–3055. doi:10.1002/ece3.2104
- Hu, C., & Cao, Z. P. (2008). Nematode community structure under compost and chemical fertilizer management practice, in the north China plain. *Experimental Agriculture*, 44(4), 485–496. doi:10.1017/s0014479708006716
- Hudson, L. N., Isaac, N. J. B., & Reuman, D. C. (2013). The relationship between body mass and field metabolic rate among individual birds and mammals. *Journal of Animal Ecology*, 82(5), 1009–1020. doi:10.1111/1365-2656.12086
- Hudson, L. N., Newbold, T., Contu, S., Hill, S. L. L., Lysenko, I., De Palma, A., ... Purvis, A. (2014). The PREDICTS database: A global database of how local terrestrial biodiversity responds to human impacts. *Ecology and Evolution*, 4(24), 4701–4735. doi:10.1002/ece3.1303
- Hudson, L. N., Newbold, T., Purves, D. W., Scharlemann, J. P. W., Mace, G., & Purvis, A. (2013). Projecting Responses of Ecological Diversity In Changing Terrestrial Systems (PREDICTS): Can you help? *BES Bulletin*, 44(1), 36–37.
- Hull, P. M., Darroch, S. A. F., & Erwin, D. H. (2015). Rarity in mass extinctions and the future of ecosystems. *Nature*, 528(7582), 345–351. doi:10.1038/nature16160
- Hurttt, G. C., Chini, L. P., Froking, S., Betts, R. A., Feddema, J., Fischer, G., ... Wang, Y. P. (2011). Harmonization of land-use scenarios for the period 1500–2100: 600 years of global gridded annual land-use transitions, wood harvest, and resulting secondary lands. *Climatic Change*, 109, 117–161. doi:10.1007/s10584-011-0153-2
- Hylander, K., & Nemomissa, S. (2009). Complementary roles of home gardens and exotic tree plantations as alternative habitats for plants of the Ethiopian montane rainforest. *Conservation Biology*, 23(2), 400–409. doi:10.1111/j.1523-1739.2008.01097.x
- Hylander, K., Nilsson, C., & Gothner, T. (2004). Effects of buffer-strip retention and clearcutting on land snails in boreal riparian forests. *Conservation Biology*, 18(4), 1052–1062. doi:10.1111/j.1523-1739.2004.00199.x

- Hylander, K., & Weibull, H. (2012). Do time-lagged extinctions and colonizations change the interpretation of buffer strip effectiveness? – a study of riparian bryophytes in the first decade after logging. *Journal of Applied Ecology*, 49(6), 1316–1324. doi:10.1111/j.1365-2664.2012.02218.x
- Ims, R. A., & Henden, J. A. (2012). Collapse of an arctic bird community resulting from ungulate-induced loss of erect shrubs. *Biological Conservation*, 149(1), 2–5. doi:10.1016/j.biocon.2012.02.008
- Inchausti, P., & Halley, J. (2001). Investigating long-term ecological variability using the global population dynamics database. *Science*, 293(5530), 655–657. doi:10.1126/science.293.5530.655
- International Union for Conservation of Nature (2016). The IUCN Red List of Threatened Species. Version 2016-1. <http://www.iucnredlist.org>
- Isaacs-Cubides, P. J., & Urbina-Cardona, J. N. (2011). Anthropogenic disturbance and edge effects on anuran assemblages inhabiting cloud forest fragments in Colombia. *Natureza & Conservacao*, 9(1), 39–46. doi:10.4322/natcon.2011.004
- Ishida, H., Hattori, T., & Takeda, Y. (2005). Comparison of species composition and richness between primary and secondary lucidophyllous forests in two altitudinal zones of Tsushima Island, Japan. *Forest Ecology and Management*, 213(1–3), 273–287. doi:10.1016/j.foreco.2005.03.046
- Ishitani, M., Kotze, D. J., & Niemela, J. (2003). Changes in carabid beetle assemblages across an urban-rural gradient in Japan. *Ecography*, 26(4), 481–489. doi:10.1034/j.1600-0587.2003.03436.x
- Jacobs, C. T., Scholtz, C. H., Escobar, F., & Davis, A. L. V. (2010). How might intensification of farming influence dung beetle diversity (Coleoptera: Scarabaeidae) in Maputo Special Reserve (Mozambique)? *Journal of Insect Conservation*, 14(4), 389–399. doi:10.1007/s10841-010-9270-x
- Jauker, B., Krauss, J., Jauker, F., & Steffan-Dewenter, I. (2013). Linking life history traits to pollinator loss in fragmented calcareous grasslands. *Landscape Ecology*, 28(1), 107–120. doi:10.1007/s10980-012-9820-6
- Johnson, M. F., Gómez, A., & Pinedo-Vasquez, M. (2008). Land use and mosquito diversity in the Peruvian Amazon. *Journal of Medical Entomology*, 45(6), 1023–1030. doi:10.1603/0022-2585(2008)45[1023:luamd]2.0.co;2
- Jolli, V., & Pandit, M. K. (2011). Monitoring pheasants (Phasianidae) in the western Himalayas to measure the impact of hydro-electric projects. *Ring*, 33(1–2), 37–46. doi:10.2478/v10050-011-0003-7
- Jones, K. E., Bielby, J., Cardillo, M., Fritz, S. A., O'Dell, J., Orme, C. D. L., ... Purvis, A. (2009). PanTHERIA: A species-level database of life history, ecology, and geography of extant and recently extinct mammals. *Ecology*, 90(9), 2648. doi:10.1890/08-1494.1
- Jonsell, M. (2012). Old park trees as habitat for saproxylic beetle species. *Biodiversity and Conservation*, 21(3), 619–642. doi:10.1007/s10531-011-0203-0
- Joubert, L., Esler, K. J., & Privett, S. D. J. (2009). The effect of ploughing and augmenting natural vegetation with commercial fynbos species on the biodiversity of Overberg Sandstone fynbos on the Agulhas Plain, South Africa. *South African Journal of Botany*, 75(3), 526–531. doi:10.1016/j.sajb.2009.05.002
- Julier, H. E., & Roulston, T. H. (2009). Wild bee abundance and pollination service in cultivated pumpkins: Farm management, nesting behavior and landscape effects. *Journal of Economic Entomology*, 102(2), 563–573. doi:10.1603/029.102.0214
- Jung, T. S., & Powell, T. (2011). Spatial distribution of meadow jumping mice (*Zapus hudsonius*) in logged boreal forest of northwestern Canada. *Mammalian Biology*, 76(6), 678–682. doi:10.1016/j.mambio.2011.08.002
- Justice, C. O., Vermote, E., Townshend, J. R., Defries, R., Roy, D. P., Hall, D. K., ... Barnsley, M. J. (1998). The Moderate Resolution Imaging Spectroradiometer (MODIS): Land remote sensing for global change research. *IEEE Transactions on Geoscience and Remote Sensing*, 36(4), 1228–1249.
- Kapoor, V. (2008). Effects of rainforest fragmentation and shade-coffee plantations on spider communities in the Western Ghats, India. *Journal of Insect Conservation*, 12(1), 53–68. doi:10.1007/s10841-006-9062-5
- Kappes, H., Katschnner, L., & Nowak, C. (2012). Urban summer heat load: Meteorological data as a proxy for metropolitan biodiversity. *Meteorologische Zeitschrift*, 21(5), 525–528. doi:10.1127/0941-2948/2012/0361
- Kati, V., Zografou, K., Tzirkalli, E., Chitos, T., & Willemse, L. (2012). Butterfly and grasshopper diversity patterns in humid Mediterranean grasslands: The roles of disturbance and environmental factors. *Journal of Insect Conservation*, 16(6), 807–818. doi:10.1007/s10841-012-9467-2
- Katovai, E., Burley, A. L., & Mayfield, M. M. (2012). Understory plant species and functional diversity in the degraded wet tropical forests of Kolombangara Island, Solomon Islands. *Biological Conservation*, 145(1), 214–224. doi:10.1016/j.biocon.2011.11.008
- Kattge, J., Diaz, S., Lavorel, S., Prentice, C., Leadley, P., Bonisch, G., ... Wirth, C. (2011). TRY – a global database of plant traits. *Global Change Biology*, 17(9), 2905–2935. doi:10.1111/j.1365-2486.2011.02451.x
- Kessler, M., Abrahamczyk, S., Bos, M., Buchori, D., Putra, D. D., Gradstein, S. R., ... Tschardt, T. (2009). Alpha and beta diversity of plants and animals along a tropical land-use gradient. *Ecological Applications*, 19(8), 2142–2156. doi:10.1890/08-1074.1
- Kessler, M., Kessler, P. J. A., Gradstein, S. R., Bach, K., Schull, M., & Pitopang, R. (2005). Tree diversity in primary forest and different land use systems in Central Sulawesi, Indonesia. *Biodiversity and Conservation*, 14(3), 547–560. doi:10.1007/s10531-004-3914-7
- Kittle, A. M., Watson, A. C., Chanaka Kumara, P. H., & Nimalka Sanjeevani, H. K. (2012). Status and distribution of the leopard in the central hills of Sri Lanka. *Cat News*, 56, 28–31.
- Knight, M. E., Osborne, J. L., Sanderson, R. A., Hale, R. J., Martin, A. P., & Goulson, D. (2009). Bumblebee nest density and the scale of available forage in arable landscapes. *Insect Conservation and Diversity*, 2(2), 116–124. doi:10.1111/j.1752-4598.2009.00049.x
- Knop, E., Ward, P. I., & Wich, S. A. (2004). A comparison of orang-utan density in a logged and unlogged forest on Sumatra. *Biological Conservation*, 120(2), 183–188. doi:10.1016/j.biocon.2004.02.010
- Kohler, F., Verhulst, J., van Klink, R., & Kleijn, D. (2008). At what spatial scale do high-quality habitats enhance the diversity of forbs and pollinators in intensively farmed landscapes? *Journal of Applied Ecology*, 45(3), 753–762. doi:10.1111/j.1365-2664.2007.01394.x
- Koivula, M., Hyrylainen, V., & Soininen, E. (2004). Carabid beetles (Coleoptera: Carabidae) at forest-farmland edges in southern Finland. *Journal of Insect Conservation*, 8(4), 297–309. doi:10.1007/s10841-004-0296-9
- Kolb, A., & Diekmann, M. (2004). Effects of environment, habitat configuration and forest continuity on the distribution of forest plant species. *Journal of Vegetation Science*, 15(2), 199–208. doi:10.1111/j.1654-1103.2004.tb02255.x
- Kone, M., Konate, S., Yeo, K., Kouassi, P. K., & Linsenmair, K. E. (2010). Diversity and abundance of terrestrial ants along a gradient of land use intensification in a transitional forest-savannah zone of Côte d'Ivoire. *Journal of Applied Biosciences*, 29, 1809–1827.
- Körösi, A., Batáry, P., Orosz, A., Rédei, D., & Báldi, A. (2012). Effects of grazing, vegetation structure and landscape complexity on grassland leafhoppers (Hemiptera: Auchenorrhyncha) and true bugs (Hemiptera: Heteroptera) in Hungary. *Insect Conservation and Diversity*, 5(1), 57–66. doi:10.1111/j.1752-4598.2011.00153.x
- Krauss, J., Bommarco, R., Guardiola, M., Heikkinen, R. K., Helm, A., Kuussaari, M., ... Steffan-Dewenter, I. (2010). Habitat fragmentation causes immediate and time-delayed biodiversity loss at different trophic levels. *Ecology Letters*, 13(5), 597–605. doi:10.1111/j.1461-0248.2010.01457.x
- Krauss, J., Klein, A. M., Steffan-Dewenter, I., & Tschardt, T. (2004). Effects of habitat area, isolation, and landscape diversity on plant species richness of calcareous grasslands. *Biodiversity and Conservation*, 13(8), 1427–1439. doi:10.1023/b:bioc.0000021323.18165.58
- Krauss, J., Steffan-Dewenter, I., & Tschardt, T. (2003). How does landscape context contribute to effects of habitat fragmentation on

- diversity and population density of butterflies? *Journal of Biogeography*, 30(6), 889–900. doi:10.1046/j.1365-2699.2003.00878.x
- Kumar, R., & Shahabuddin, G. (2005). Effects of biomass extraction on vegetation structure, diversity and composition of forests in Sariska Tiger Reserve, India. *Environmental Conservation*, 32(3), 248–259. doi:10.1017/s0376892905002316
- Kurz, D. J., Nowakowski, A. J., Tingley, M. W., Donnelly, M. A., & Wilcove, D. S. (2014). Forest-land use complementarity modifies community structure of a tropical herpetofauna. *Biological Conservation*, 170, 246–255. doi:10.1016/j.biocon.2013.12.027
- Kutt, A. S., Vanderduys, E. P., & O'Reagain, P. (2012). Spatial and temporal effects of grazing management and rainfall on the vertebrate fauna of a tropical savanna. *Rangeland Journal*, 34(2), 173–182. doi:10.1071/rj11049
- Kutt, A. S., & Woinarski, J. C. Z. (2007). The effects of grazing and fire on vegetation and the vertebrate assemblage in a tropical savanna woodland in north-eastern Australia. *Journal of Tropical Ecology*, 23, 95–106. doi:10.1017/s0266467406003579
- Lachat, T., Attignon, S., Djego, J., Goergen, G., Nagel, P., Sinsin, B., & Peveling, R. (2006). Arthropod diversity in Lama forest reserve (South Benin), a mosaic of natural, degraded and plantation forests. *Biodiversity and Conservation*, 15(1), 3–23. doi:10.1007/s10531-004-1234-6
- Lantschner, M. V., Rusch, V., & Hayes, J. P. (2012). Habitat use by carnivores at different spatial scales in a plantation forest landscape in Patagonia, Argentina. *Forest Ecology and Management*, 269, 271–278. doi:10.1016/j.foreco.2011.12.045
- Lantschner, M. V., Rusch, V., & Peyrou, C. (2008). Bird assemblages in pine plantations replacing native ecosystems in NW Patagonia. *Biodiversity and Conservation*, 17(5), 969–989. doi:10.1007/s10531-007-9243-x
- Lasky, J. R., & Keitt, T. H. (2010). Abundance of Panamanian dry-forest birds along gradients of forest cover at multiple scales. *Journal of Tropical Ecology*, 26, 67–78. doi:10.1017/s0266467409990368
- Latta, S. C., Tinoco, B. A., Astudillo, P. X., & Graham, C. H. (2011). Patterns and magnitude of temporal change in avian communities in the Ecuadorian Andes. *Condor*, 113(1), 24–40. doi:10.1525/cond.2011.090252
- Laurance, W. F., & Laurance, S. G. W. (1996). Responses of five arboreal marsupials to recent selective logging in tropical Australia. *Biotropica*, 28(3), 310–322. doi:10.2307/2389195
- Lawton, J. H., Bignell, D. E., Bolton, B., Bloemers, G. F., Eggleton, P., Hammond, P. M., ... Watt, A. D. (1998). Biodiversity inventories, indicator taxa and effects of habitat modification in tropical forest. *Nature*, 391(6662), 72–76. doi:10.1038/34166
- Le Féon, V., Schermann-Legionnet, A., Delettre, Y., Aviron, S., Billeter, R., Bugter, R., ... Burel, F. (2010). Intensification of agriculture, landscape composition and wild bee communities: a large scale study in four European countries. *Agriculture Ecosystems & Environment*, 137(1–2), 143–150. doi:10.1016/j.agee.2010.01.015
- Légaré, J. P., Hébert, C., & Ruel, J. C. (2011). Alternative silvicultural practices in irregular boreal forests: Response of beetle assemblages. *Silva Fennica*, 45(5), 937–956.
- Lehouck, V., Spanhove, T., Colson, L., Adringa-Davis, A., Cordeiro, N., & Lens, L. (2009). Habitat disturbance reduces seed dispersal of a forest interior tree in a fragmented African cloud forest. *Oikos*, 118(7), 1023–1034. doi:10.1111/j.1600-0706.2009.17300.x
- Leighton-Goodall, I., Brown, K., Hammond, P. M., & Eggleton, P. (2012). Unpublished data of soil macrofauna in London woodlands: species density, composition and level of synanthropy vary with distance from the centre of the city.
- Lentini, P. E., Martin, T. G., Gibbons, P., Fischer, J., & Cunningham, S. A. (2012). Supporting wild pollinators in a temperate agricultural landscape: Maintaining mosaics of natural features and production. *Biological Conservation*, 149(1), 84–92. doi:10.1016/j.biocon.2012.02.004
- Letcher, S. G., & Chazdon, R. L. (2009). Rapid recovery of biomass, species richness, and species composition in a forest chronosequence in northeastern Costa Rica. *Biotropica*, 41(5), 608–617. doi:10.1111/j.1744-7429.2009.00517.x
- Li, S. N., Zou, F. S., Zhang, Q., & Sheldon, F. H. (2013). Species richness and guild composition in rubber plantations compared to secondary forest on Hainan Island. *China. Agroforestry Systems*, 87(5), 1117–1128. doi:10.1007/s10457-013-9624-y
- de Lima, R. F., Dallimer, M., Atkinson, P. W., & Barlow, J. (2013). Biodiversity and land-use change: Understanding the complex responses of an endemic-rich bird assemblage. *Diversity and Distributions*, 19(4), 411–422. doi:10.1111/ddi.12015
- Liow, L. H., Sodhi, N. S., & Elmqvist, T. (2001). Bee diversity along a disturbance gradient in tropical lowland forests of south-east Asia. *Journal of Applied Ecology*, 38(1), 180–192. doi:10.1046/j.1365-2664.2001.00582.x
- Litchwark, S. A. (2013). *Honeybee declines in a changing landscape: Interactive effects of honeybee declines and land-use intensification on pollinator communities*. MSc thesis, University of Canterbury, Christchurch, New Zealand.
- Littlewood, N. A. (2008). Grazing impacts on moth diversity and abundance on a Scottish upland estate. *Insect Conservation and Diversity*, 1(3), 151–160. doi:10.1111/j.1752-4598.2008.00021.x
- Littlewood, N. A., Pakeman, R. J., & Pozsgai, G. (2012). Grazing impacts on Auchenorrhyncha diversity and abundance on a Scottish upland estate. *Insect Conservation and Diversity*, 5(1), 67–74. doi:10.1111/j.1752-4598.2011.00135.x
- Liu, Y. H., Axmacher, J. C., Wang, C. L., Li, L. T., & Yu, Z. R. (2012). Ground beetle (Coleoptera: Carabidae) assemblages of restored semi-natural habitats and intensively cultivated fields in northern China. *Restoration Ecology*, 20(2), 234–239. doi:10.1111/j.1526-100x.2010.00755.x
- Lo-Man-Hung, N. F., Gardner, T. A., Ribeiro-Júnior, M. A., Barlow, J., & Bonaldo, A. B. (2008). The value of primary, secondary, and plantation forests for Neotropical epigeic arachnids. *Journal of Arachnology*, 36(2), 394–401. doi:10.1636/ct07-136.1
- Lo-Man-Hung, N. F., Marichal, R., Candiani, D. F., Carvalho, L. S., Indicatti, R. P., Bonaldo, A. B., ... Lavelle, P. (2011). Impact of different land management on soil spiders (Arachnida: Araneae) in two Amazonian areas of Brazil and Colombia. *Journal of Arachnology*, 39(2), 296–302. doi:10.1636/cp10-89.1
- López-Quintero, C. A., Straatsma, G., Franco-Molano, A. E., & Boekhout, T. (2012). Macrofungal diversity in Colombian Amazon forests varies with regions and regimes of disturbance. *Biodiversity Conservation*, 21, 2221–2243. doi:10.1007/s10531-012-0280-8
- Louhaichi, M., Salkini, A. K., & Petersen, S. L. (2009). Effect of small ruminant grazing on the plant community characteristics of semiarid Mediterranean ecosystems. *International Journal of Agriculture and Biology*, 11(6), 681–689.
- Lucas-Borja, M. E., Bastida, F., Moreno, J. L., Nicolas, C., Andres, M., Lopez, F. R., & Del Cerro, A. (2011). The effects of human trampling on the microbiological properties of soil and vegetation in Mediterranean mountain areas. *Land Degradation & Development*, 22(4), 383–394. doi:10.1002/ldr.1014
- Luja, V., Herrando-Perez, S., Gonzalez-Solis, D., & Luiselli, L. (2008). Secondary rain forests are not havens for reptile species in tropical Mexico. *Biotropica*, 40(6), 747–757. doi:10.1111/j.1744-7429.2008.00439.x
- Luskin, M. S. (2010). Flying foxes prefer to forage in farmland in a tropical dry forest landscape mosaic in Fiji. *Biotropica*, 42(2), 246–250. doi:10.1111/j.1744-7429.2009.00577.x
- Mace, G., & Balmford, A. (2000). Patterns and processes in contemporary mammalian extinction. In A. Entwistle & N. Dunstone (Eds.), *Future priorities for the conservation of mammalian diversity*, chapter 3 (pp. 27–52). Cambridge, UK: Cambridge University Press.
- Macip-Rios, R., & Muñoz-Alonso, A. (2008). Diversidad de lagartijas en cafetales y bosque primario en el Soconusco chiapaneco. *Revista Mexicana De Biodiversidad*, 79(1), 185–195.
- MacKenzie, D. I., Nichols, J. D., Lachman, G. B., Droege, S., Royle, J. A., & Langtimm, C. A. (2002). Estimating site occupancy rates when detection probabilities are less than one. *Ecology*, 83(8), 2248–2255. doi:10.1890/0012-9658(2002)083[2248:ESORWD]2.0.CO;2

- MacSwiney, M. C. G., Vilchis, P. L., Clarke, F. M., & Racey, P. A. (2007). The importance of cenotes in conserving bat assemblages in the Yucatan, Mexico. *Biological Conservation*, 136(4), 499–509. doi:10.1016/j.biocon.2006.12.021
- Madin, J. S., Anderson, K. D., Andreassen, M. H., Bridge, T. C., Cairns, S. D., Connolly, S. R., ... Baird, A. H. (2016). The Coral Trait Database, a curated database of trait information for coral species from the global oceans. *Scientific Data*, 3, doi:10.1038/sdata.2016.17
- Maeto, K., & Sato, S. (2004). Impacts of forestry on ant species richness and composition in warm-temperate forests of Japan. *Forest Ecology and Management*, 187(2–3), 213–223. doi:10.1016/s0378-1127(03)00333-5
- Magrini, M. J., Freitas, A. V. L., & Uehara-Prado, M. (2011). The effects of four types of anthropogenic disturbances on composition and abundance of terrestrial isopods (Isopoda: Oniscidea). *Zoologia*, 28(1), 63–71. doi:10.1590/s1984-46702011000100010
- Magura, T., Horvath, R., & Tothmeresz, B. (2010). Effects of urbanization on ground-dwelling spiders in forest patches, in Hungary. *Landscape Ecology*, 25(4), 621–629. doi:10.1007/s10980-009-9445-6
- Mallari, N. A. D., Collar, N. J., Lee, D. C., McGowan, P. J. K., Wilkinson, R., & Marsden, S. J. (2011). Population densities of understorey birds across a habitat gradient in Palawan, Philippines: Implications for conservation. *Oryx*, 45(2), 234–242. doi:10.1017/s0030605310001031
- Malone, L., Aulsford, J., Howlett, B., Scott-Dupree, C., Bardol, N., & Donovan, B. (2010). Observations on bee species visiting white clover in New Zealand pastures. *Journal of Apicultural Research*, 49(3), 284–286. doi:10.3896/ibra.1.49.3.09
- Malonza, P. K., & Veith, M. (2012). Amphibian community along elevational and habitat disturbance gradients in the Taita Hills, Kenya. *Herpetotropicos*, 7(1–2), 7–16.
- Malumbres-Olarte, J., Barratt, B. I. P., Vink, C. J., Paterson, A. M., Cruickshank, R. H., Ferguson, C. M., & Barton, D. M. (2014). Big and aerial invaders: Dominance of exotic spiders in burned New Zealand tussock grasslands. *Biological Invasions*, 16(11), 2311–2322. doi:10.1007/s10530-014-0666-5
- Mären, I. (2011) Unpublished data of woody species study in Nepal.
- Mären, I., Bhattarai, K. R., & Chaudhary, R. P. (2013). Forest ecosystem services and biodiversity in contrasting Himalayan forest management systems. *Environmental Conservation*, 41(1), 73–83. doi:10.1017/s0376892913000258
- Marin-Spiotta, E., Ostertag, R., & Silver, W. L. (2007). Long-term patterns in tropical reforestation: Plant community composition and aboveground biomass accumulation. *Ecological Applications*, 17(3), 828–839. doi:10.1890/06-1268
- Marsh, C. J., Lewis, O. T., Said, I., & Ewers, R. M. (2010). Community-level diversity modelling of birds and butterflies on Anjouan, Comoro Islands. *Biological Conservation*, 143(6), 1364–1374. doi:10.1016/j.biocon.2010.03.010
- Marshall, E. J. P., West, T. M., & Kleijn, D. (2006). Impacts of an agri-environment field margin prescription on the flora and fauna of arable farmland in different landscapes. *Agriculture Ecosystems & Environment*, 113(1–4), 36–44. doi:10.1016/j.agee.2005.08.036
- Martin, P. S., Gheler-Costa, C., Lopes, P. C., Rosalino, L. M., & Verdade, L. M. (2012). Terrestrial non-volant small mammals in agro-silvicultural landscapes of Southeastern Brazil. *Forest Ecology and Management*, 282, 185–195. doi:10.1016/j.foreco.2012.07.002
- Matsumoto, T., Itoioka, T., Yamane, S., & Momose, K. (2009). Traditional land use associated with swidden agriculture changes encounter rates of the top predator, the army ant, in Southeast Asian tropical rain forests. *Biodiversity and Conservation*, 18(12), 3139–3151. doi:10.1007/s10531-009-9632-4
- Mayfield, M. M., Ackerly, D., & Daily, G. C. (2006). The diversity and conservation of plant reproductive and dispersal functional traits in human-dominated tropical landscapes. *Journal of Ecology*, 94(3), 522–536. doi:10.1111/j.1365-2745.2006.01108.x
- McCarthy, J. L., McCarthy, K. P., Fuller, T. K., & McCarthy, T. M. (2010). Assessing variation in wildlife biodiversity in the Tien Shan Mountains of Kyrgyzstan using ancillary camera-trap photos. *Mountain Research and Development*, 30(3), 295–301. doi:10.1659/mrd-journal-d-09-00080.1
- McFrederick, Q. S., & LeBuhn, G. (2006). Are urban parks refuges for bumble bees *Bombus* spp. (Hymenoptera: Apidae)? *Biological Conservation*, 129(3), 372–382. doi:10.1016/j.biocon.2005.11.004
- McKinney, M. L. (1997). Extinction vulnerability and selectivity: Combining ecological and paleontological views. *Annual Review of Ecology and Systematics*, 28, 495–516. doi:10.1146/annurev.ecolsys.28.1.495
- McNamara, S., Erskine, P. D., Lamb, D., Chantalangsy, L., & Boyle, S. (2012). Primary tree species diversity in secondary fallow forests of Laos. *Forest Ecology and Management*, 281, 93–99. doi:10.1016/j.foreco.2012.06.004
- McShea, W. J., Stewart, C., Peterson, L., Erb, P., Stuebing, R., & Gimán, B. (2009). The importance of secondary forest blocks for terrestrial mammals within an *Acacia*/secondary forest matrix in Sarawak, Malaysia. *Biological Conservation*, 142(12), 3108–3119. doi:10.1016/j.biocon.2009.08.009
- Medina, R., Lara, F., Albertos, B., Draper, I., Garilleti, R., & Mazimpaka, V. (2010). Epiphytic bryophytes in harsh environments: The *Juniperus thurifera* forests. *Journal of Bryology*, 32(1), 23–31. doi:10.1179/037366810x12578498135715
- Meijer, S. S., Whittaker, R. J., & Borges, P. A. V. (2011). The effects of land-use change on arthropod richness and abundance on Santa Maria Island (Azores): Unmanaged plantations favour endemic beetles. *Journal of Insect Conservation*, 15(4), 505–522. doi:10.1007/s10841-010-9330-2
- Mena, J. L., & Medellín, R. A. (2010). Small mammal assemblages in a disturbed tropical landscape at Pozuzo, Peru. *Mammalian Biology*, 75(1), 83–91. doi:10.1016/j.mambio.2009.08.006
- Meyer, B., Gaebele, V., & Steffan-Dewenter, I. D. (2007). Patch size and landscape effects on pollinators and seed set of the horseshoe vetch, *Hippocrepis comosa*, in an agricultural landscape of central Europe. *Entomologia Generalis*, 30(2), 173–185.
- Meyer, B., Jauker, F., & Steffan-Dewenter, I. (2009). Contrasting resource-dependent responses of hoverfly richness and density to landscape structure. *Basic and Applied Ecology*, 10(2), 178–186. doi:10.1016/j.baae.2008.01.001
- Meyer, C., Kreft, H., Guralnick, R., & Jetz, W. (2015). Global priorities for an effective information basis of biodiversity distributions. *Nature Communications*, 6, doi:10.1038/ncomms9221
- Mico, E., Garcia-Lopez, A., Brustel, H., Padilla, A., & Galante, E. (2013). Explaining the saproxylic beetle diversity of a protected Mediterranean area. *Biodiversity and Conservation*, 22(4), 889–904. doi:10.1007/s10531-013-0456-x
- Milder, J. C., DeClerck, F. A. J., Sanfiorenzo, A., Sanchez, D. M., Tobar, D. E., & Zuckerberg, B. (2010). Effects of farm and landscape management on bird and butterfly conservation in western Honduras. *Ecosphere*, 1(1), art2. doi:10.1890/es10-00003.1
- Miranda, M. V., Politi, N., & Rivera, L. O. (2010). Unexpected changes in the bird assemblage in areas under selective logging in piedmont forest in northwestern Argentina. *Ornitologia Neotropical*, 21(3), 323–337.
- Mittermeier, R. A., Gil, P. R., & Mittermeier, C. G. (1997). *Megadiversity: Earth's biologically wealthiest nations*. Mexico City Mexico, CEMEX.
- Mittermeier, R. A., Mittermeier, C. G., Brooks, T. M., Pilgrim, J. D., Konstant, W. R., da Fonseca, G. A. B., & Kormos, C. (2003). Wilderness and biodiversity conservation. Proceedings of the National Academy of Sciences of the United States of America, 100(18), 10309–10313. doi:10.1073/pnas.1732458100
- Moir, M. L., Brennan, K. E. C., Koch, J. M., Majer, J. D., & Fletcher, M. J. (2005). Restoration of a forest ecosystem: The effects of vegetation and dispersal capabilities on the reassembly of plant-dwelling arthropods. *Forest Ecology and Management*, 217(2–3), 294–306. doi:10.1016/j.foreco.2005.06.012

- Moreno-Mateos, D., Rey Benayas, J. M., Perez-Camacho, L., de la Montana, E., Rebollo, S., & Cayuela, L. (2011). Effects of land use on nocturnal birds in a Mediterranean agricultural landscape. *Acta Ornithologica*, 46(2), 173–182. doi:10.3161/000164511x625946
- Muchane, M. N., Karanja, D., Wambugu, G. M., Mutahi, J. M., Masiga, C. W., Mugoya, C., & Muchai, M. (2012). Land use practices and their implications on soil macro-fauna in Maasai Mara ecosystem. *International Journal of Biodiversity and Conservation*, 4(13), 500–514. doi:10.5897/ijbc12.030
- Mudri-Stojnic, S., Andric, A., Jozan, Z., & Vujic, A. (2012). Pollinator diversity (Hymenoptera and Diptera) in semi-natural habitats in Serbia during summer. *Archives of Biological Sciences*, 64(2), 777–786. doi:10.2298/abs1202777s
- Munyekenye, F., Mwangi, E., & Gichuki, N. (2008). Bird species richness and abundance in different forest types at Kakamega Forest, western Kenya. *Ostrich*, 79(1), 37–42. doi:10.2989/ostrich.2008.79.1.4.361
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403(6772), 853–858. doi:10.1038/35002501
- Naidoo, R. (2004). Species richness and community composition of songbirds in a tropical forest-agricultural landscape. *Animal Conservation*, 7, 93–105. doi:10.1017/s1367943003001185
- Naithani, A., & Bhatt, D. (2012). Bird community structure in natural and urbanized habitats along an altitudinal gradient in Pauri district (Garhwal Himalaya) of Uttarakhand state, India. *Biologia*, 67(4), 800–808. doi:10.2478/s11756-012-0068-z
- Nakagawa, M., Miguchi, H., & Nakashizuka, T. (2006). The effects of various forest uses on small mammal communities in Sarawak, Malaysia. *Forest Ecology and Management*, 231(1–3), 55–62. doi:10.1016/j.foreco.2006.05.006
- Nakamura, A., Proctor, H., & Catterall, C. P. (2003). Using soil and litter arthropods to assess the state of rainforest restoration. *Ecological Management & Restoration*, 4(Suppl.), S20–S28. doi:10.1046/j.1442-8903.4.s.3.x
- Nakashima, Y., Inoue, E., & Akomo-Okoue, E. (2013). Population density and habitat preferences of forest duikers in Moukalaba-Doudou National Park, Gabon. *African Zoology*, 48(2), 395–399. doi:10.3377/004.048.0212
- Naoue, S., Sakai, S., & Masaki, T. (2012). Effect of forest shape on habitat selection of birds in a plantation-dominant landscape across seasons: Comparison between continuous and strip forests. *Journal of Forest Research*, 17(2), 219–223. doi:10.1007/s10310-011-0296-z
- Navarrete, D., & Halffter, G. (2008). Dung beetle (Coleoptera: Scarabaeidae: Scarabaeinae) diversity in continuous forest, forest fragments and cattle pastures in a landscape of Chiapas, Mexico: The effects of anthropogenic changes. *Biodiversity and Conservation*, 17(12), 2869–2898. doi:10.1007/s10531-008-9402-8
- Navarro, I. L., Roman, A. K., Gomez, F. H., & Perez, H. A. (2011). Seasonal variation in dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) from Serrania de Coraza, Sucre (Colombia). *Revista Colombiana de Ciencia Animal*, 3(1), 102–110.
- Ndang'ang'a, P., Njoroge, J., & Githiru, M. (2013). Vegetation composition and structure influences bird species community assemblages in the highland agricultural landscape of Nyandarua, Kenya. *Ostrich*, 84 (3), 171–179. doi:10.2989/00306525.2013.860929
- Neuschulz, E. L., Botzat, A., & Farwig, N. (2011). Effects of forest modification on bird community composition and seed removal in a heterogeneous landscape in South Africa. *Oikos*, 120(9), 1371–1379. doi:10.1111/j.1600-0706.2011.19097.x
- Newbold, T., Hudson, L. N., Arnell, A. P., Contu, S., De Palma, A., Ferrier, S., ... Purvis, A. (2016). Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment *Science*, 353(6296), 288–291. doi:10.1126/science.aaf2201
- Newbold, T., Hudson, L. N., Hill, S. L. L., Contu, S., Gray, C. L., Scharlemann, J. P. W., ... Purvis, A. (2016). Global patterns of terrestrial assemblage turnover within and among land uses. *Ecography*, 39, 1–13. doi:10.1111/ecog.01932
- Newbold, T., Hudson, L. N., Hill, S. L. L., Contu, S., Lysenko, I., Senior, R. A., ... Purvis, A. (2015). Global effects of land use on local terrestrial biodiversity. *Nature*, 520(7545), 45–50. doi:10.1038/nature14324
- Newbold, T., Hudson, L. N., Phillips, H. R., Hill, S. L. L., Contu, S., Lysenko, I., ... Purvis, A. (2014). A global model of the response of tropical and subtropical forest biodiversity to anthropogenic pressures. *Proceedings of the Royal Society B – Biological Sciences*, 281(1792), doi:10.1098/rspb.2014.1371
- Newbold, T., Hudson, L., Purves, D. W., Scharlemann, J. P. W., Mace, G., & Purvis, A. (2012). Call for data: PREDICTS: Projecting responses of ecological diversity in changing terrestrial systems. *Frontiers of Biogeography*, 4(4), 155–156.
- Ngai, J. T., Kirby, K. R., Gilbert, B., Starzomski, B. M., Pelletier, A. J. D., & Conner, J. C. R. (2008). The impact of land-use change on larval insect communities: Testing the role of habitat elements in conservation. *Ecoscience*, 15(2), 160–168. doi:10.2980/15-2-3098
- Nicolas, V., Barriere, P., Tapiero, A., & Colyn, M. (2009). Shrew species diversity and abundance in Ziama Biosphere Reserve, Guinea: Comparison among primary forest, degraded forest and restoration plots. *Biodiversity and Conservation*, 18(8), 2043–2061. doi:10.1007/s10531-008-9572-4
- Nielsen, A., Steffan-Dewenter, I., Westphal, C., Messinger, O., Potts, S. G., Roberts, S. P. M., ... Petanidou, T. (2011). Assessing bee species richness in two Mediterranean communities: Importance of habitat type and sampling techniques. *Ecological Research*, 26(5), 969–983. doi:10.1007/s11284-011-0852-1
- Noreika, N. (2009). New records of rare species of Coleoptera found in Ukmergė district in 2004–2005. *New and Rare for Lithuania Insect Species*, 21, 68–71.
- Noreika, N., & Kotze, D. J. (2012). Forest edge contrasts have a predictable effect on the spatial distribution of carabid beetles in urban forests. *Journal of Insect Conservation*, 16(6), 867–881. doi:10.1007/s10841-012-9474-3
- Norfolk, O., Abdel-Dayem, M., & Gilbert, F. (2012). Rainwater harvesting and arthropod biodiversity within an arid agro-ecosystem. *Agriculture Ecosystems & Environment*, 162, 8–14. doi:10.1016/j.agee.2012.08.007
- Norfolk, O., Eichhorn, M. P., & Gilbert, F. (2013). Traditional agricultural gardens conserve wild plants and functional richness in arid South Sinai. *Basic and Applied Ecology*, 14(8), 659–669. doi:10.1016/j.baae.2013.10.004
- Noriega, J. A., Palacio, J. M., Monroy-G, J. D., & Valencia, E. (2012). Estructura de un ensamblaje de escarabajos coprofagos (Coleoptera: Scarabaeinae) en tres sitios con diferente uso del suelo en Antioquia, Colombia. *Actualidades Biológicas (Medellin)*, 34(96), 43–54.
- Noriega, J. A., Realpe, E., & Fagua, G. (2007). Diversidad de escarabajos coprofagos (Coleoptera: Scarabaeidae) en un bosque de galería con tres estadios de alteración. *Universitas Scientiarum*, 12, 51–63.
- Norris, K. (2012). Biodiversity in the context of ecosystem services: The applied need for systems approaches. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 367(1586), 191–199. doi:10.1098/rstb.2011.0176
- Norton, D. A., Espie, P. R., Murray, W., & Murray, J. (2006). Influence of pastoral management on plant biodiversity in a depleted short tussock grassland, Mackenzie Basin. *New Zealand Journal of Ecology*, 30(3), 335–344. doi:10.092/26
- Nöske, N. M., Hilt, N., Werner, F. A., Brehm, G., Fiedler, K., Sipman, H. J. M., & Gradstein, S. R. (2008). Disturbance effects on diversity of epiphytes and moths in a montane forest in Ecuador. *Basic and Applied Ecology*, 9(1), 4–12. doi:10.1016/j.baae.2007.06.014
- Numa, C., Verdu, J. R., Rueda, C., & Galante, E. (2012). Comparing dung beetle species assemblages between protected areas and adjacent pasturelands in a Mediterranean savanna landscape. *Rangeland Ecology & Management*, 65(2), 137–143. doi:10.2111/rem-d-10-00050.1

- Nyeko, P. (2009). Dung beetle assemblages and seasonality in primary forest and forest fragments on agricultural landscapes in Budongo, Uganda. *Biotropica*, 41(4), 476–484. doi:10.1111/j.1744-7429.2009.00499.x
- O'Connor, T. G. (2005). Influence of land use on plant community composition and diversity in Highland Sourveld grassland in the southern Drakensberg, South Africa. *Journal of Applied Ecology*, 42(5), 975–988. doi:10.1111/j.1365-2664.2005.01065.x
- O'Dea, N., & Whittaker, R. J. (2007). How resilient are Andean montane forest bird communities to habitat degradation? *Biodiversity and Conservation*, 16(4), 1131–1159. doi:10.1007/s10531-006-9095-9
- Oertli, S., Muller, A., & Dorn, S. (2005). Ecological and seasonal patterns in the diversity of a species-rich bee assemblage (Hymenoptera: Apoidea: Apiformes). *European Journal of Entomology*, 102(1), 53–63. doi:10.1016/j.biocon.2005.05.014
- O'Farrell, P. J., Donaldson, J. S., Hoffman, M. T., & Mader, A. D. (2008). Small mammal diversity and density on the Bokkeveld escarpment, South Africa – implications for conservation and livestock predation. *African Zoology*, 43(1), 117–124. doi:10.3377/1562-7020(2008)43[17:smddo]2.0.co;2
- Ofori-Boateng, C., Oduro, W., Hillers, A., Norris, K., Oppong, S. K., Adum, G. B., & Rodel, M. O. (2013). Differences in the effects of selective logging on amphibian assemblages in three West African forest types. *Biotropica*, 45(1), 94–101. doi:10.1111/j.1744-7429.2012.00887.x
- Oke, C. (2013). Land snail diversity in post extraction secondary forest reserves in Edo State, Nigeria. *African Journal of Ecology*, 51(2), 244–254. doi:10.1111/aje.12029
- Oke, O. C., & Chokor, J. U. (2009). The effect of land use on snail species richness and diversity in the tropical rainforest of south-western Nigeria. *African Scientist*, 10(2), 95–108.
- Oliveira, D. E., Carrijo, T. F., & Brandão, D. (2013). Species composition of termites (Isoptera) in different Cerrado vegetation physiognomies. *Sociobiology*, 60(2), 190–197. doi:10.13102/sociobiology.v60i2.190-197
- Oostra, V., Gomes, L. G. L., & Nijman, V. (2008). Implications of deforestation for the abundance of restricted-range bird species in a Costa Rican cloud forest. *Bird Conservation International*, 18(1), 11–19.
- Osgathorpe, L. M., Park, K., & Goulson, D. (2012). The use of off-farm habitats by foraging bumblebees in agricultural landscapes: Implications for conservation management. *Apidologie*, 43(2), 113–127. doi:10.1007/s13592-011-0083-z
- Otavo, S. E., Parrado-Rosselli, A., & Noriega, J. A. (2013). Superfamilia Scarabaeoidea (Insecta: Coleoptera) como elemento bioindicador de perturbación antropogénica en un parque nacional amazónico. *Revista de Biología Tropical*, 61(2), 735–752.
- Otto, C. R. V., & Roloff, G. J. (2012). Songbird response to green-tree retention prescriptions in clearcut forests. *Forest Ecology and Management*, 284, 241–250. doi:10.1016/j.foreco.2012.07.016
- Owini, I., & Plumtre, A. J. (1998). Bird communities in logged and unlogged compartments in Budongo Forest, Uganda. *Forest Ecology and Management*, 108(1–2), 115–126. doi:10.1016/s0378-1127(98)00219-9
- Pacifici, M., Santini, L., Di Marco, M., Baisero, D., Francucci, L., Marasini, G. G., ... Rondinini, C. (2013). Generation length for mammals. *Nature Conservation*, 5, 87–94. doi:10.3897/natureconservation.5.5734
- Page, N. V., Qureshi, Q., Rawat, G. S., & Kushalappa, C. G. (2010). Plant diversity in sacred forest fragments of Western Ghats: A comparative study of four life forms. *Plant Ecology*, 206(2), 237–250. doi:10.1007/s11258-009-9638-8
- Paradis, S., & Work, T. T. (2011). Partial cutting does not maintain spider assemblages within the observed range of natural variability in Eastern Canadian black spruce forests. *Forest Ecology and Management*, 262(11), 2079–2093. doi:10.1016/j.foreco.2011.08.032
- Paritsis, J., & Aizen, M. A. (2008). Effects of exotic conifer plantations on the biodiversity of understory plants, epigeal beetles and birds in *Nothofagus dombeyi* forests. *Forest Ecology and Management*, 255(5–6), 1575–1583. doi:10.1016/j.foreco.2007.11.015
- Parra-H, A., & Nates-Parra, G. (2007). Variation of the orchid bees community (Hymenoptera: Apidae) in three altered habitats of the Colombian "llano" piedmont. *Revista de Biología Tropical*, 55(3–4), 931–941.
- Parry, L., Barlow, J., & Peres, C. A. (2009). Hunting for sustainability in tropical secondary forests. *Conservation Biology*, 23(5), 1270–1280. doi:10.1111/j.1523-1739.2009.01224.x
- Pearman, P. B. (2002). The scale of community structure: Habitat variation and avian guilds in tropical forest understory. *Ecological Monographs*, 72(1), 19–39. doi:10.2307/3100083
- Pe'er, G., van Maanen, C., Turbe, A., Matsinos, Y. G., & Kark, S. (2011). Butterfly diversity at the ecotone between agricultural and semi-natural habitats across a climatic gradient. *Diversity and Distributions*, 17(6), 1186–1197. doi:10.1111/j.1472-4642.2011.00795.x
- Pelegri, N., & Bucher, E. H. (2012). Effects of habitat degradation on the lizard assemblage in the Arid Chaco, central Argentina. *Journal of Arid Environments*, 79, 13–19. doi:10.1016/j.jaridenv.2011.11.004
- Pereira, H. M., Ferrier, S., Walters, M., Geller, G. N., Jongman, R. H. G., Scholes, R. J., ... Wegmann, M. (2013). Essential biodiversity variables. *Science*, 339(6117), 277–278. doi:10.1126/science.1229931
- Peres, C. A., & Nascimento, H. S. (2006). Impact of game hunting by the Kayapo of south-eastern Amazonia: Implications for wildlife conservation in tropical forest indigenous reserves. *Biodiversity and Conservation*, 15(8), 2627–2653. doi:10.1007/s10531-005-5406-9
- Peri, P. L., Lencinas, M. V., Martínez Pastur, G., Wardell-Johnson, G. W., & Lasagno, R. (2013). Diversity patterns in the steppe of Argentinean southern Patagonia: Environmental drivers and impact of grazing. In M. B. Morales Prieto & J. Traba Diaz (Eds.), *Steppe ecosystems: Biological diversity, management and restoration*, p. 346. New York, USA: Nova Science Publishers Inc.
- Peters, M. K., Fischer, G., Schaab, G., & Kraemer, M. (2009). Species compensation maintains abundance and raid rates of African swarm-raiding army ants in rainforest fragments. *Biological Conservation*, 142(3), 668–675. doi:10.1016/j.biocon.2008.11.021
- Peters, M. K., Lung, T., Schaab, G., & Waegerle, J. (2011). Deforestation and the population decline of the army ant *Dorylus wilverthi* in western Kenya over the last century. *Journal of Applied Ecology*, 48(3), 697–705. doi:10.1111/j.1365-2664.2011.01959.x
- Pethiyagoda Jr., R. S. & Manamendra-Arachchi, K. (2012). Endangered anurans in a novel forest in the highlands of Sri Lanka. *Wildlife Research*, 39(7), 641–648. doi:10.1071/wr12079
- Pfeifer, M., Lefebvre, V., Gardner, T. A., Arroyo-Rodriguez, V., Baeten, L., Banks-Leite, C. ... Ewers, R. M. (2014). BIOFRAG – a new database for analyzing Biodiversity responses to forest FRAGMENTATION. *Ecology and Evolution*, 4(9), 1524–1537. doi:10.1002/ece3.1036
- Phalan, B., Onial, M., Balmford, A., & Green, R. (2011). Reconciling food production and biodiversity conservation: Land sharing and land sparing compared. *Science*, 333(6047), 1289–1291. doi:10.1126/science.1208742
- Pillsbury, F. C., & Miller, J. R. (2008). Habitat and landscape characteristics underlying anuran community structure along an urban-rural gradient. *Ecological Applications*, 18(5), 1107–1118. doi:10.1890/07-1899.1
- Pincheira-Ulbrich, J., Rau, J. R., & Smith-Ramirez, C. (2012). Vascular epiphytes and climbing plants diversity in an agroforestral landscape in southern Chile: A comparison among native forest fragments. *Boletín De La Sociedad Argentina De Botánica*, 47(3–4), 411–426.
- Pineda, E., & Halffter, G. (2004). Species diversity and habitat fragmentation: Frogs in a tropical montane landscape in Mexico. *Biological Conservation*, 117(5), 499–508. doi:10.1016/j.biocon.2003.08.009
- Pineda, E., & Lobo, J. M. (2008). Assessing the accuracy of species distribution models to predict amphibian species richness patterns. *Journal of Animal Ecology*, 78(1), 182–190. doi:10.1111/j.1365-2656.2008.01471.xView
- Poggio, S. L., Chaneton, E. J., & Ghersa, C. M. (2013). The arable plant diversity of intensively managed farmland: Effects of field position and crop type at local and landscape scales. *Agriculture Ecosystems & Environment*, 166, 55–64. doi:10.1016/j.agee.2012.01.013

- Politi, N., Hunter Jr., M. & Rivera, L. (2012). Assessing the effects of selective logging on birds in Neotropical piedmont and cloud montane forests. *Biodiversity and Conservation*, 21(12), 3131–3155. doi:10.1007/s10531-012-0358-3
- Pons, P., & Wendenburg, C. (2005). The impact of fire and forest conversion into savanna on the bird communities of West Madagascar dry forests. *Animal Conservation*, 8, 183–193. doi:10.1017/s1367943005001940
- Poveda, K., Martinez, E., Kersch-Becker, M., Bonilla, M., & Tschardtke, T. (2012). Landscape simplification and altitude affect biodiversity, herbivory and Andean potato yield. *Journal of Applied Ecology*, 49(2), 513–522. doi:10.1111/j.1365-2664.2012.02120.x
- Power, E. F., Kelly, D. L., & Stout, J. C. (2012). Organic farming and landscape structure: Effects on insect-pollinated plant diversity in intensively managed grasslands. *PLoS One*, 7(5), doi:10.1371/journal.pone.0038073
- Power, E. F., & Stout, J. C. (2011). Organic dairy farming: Impacts on insect-ovener interaction networks and pollination. *Journal of Applied Ecology*, 48(3), 561–569. doi:10.1111/j.1365-2664.2010.01949.x
- Presley, S. J., Willig, M. R., Wunderle, J., Joseph, M., & Saldanha, L. N. (2008). Effects of reduced-impact logging and forest physiognomy on bat populations of lowland Amazonian forest. *Journal of Applied Ecology*, 45(1), 14–25. doi:10.1111/j.1365-2664.2007.01373.x
- Proença, V. M., Pereira, H. M., Guilherme, J. A., & Vicente, L. (2010). Plant and bird diversity in natural forests and in native and exotic plantations in NW Portugal. *Acta Oecologica-International Journal of Ecology*, 36(2), 219–226. doi:10.1016/j.actao.2010.01.002
- Purvis, A., Agapow, P.-M., Gittleman, J. L., & Mace, G. M. (2000). Nonrandom extinction and the loss of evolutionary history. *Science*, 288(5464), 328–330. doi:10.1126/science.288.5464.328
- Quaranta, M., Ambroselli, S., Barro, P., Bella, S., Carini, A., Celli, G., ... Zandigiaco, P. (2004) Wild bees in agroecosystems and semi-natural landscapes. 1997–2000 collection period in Italy. *Bulletin of Insectology*, 57(1), 11–62.
- Quintero, C., Morales, C. L., & Aizen, M. A. (2010). Effects of anthropogenic habitat disturbance on local pollinator diversity and species turnover across a precipitation gradient. *Biodiversity and Conservation*, 19(1), 257–274. doi:10.1007/s10531-009-9720-5
- R Core Team (2015). R: A Language and Environment for Statistical Computing. <http://www.r-project.org>
- Rader, R., Bartomeus, I., Tylianakis, J. M., & Laliberte, E. (2014). The winners and losers of land use intensification: Pollinator community disassembly is non-random and alters functional diversity. *Diversity and Distributions*, 20(8), 908–917. doi:10.1111/ddi.12221
- Ramesh, B. R., Swaminath, M. H., Patil, S. V., Dasappa, Pélissier, R., Venugopal, P. D., ... Ramalingam, S. (2010). Forest stand structure and composition in 96 sites along environmental gradients in the central Western Ghats of India. *Ecology*, 91(10), 3118. doi:10.1890/10-0133.1
- Ramos-Robles, M., Gallina, S., & Mandujano, S. (2013). Habitat and human factors associated with white-tailed deer density in the tropical dry forest of Tehuacan-Cuicatlan Biosphere Reserve, Mexico. *Tropical Conservation Science*, 6(1), 70–86.
- Ranganathan, J., Chan, K. M. A., & Daily, G. C. (2007). Satellite detection of bird communities in tropical countryside. *Ecological Applications*, 17(5), 1499–1510. doi:10.1890/06-0285.1
- Ranganathan, J., Daniels, R. J. R., Chandran, M. D. S., Ehrlich, P. R., & Daily, G. C. (2008). Sustaining biodiversity in ancient tropical countryside. *Proceedings of the National Academy of Sciences of the United States of America*, 105(46), 17852–17854. doi:10.1073/pnas.0808874105
- Rasmussen, C. (2009). Diversity and abundance of orchid bees (Hymenoptera: Apidae, Euglossini) in a tropical rainforest succession. *Neotropical Entomology*, 38(1), 66–73. doi:10.1590/s1519-566x2009000100006
- Raub, F., Hoyer, H., Scheuermann, L., & Brandl, R. (2014). The conservation value of secondary forests in the southern Brazilian Mata Atlântica from a spider perspective. *Journal of Arachnology*, 42(1), 52–73. doi:10.1636/p13-47.1
- Redpath, N., Osgathorpe, L. M., Park, K., & Goulson, D. (2010). Crofting and bumblebee conservation: The impact of land management practices on bumblebee populations in northwest Scotland. *Biological Conservation*, 143(2), 492–500. doi:10.1016/j.biocon.2009.11.019
- Reid, J. L., Harris, J. B. C., & Zahawi, R. A. (2012). Avian habitat preference in tropical forest restoration in southern Costa Rica. *Biotropica*, 44(3), 350–359. doi:10.1111/j.1744-7429.2011.00814.x
- Reis, Y. T., & Cancellato, E. M. (2007). Termite (Insecta, Isoptera) richness in primary and secondary Atlantic Forest in southeastern Bahia. *Iheringia Serie Zoologia*, 97(3), 229–234.
- Rey-Benayas, J. M., Galvan, I., & Carrascal, L. M. (2010). Differential effects of vegetation restoration in Mediterranean abandoned cropland by secondary succession and pine plantations on bird assemblages. *Forest Ecology and Management*, 260(1), 87–95. doi:10.1016/j.foreco.2010.04.004
- Reynolds, C., & Symes, C. T. (2013). Grassland bird response to vegetation structural heterogeneity and clearing of invasive bramble. *African Zoology*, 48(2), 228–239. doi:10.3377/004.048.0217
- Rey-Velasco, J. C., & Miranda-Esquivel, D. R. (2012) Unpublished data of the response of ground beetles (Coleoptera: Carabidae) in the north-eastern Colombian Andes to habitat modification.
- Ribeiro, D. B., & Freitas, A. V. L. (2012). The effect of reduced-impact logging on fruit-feeding butterflies in Central Amazon, Brazil. *Journal of Insect Conservation*, 16(5), 733–744. doi:10.1007/s10841-012-9458-3
- Richards, M. H., Rutgers-Kelly, A., Gibbs, J., Vickruck, J. L., Rehan, S. M., & Sheffield, C. S. (2011). Bee diversity in naturalizing patches of Carolinian grasslands in southern Ontario, Canada. *Canadian Entomologist*, 143(3), 279–299. doi:10.4039/n11-010
- Richardson, B. A., Richardson, M. J., & Soto-Adames, F. N. (2005). Separating the effects of forest type and elevation on the diversity of litter invertebrate communities in a humid tropical forest in Puerto Rico. *Journal of Animal Ecology*, 74(5), 926–936. doi:10.1111/j.1365-2656.2005.00990.x
- Robinson, R. M., & Williams, M. R. (2011). FORESTCHECK: The response of epigeous macrofungi to silviculture in jarrah (*Eucalyptus marginata*) forest. *Australian Forestry*, 74(4), 288–302. doi:10.1080/00049158.2011.10676373
- Robles, C. A., Carmaran, C. C., & Lopez, S. E. (2011). Screening of xylophagous fungi associated with *Platanus acerifolia* in urban landscapes: Biodiversity and potential biodeterioration. *Landscape and Urban Planning*, 100(1–2), 129–135. doi:10.1016/j.landurbplan.2010.12.003
- Rodrigues, M. M., Uchoa, M. A., & Ide, S. (2013). Dung beetles (Coleoptera: Scarabaeoidea) in three landscapes in Mato Grosso do Sul, Brazil. *Brazilian Journal of Biology*, 73(1), 211–220.
- Römbke, J., Schmidt, P., & Höfer, H. (2009). The earthworm fauna of regenerating forests and anthropogenic habitats in the coastal region of Paraná. *Pesquisa Agropecuária Brasileira*, 44(8), 1040–1049. doi:10.1590/s0100-204x2009000800037
- Romero-Duque, L. P., Jaramillo, V. J., & Perez-Jimenez, A. (2007). Structure and diversity of secondary tropical dry forests in Mexico, differing in their prior land-use history. *Forest Ecology and Management*, 253(1–3), 38–47. doi:10.1016/j.foreco.2007.07.002
- Rös, M., Escobar, F., & Halffter, G. (2012). How dung beetles respond to a human-modified variegated landscape in Mexican cloud forest: A study of biodiversity integrating ecological and biogeographical perspectives. *Diversity and Distributions*, 18(4), 377–389. doi:10.1111/j.1472-4642.2011.00834.x
- Roskov, Y., Kunz, T., Paglinawan, L., Orrell, T., Nicolson, D., Culham, A., ... De Wever, A. (2013) Species 2000 & Catalogue of Life, 2013 Annual Checklist. <http://catalogueoflife.org/annual-checklist/2013/>
- Rosselli, L. (2011). *Factores ambientales relacionados con la presencia y abundancia de las aves de los humedales de la Sabana de Bogotá*. PhD thesis, Universidad Nacional de Colombia, Bogotá, Colombia.

- Roth, D. S., Perfecto, I., & Rathcke, B. (1994). The effects of management systems on ground-foraging ant diversity in Costa Rica. *Ecological Applications*, 4(3), 423–436. doi:10.2307/1941947
- Rousseau, G., Deheuvels, O., Rodriguez Arias, I., & Somarriba, E. (2012). Indicating soil quality in cacao-based agroforestry systems and old-growth forests: The potential of soil macrofauna assemblage. *Ecological Indicators*, 23, 535–543. doi:10.1016/j.ecolind.2012.05.008
- Rousseau, L., Fonte, S. J., Tellez, O., van der Hoek, R., & Lavelle, P. (2013). Soil macrofauna as indicators of soil quality and land use impacts in smallholder agroecosystems of western Nicaragua. *Ecological Indicators*, 27, 71–82. doi:10.1016/j.ecolind.2012.11.020
- Rubio, A. V., & Simonetti, J. A. (2011). Lizard assemblages in a fragmented landscape of central Chile. *European Journal of Wildlife Research*, 57(1), 195–199. doi:10.1007/s10344-010-0434-5
- Safian, S., Csontos, G., & Winkler, D. (2011). Butterfly community recovery in degraded rainforest habitats in the Upper Guinean Forest Zone (Kakum forest, Ghana). *Journal of Insect Conservation*, 15(1–2), 351–359. doi:10.1007/s10841-010-9343-x
- Sakchoowong, W., Nomura, S., Ogata, K., & Chanpaisaeng, J. (2008). Diversity of pselaphine beetles (Coleoptera: Staphylinidae: Pselaphinae) in eastern Thailand. *Entomological Science*, 11(3), 301–313. doi:10.1111/j.1479-8298.2008.00281.x
- Saldaña-Vázquez, R. A., Sosa, V. J., Hernández-Montero, J. R., & López-Barrera, F. (2010). Abundance responses of frugivorous bats (Stenodermatinae) to coffee cultivation and selective logging practices in mountainous central Veracruz, Mexico. *Biodiversity and Conservation*, 19(7), 2111–2124. doi:10.1007/s10531-010-9829-6
- Sam, K., Koane, B., Jeppy, S., & Novotny, V. (2014). Effect of forest fragmentation on bird species richness in Papua New Guinea. *Journal of Field Ornithology*, 85(2), 152–167. doi:10.1111/jof.12057
- Samnegård, U., Persson, A. S., & Smith, H. G. (2011). Gardens benefit bees and enhance pollination in intensively managed farmland. *Biological Conservation*, 144(11), 2602–2606. doi:10.1016/j.biocon.2011.07.008
- Santana, J., Porto, M., Gordinho, L., Reino, L., & Beja, P. (2012). Long-term responses of Mediterranean birds to forest fuel management. *Journal of Applied Ecology*, 49(3), 632–643. doi:10.1111/j.1365-2664.2012.02141.x
- de Sassi, C., Lewis, O. T., & Tylianakis, J. M. (2012). Plant-mediated and nonadditive effects of two global change drivers on an insect herbivore community. *Ecology*, 93(8), 1892–1901. doi:10.1890/11-1839.1
- Savage, J., Wheeler, T. A., Moores, A. M. A., & Taillefer, A. G. (2011). Effects of habitat size, vegetation cover, and surrounding land use on Diptera diversity in temperate nearctic bogs. *Wetlands*, 31(1), 125–134. doi:10.1007/s13157-010-0133-8
- Schilthuizen, M., Liew, T. S., Bin Elahan, B., & Lackman-Ancrenaz, I. (2005). Effects of karst forest degradation on pulmonate and prosobranch land snail communities in Sabah. *Malaysian Borneo. Conservation Biology*, 19(3), 949–954. doi:10.1111/j.1523-1739.2005.00209.x
- Schmidt, A. C., Fraser, L. H., Carlyle, C. N., & Bassett, E. R. L. (2012). Does cattle grazing affect ant abundance and diversity in temperate grasslands? *Rangeland Ecology & Management*, 65(3), 292–298. doi:10.2111/rem-d-11-00100.1
- Schmitt, C. B., Senbeta, F., Denich, M., Preisinger, H., & Boehmer, H. J. (2010). Wild coffee management and plant diversity in the montane rainforest of southwestern Ethiopia. *African Journal of Ecology*, 48(1), 78–86. doi:10.1111/j.1365-2028.2009.01084.x
- Scholes, R. J., & Biggs, R. (2005). A biodiversity intactness index. *Nature*, 434(7029), 45–49. doi:10.1038/nature03289
- Schon, N. L., Mackay, A. D., & Minor, M. A. (2011). Soil fauna in sheep-grazed hill pastures under organic and conventional livestock management and in an adjacent ungrazed pasture. *Pedobiologia*, 54(3), 161–168. doi:10.1016/j.pedobi.2011.01.001
- Schon, N. L., Mackay, A. D., Minor, M. A., Yeates, G. W., & Hedley, M. J. (2008). Soil fauna in grazed New Zealand hill country pastures at two management intensities. *Applied Soil Ecology*, 40(2), 218–228. doi:10.1016/j.apsoil.2008.04.007
- Schon, N. L., Mackay, A. D., Yeates, G. W., & Minor, M. A. (2010). Separating the effects of defoliation and dairy cow treading pressure on the abundance and diversity of soil invertebrates in pastures. *Applied Soil Ecology*, 46(2), 209–221. doi:10.1016/j.apsoil.2010.08.011
- Schüepf, C., Herrmann, J. D., Herzog, F., & Schmidt-Entling, M. H. (2011). Differential effects of habitat isolation and landscape composition on wasps, bees, and their enemies. *Oecologia*, 165(3), 713–721. doi:10.1007/s00442-010-1746-6
- Schüepf, C., Rittiner, S., & Entling, M. H. (2012). High bee and wasp diversity in a heterogeneous tropical farming system compared to protected forest. *PLoS One*, 7(12), e52109. doi:10.1371/journal.pone.0052109
- Schumann, K., Wittig, R., Thiombiano, A., Becker, U., & Hahn, K. (2011). Impact of land-use type and harvesting on population structure of a non-timber forest product-providing tree in a semi-arid savanna, West Africa. *Biological Conservation*, 144(9), 2369–2376. doi:10.1016/j.biocon.2011.06.018
- Scott, D. M., Brown, D., Mahood, S., Denton, B., Silburn, A., & Rakotondraparany, F. (2006). The impacts of forest clearance on lizard, small mammal and bird communities in the arid spiny forest, southern Madagascar. *Biological Conservation*, 127(1), 72–87. doi:10.1016/j.biocon.2005.07.014
- Scott, K. A., Setterfield, S. A., Douglas, M. M., & Andersen, A. N. (2010). Fire tolerance of perennial grass tussocks in a savanna woodland. *Austral Ecology*, 35(8), 858–861. doi:10.1111/j.1442-9993.2009.02091.x
- Sedlock, J. L., Weyandt, S. E., Cororan, L., Damerow, M., Hwa, S., & Pauli, B. (2008). Bat diversity in tropical forest and agro-pastoral habitats within a protected area in the Philippines. *Acta Chiropterologica*, 10(2), 349–358. doi:10.3161/150811008x414926
- Shafie, N. J., Sah, S. A. M., Latip, N. S. A., Azman, N. M., & Khairuddin, N. L. (2011). Diversity pattern of bats at two contrasting habitat types along Kerian River, Perak, Malaysia. *Tropical Life Sciences Research*, 22(2), 13–22.
- Shahabuddin, G., & Kumar, R. (2006). Influence of anthropogenic disturbance on birds of tropical dry forest: The role of vegetation structure. *Animal Conservation*, 9(4), 404–413. doi:10.1111/j.1469-1795.2006.00051.x
- Shahabuddin, G., & Kumar, R. (2007). Effects of extractive disturbance on bird assemblages, vegetation structure and floristics in tropical scrub forest, Sariska Tiger Reserve, India. *Forest Ecology and Management*, 246(2–3), 175–185. doi:10.1016/j.foreco.2007.03.061
- Shannon, G., Druce, D. J., Page, B. R., Eckhardt, H. C., Grant, R., & Slotow, R. (2008). The utilization of large savanna trees by elephant in southern Kruger National Park. *Journal of Tropical Ecology*, 24, 281–289. doi:10.1017/s0266467408004951
- Sheil, D., Puri, R. K., Basuki, I., van Heist, M., Wan, M., Liswanti, N., ... Wijaya, A. (2002). *Exploring biological diversity, environment and local people's perspectives in forest landscapes: Methods for a multidisciplinary landscape assessment*. Technical report, Center for International Forestry Research (CIFOR), Jakarta, Indonesia.
- Sheldon, F., Styling, A., & Hosner, P. (2010). Bird species richness in a Bornean exotic tree plantation: A long-term perspective. *Biological Conservation*, 143(2), 399–407. doi:10.1016/j.biocon.2009.11.004
- Shochat, E., Stefanov, W. L., Whitehouse, M. E. A., & Faeth, S. H. (2004). Urbanization and spider diversity: Influences of human modification of habitat structure and productivity. *Ecological Applications*, 14(1), 268–280. doi:10.1890/02-5341
- Shuler, R. E., Roulston, T. H., & Farris, G. E. (2005). Farming practices influence wild pollinator populations on squash and pumpkin. *Journal of Economic Entomology*, 98(3), 790–795. doi:10.1603/0022-0493-98.3.790
- Siebert, S. J. (2011). Patterns of plant species richness of temperate and tropical grassland in South Africa. *Plant Ecology and Evolution*, 144(3), 249–254. doi:10.5091/plecevo.2011.501
- da Silva, P. G. (2011). *Espécies de Scarabaeinae (Coleoptera: Scarabaeidae) de fragmentos florestais com diferentes níveis de alteração em Santa Maria, Rio Grande do Sul*. MSc thesis, Universidade Federal de Santa Maria, Santa Maria, Brazil.

- Silva, F. A. B., Costa, C. M. Q., Moura, R. C., & Farias, A. I. (2010). Study of the dung beetle (Coleoptera: Scarabaeidae) community at two sites: Atlantic forest and clear-cut, Pernambuco, Brazil. *Environmental Entomology*, 39(2), 359–367. doi:10.1603/en09180
- Simkin, S. M., Allen, E. B., Bowman, W. D., Clark, C. M., Belnap, J., Brooks, ... Waller, D. M. (2016). Conditional vulnerability of plant diversity to atmospheric nitrogen deposition across the United States. *Proceedings of the National Academy of Sciences of the United States of America*, 113(15), 4086–4091. doi:10.1073/pnas.1515241113
- Slade, E. M., Mann, D. J., & Lewis, O. T. (2011). Biodiversity and ecosystem function of tropical forest dung beetles under contrasting logging regimes. *Biological Conservation*, 144(1), 166–174. doi:10.1016/j.biocon.2010.08.011
- Smith, J. (2006). *Arable field margins increase soil macroinvertebrate biodiversity in agroecosystems*. PhD thesis, University of Reading, Reading, U.K.
- Smith, J., Potts, S., & Eggleton, P. (2008). Evaluating the efficiency of sampling methods in assessing soil macrofauna communities in arable systems. *European Journal of Soil Biology*, 44(3), 271–276. doi:10.1016/j.ejsobi.2008.02.002
- Smith, J., Potts, S. G., Woodcock, B. A., & Eggleton, P. (2008). Can arable field margins be managed to enhance their biodiversity, conservation and functional value for soil macrofauna? *Journal of Applied Ecology*, 45(1), 269–278. doi:10.1111/j.1365-2664.2007.01433.x
- Smith-Pardo, A., & Gonzalez, V. H. (2007). Diversidad de abejas (Hymenoptera: Apoidea) en estados sucesionales del bosque humedo tropical. *Acta Biológica Colombiana*, 12 (1), 43–55.
- Sodhi, N. S., Wilcove, D. S., Lee, T. M., Şekercioglu, C. H., Subaraj, R., Bernard, H., ... Brook, B. W. (2010). Deforestation and avian extinction on tropical landbridge islands. *Conservation Biology*, 24 (5), 1290–1298. doi:10.1111/j.1523-1739.2010.01495.x
- Soh, M. C. K., Sodhi, N. S., & Lim, S. L. H. (2006). High sensitivity of montane bird communities to habitat disturbance in Peninsular Malaysia. *Biological Conservation*, 129(2), 149–166. doi:10.1016/j.biocon.2005.10.030
- Sosa, R. A., Benz, V. A., Galea, J. M., & Poggio Herrero, I. V. (2010). Efecto del grado de disturbio sobre el ensamble de aves en la reserva provincial Parque Luro, La Pampa, Argentina. *Revista de la Asociación Argentina de Ecología de Paisajes*, 1 (1), 101–110.
- de Souza, V. M., de Souza, B., & Morato, E. F. (2008). Effect of the forest succession on the anurans (Amphibia: Anura) of the Reserve Catuaba and its periphery, Acre, southwestern Amazonia. *Revista Brasileira de Zoologia*, 25(1), 49–57.
- Sridhar, H., Raman, T. R. S., & Mudappa, D. (2008). Mammal persistence and abundance in tropical rainforest remnants in the southern Western Ghats, India. *Current Science*, 94(6), 748–757.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., ... Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 1259855. doi:10.1126/science.1259855
- St-Laurent, M. H., Ferron, J., Hins, C., & Gagnon, R. (2007). Effects of stand structure and landscape characteristics on habitat use by birds and small mammals in managed boreal forest of eastern Canada. *Canadian Journal of Forest Research—Revue Canadienne de Recherche Forestiere*, 37(8), 1298–1309. doi:10.1139/x06-295
- Stouffer, P. C., Johnson, E. I., Bierregaard, J., Richard, O., & Lovejoy, T. E. (2011). Understory bird communities in Amazonian rainforest fragments: Species turnover through 25 years post-isolation in recovering landscapes. *PLoS One*, 6(6), doi:10.1371/journal.pone.0020543
- Strauch, A. M., & Eby, S. (2012). The influence of fire frequency on the abundance of Maerua subcordata in the Serengeti National Park, Tanzania. *Journal of Plant Ecology*, 5(4), 400–406. doi:10.1093/jpe/rts008
- Ström, L., Hylander, K., & Dynesius, M. (2009). Different long-term and short-term responses of land snails to clear-cutting of boreal streamside forests. *Biological Conservation*, 142(8), 1580–1587. doi:10.1016/j.biocon.2009.02.028
- Struebig, M. J., Kingston, T., Zubaid, A., Mohd-Adnan, A., & Rossiter, S. J. (2008). Conservation value of forest fragments to Palaeotropical bats. *Biological Conservation*, 141(8), 2112–2126. doi:10.1016/j.biocon.2008.06.009
- Su, Z. M., Zhang, R. Z., & Qiu, J. X. (2011). Decline in the diversity of willow trunk-dwelling weevils (Coleoptera: Curculionoidea) as a result of urban expansion in Beijing, China. *Journal of Insect Conservation*, 15(3), 367–377. doi:10.1007/s10841-010-9310-6
- Suarez-Rubio, M., & Thomlinson, J. R. (2009). Landscape and patch-level factors influence bird communities in an urbanized tropical island. *Biological Conservation*, 142(7), 1311–1321. doi:10.1016/j.biocon.2008.12.035
- Sugiura, S., Tsuru, T., Yamaura, Y., & Makihara, H. (2009). Small off-shore islands can serve as important refuges for endemic beetle conservation. *Journal of Insect Conservation*, 13(4), 377–385. doi:10.1007/s10841-008-9185-y
- Summerville, K. S. (2011). Managing the forest for more than the trees: Effects of experimental timber harvest on forest Lepidoptera. *Ecological Applications*, 21(3), 806–816. doi:10.1890/10-0715.1
- Summerville, K. S., Conoan, C. J., & Steichen, R. M. (2006). Species traits as predictors of lepidopteran application in restored and remnant tallgrass prairies. *Ecological Applications*, 16(3), 891–900. doi:10.1890/1051-0761(2006)016[0891:stapol]2.0.co;2
- Summerville, K. S., & Crist, T. O. (2002). Effects of timber harvest on forest Lepidoptera: Community, guild and species responses. *Ecological Applications*, 12(3), 820–835. doi:10.1890/1051-0761(2002)012[0820:eothof]2.0.co;2
- Sung, Y. H., Karraker, N. E., & Hau, B. C. H. (2012). Terrestrial herpetofaunal assemblages in secondary forests and exotic *Lophostemon confertus* plantations in South China. *Forest Ecology and Management*, 270, 71–77. doi:10.1016/j.foreco.2012.01.011
- Sutrisno, H. (2010). The impact of human activities to dynamic of insect communities: A case study in Gunung Salak, West Java. *HAYATI Journal of Biosciences*, 17(4), 161–166. doi:10.4308/hjb.17.4.161
- Svenning, J. C. (1998). The effect of land-use on the local distribution of palm species in an Andean rain forest fragment in northwestern Ecuador. *Biodiversity and Conservation*, 7(12), 1529–1537. doi:10.1023/a:1008831600795
- The BioTIME Research Group (2016). The BioTIME database. <http://synergy.st-andrews.ac.uk/biotime/>
- The Nature Conservancy (2009). Terrestrial ecoregions of the world. <http://maps.tnc.org/gis.data.html>
- Theoharides, K. A., & Dukes, J. S. (2007). Plant invasion across space and time: Factors affecting nonindigenous species success during four stages of invasion. *New Phytologist*, 176(2), 256–273. doi:10.1111/j.1469-8137.2007.02207.x
- Thibault, K. M., Supp, S. R., Giffin, M., White, E. P., & Ernest, S. K. M. (2011). Species composition and abundance of mammalian communities. *Ecology*, 92(2316), 2316. doi:10.1890/11-0262.1
- de Thoisy, B., Richard-Hansen, C., Goguillon, B., Joubert, P., Obstancias, J., Winterton, P., & Brosse, S. (2010). Rapid evaluation of threats to biodiversity: Human footprint score and large vertebrate species responses in French Guiana. *Biodiversity and Conservation*, 19(6), 1567–1584. doi:10.1007/s10531-010-9787-z
- Threlfall, C. G., Law, B., & Banks, P. B. (2012). Sensitivity of insectivorous bats to urbanization: Implications for suburban conservation planning. *Biological Conservation*, 146(1), 41–52. doi:10.1016/j.biocon.2011.11.026
- Tittensor, D. P., Walpole, M., Hill, S. L., Boyce, D. G., Britten, G. L., Burgess, N. D., ... Ye, Y. (2014). A mid-term analysis of progress toward international biodiversity targets. *Science*, 346(6206), 241–244. doi:10.1126/science.1257484
- Todd, J. H., Malone, L. A., McArdle, B. H., Bengé, J., Poulton, J., Thorpe, S., & Beggs, J. R. (2011). Invertebrate community richness in New Zealand kiwifruit orchards under organic or integrated pest management.

- Agriculture, Ecosystems & Environment*, 141(1–2), 32–38. doi:10.1016/j.agee.2011.02.007
- Tonietto, R., Fant, J., Ascher, J., Ellis, K., & Larkin, D. (2011). A comparison of bee communities of Chicago green roofs, parks and prairies. *Landscape and Urban Planning*, 103(1), 102–108. doi:10.1016/j.landurbplan.2011.07.004
- Torre, I., Bros, V., & Santos, X. (2014). Assessing the impact of reforestation on the diversity of Mediterranean terrestrial Gastropoda. *Biodiversity and Conservation*, 23(10), 2579–2589. doi:10.1007/s10531-014-0740-4
- Travis, J. M. J. (2003). Climate change and habitat destruction: A deadly anthropogenic cocktail. *Proceedings of the Royal Society B – Biological Sciences*, 270(1514), 467–473. doi:10.1098/rspb.2002.2246
- Tuck, S. L., Phillips, H. R. P., Hintzen, R. E., Scharlemann, J. P. W., Purvis, A., & Hudson, L. N. (2014). MODISTools-downloading and processing MODIS remotely sensed data in R. *Ecology and Evolution*, 4(24), 4658–4668. doi:10.1002/ece3.1273
- Turner, E. C., & Foster, W. A. (2009). The impact of forest conversion to oil palm on arthropod abundance and biomass in Sabah, Malaysia. *Journal of Tropical Ecology*, 25, 23–30. doi:10.1017/s0266467408005658
- Tylianakis, J. M., Klein, A. M., & Tscharntke, T. (2005). Spatiotemporal variation in the diversity of hymenoptera across a tropical habitat gradient. *Ecology*, 86(12), 3296–3302. doi:10.1890/05-0371
- Uehara-Prado, M. (2005). Effects of land use on ant species composition and diaspore removal in exotic grasslands in the Brazilian Pantanal (Hymenoptera: Formicidae). *Sociobiology*, 45(3), 915–923.
- Uehara-Prado, M., Brown, K. S. Jr., & Lucci Freitas, A. V. (2007). Species richness, composition and abundance of fruit-feeding butterflies in the Brazilian Atlantic Forest: Comparison between a fragmented and a continuous landscape. *Global Ecology and Biogeography*, 16(1), 43–54. doi:10.1111/j.1466-822x.2006.00267.x
- Uehara-Prado, M., Fernandes, J. D., Bello, A. D., Machado, G., Santos, A. J., Vaz-de-Mello, F. Z., & Freitas, A. V. L. (2009). Selecting terrestrial arthropods as indicators of small-scale disturbance: A first approach in the Brazilian Atlantic Forest. *Biological Conservation*, 142(6), 1220–1228. doi:10.1016/j.biocon.2009.01.008
- Urbina-Cardona, J. N., Londoño-Murcia, M. C., & García-Ávila, D. G. (2008). Spatio-temporal dynamics of snake diversity in four habitats with different degrees of anthropogenic disturbance in the Gorgona Island National Natural Park in the Colombian Pacific. *Caldasia*, 30(2), 479–493.
- Urbina-Cardona, J. N., Olivares-Perez, M., & Reynoso, V. H. (2006). Herpetofauna diversity and microenvironment correlates across a pasture-edge-interior ecotone in tropical rainforest fragments in the Los Tuxtlas Biosphere Reserve of Veracruz, Mexico. *Biological Conservation*, 132(1), 61–75. doi:10.1016/j.biocon.2006.03.014
- Vallan, D. (2002). Effects of anthropogenic environmental changes on amphibian diversity in the rain forests of eastern Madagascar. *Journal of Tropical Ecology*, 18, 725–742. doi:10.1017/s026646740200247x
- Vanbergen, A. J., Woodcock, B. A., Watt, A. D., & Niemela, J. (2005). Effect of land-use heterogeneity on carabid communities at the landscape scale. *Ecography*, 28(1), 3–16. doi:10.1111/j.0906-7590.2005.03991.x
- VanDerWal, J., Shoo, L. P., Johnson, C. N., & Williams, S. E. (2009). Abundance and the environmental niche: Environmental suitability estimated from niche models predicts the upper limit of local abundance. *The American Naturalist*, 174(2), 282–291. doi:10.1086/600087
- Vasconcelos, H. L. (1999). Effects of forest disturbance on the structure of ground-foraging ant communities in central Amazonia. *Biodiversity and Conservation*, 8(3), 409–420.
- Vasconcelos, H. L., Pacheco, R., Silva, R. C., Vasconcelos, P. B., Lopes, C. T., Costa, A. N., & Bruna, E. M. (2009). Dynamics of the leaf-litter arthropod fauna following fire in a neotropical woodland savanna. *PLoS One*, 4(11), 9. doi:10.1371/journal.pone.0007762
- Vasconcelos, H. L., Vilhena, J. M. S., & Caliri, G. J. A. (2000). Responses of ants to selective logging of a central Amazonian forest. *Journal of Applied Ecology*, 37(3), 508–514. doi:10.1046/j.1365-2664.2000.00512.x
- Vassilev, K., Pedashenko, H., Nikolov, S. C., Apostolova, I., & Dengler, J. (2011). Effect of land abandonment on the vegetation of upland semi-natural grasslands in the Western Balkan Mts., Bulgaria. *Plant Biosystems*, 145(3), 654–665. doi:10.1080/11263504.2011.601337
- Vellend, M., Baeten, L., Myers-Smith, I. H., Elmendorf, S. C., Beauséjour, R., Brown, C. D., ... Wipf, S. (2013). Global meta-analysis reveals no net change in local-scale plant biodiversity over time. *Proceedings of the National Academy of Sciences of the United States of America*, 110(48), 19456–19459. doi:10.1073/pnas.1312779110
- Verboven, H. A. F., Brys, R., & Hermy, M. (2012). Sex in the city: Reproductive success of *Digitalis purpurea* in a gradient from urban to rural sites. *Landscape and Urban Planning*, 106(2), 158–164. doi:10.1016/j.landurbplan.2012.02.015
- Verdasca, M. J., Leitao, A. S., Santana, J., Porto, M., Dias, S., & Beja, P. (2012). Forest fuel management as a conservation tool for early successional species under agricultural abandonment: The case of Mediterranean butterflies. *Biological Conservation*, 146(1), 14–23. doi:10.1016/j.biocon.2011.10.031
- Verdú, J. R., Moreno, C. E., Sánchez-Rojas, G., Numa, C., Galante, E., & Halffter, G. (2007). Grazing promotes dung beetle diversity in the xeric landscape of a Mexican Biosphere Reserve. *Biological Conservation*, 140(3–4), 308–317. doi:10.1016/j.biocon.2007.08.015
- Vergara, C. H., & Badano, E. I. (2009). Pollinator diversity increases fruit production in Mexican coffee plantations: The importance of rustic management systems. *Agriculture Ecosystems & Environment*, 129(1–3), 117–123. doi:10.1016/j.agee.2008.08.001
- Vergara, P. M., & Simonetti, J. A. (2004). Avian responses to fragmentation of the Maulino Forest in central Chile. *Oryx*, 38(4), 383–388. doi:10.1017/s0030605304000742
- Verhulst, J., Báldi, A., & Kleijn, D. (2004). Relationship between land-use intensity and species richness and abundance of birds in Hungary. *Agriculture Ecosystems & Environment*, 104(3), 465–473. doi:10.1016/j.agee.2004.01.043
- Virgilio, M., Backeljau, T., Emeleme, R., Juakali, J., & De Meyer, M. (2011). A quantitative comparison of frugivorous tephritids (Diptera: Tephritidae) in tropical forests and rural areas of the Democratic Republic of Congo. *Bulletin of Entomological Research*, 101(5), 591–597. doi:10.1017/s0007485311000216
- Visconti, P., Bakkenes, M., Baisero, D., Brooks, T., Butchart, S. H., Joppa, L., ... Rondinini, C. (2015). Projecting global biodiversity indicators under future development scenarios. *Conservation Letters*, 9(1), 5–13. doi:10.1111/conl.12159
- Vu, L. V. (2005) Unpublished data of diversity and similarity of butterfly communities in five different habitat types at Tam Dao National Park, Vietnam.
- Vu, L. V. (2009). Diversity and similarity of butterfly communities in five different habitat types at Tam Dao National Park, Vietnam. *Journal of Zoology*, 277(1), 15–22. doi:10.1111/j.1469-7998.2008.00498.x
- Waite, E. M. (2012) *The role of large, isolated trees in supporting urban biodiversity*. PhD thesis, University of Otago, New Zealand, Dunedin, New Zealand.
- Waite, E. M., Closs, G., Van Heezik, Y., Berry, C., & Dickinson, K. (2012). Arboreal arthropod sampling methods for urban trees. *Journal of Insect Conservation*, 16(6), 931–939. doi:10.1007/s10841-012-9480-5
- Waite, E., Closs, G. P., van Heezik, Y., & Dickinson, K. J. M. (2013). Resource availability and foraging of Silvereyes (*Zosterops lateralis*) in urban trees. *Emu*, 113(1), 26–32. doi:10.1071/mu11093
- Walker, T. R., Crittenden, P. D., Young, S. D., & Prystina, T. (2006). An assessment of pollution impacts due to the oil and gas industries in the Pechora basin, north-eastern European Russia. *Ecological Indicators*, 6, 369–387. doi:10.1016/j.ecolind.2005.03.015
- Walker, S., Wilson, D. J., Norbury, G., Monks, A., & Tanentzap, A. J. (2014). Complementarity of indigenous flora in shrublands and grasslands in a New Zealand dryland landscape. *New Zealand Journal of Ecology*, 38(2), 230–241.

- Wang, Y., Bao, Y., Yu, M., Xu, G., & Ding, P. (2010). Nestedness for different reasons: The distributions of birds, lizards and small mammals on islands of an inundated lake. *Diversity and Distributions*, 16(5), 862–873. doi:10.1111/j.1472-4642.2010.00682.x
- Wang, H. F., Lencinas, M. V., Ross Friedman, C., Wang, X. K., & Qiu, J. X. (2011). Understory plant diversity assessment of *Eucalyptus* plantations over three vegetation types in Yunnan, China. *New Forests*, 42(1), 101–116. doi:10.1007/s11056-010-9240-x
- Watling, J. I., Gerow, K., & Donnelly, M. A. (2009). Nested species subsets of amphibians and reptiles on Neotropical forest islands. *Animal Conservation*, 12(5), 467–476. doi:10.1111/j.1469-1795.2009.00274.x
- Weller, B., & Ganzhorn, J. U. (2004). Carabid beetle community composition, bodysize, and fluctuating asymmetry along an urban-rural gradient. *Basic and Applied Ecology*, 5(2), 193–201. doi:10.1078/1439-1791-00220
- Wells, K., Kalko, E. K. V., Lakim, M. B., & Pfeiffer, M. (2007). Effects of rain forest logging on species richness and assemblage composition of small mammals in Southeast Asia. *Journal of Biogeography*, 34(6), 1087–1099. doi:10.1111/j.1365-2699.2006.01677.x
- Wiafe, E. D., & Amfo-Otu, R. (2012). Forest duiker (*Cephalophus* spp.) abundance and hunting activities in the Kakum conservation area, Ghana. *Journal of Ecology and the Natural Environment*, 4(4), 114–118. doi:10.5897/jene11.144
- Williams, C. D., Sheahan, J., & Gormally, M. J. (2009). Hydrology and management of turloughs (temporary lakes) affect marsh fly (Sciomyzidae: Diptera) communities. *Insect Conservation and Diversity*, 2(4), 270–283. doi:10.1111/j.1752-4598.2009.00064.x
- Willig, M. R., Presley, S. J., Bloch, C. P., Hice, C. L., Yanoviak, S. P., Diaz, M. M., ... Weaver, S. C. (2007). Phyllostomid bats of lowland Amazonia: Effects of habitat alteration on abundance. *Biotropica*, 39(6), 737–746. doi:10.1111/j.1744-7429.2007.00322.x
- Wilman, H., Belmaker, J., Simpson, J., de la Rosa, C., Rivadeneira, M. M., & Jetz, W. (2014). EltonTraits 1.0: Species-level foraging attributes of the world's birds and mammals. *Ecology*, 95(7), 2027. doi:10.1890/13-1917.1
- Winfrey, R., Griswold, T., & Kremen, C. (2007). Effect of human disturbance on bee communities in a forested ecosystem. *Conservation Biology*, 21(1), 213–223. doi:10.1111/j.1523-1739.2006.00574.x
- Woinarski, J. C. Z., & Ash, A. J. (2002). Responses of vertebrates to pastoralism, military land use and landscape position in an Australian tropical savanna. *Austral Ecology*, 27(3), 311–323. doi:10.1046/j.1442-9993.2002.01182.x
- Woinarski, J. C. Z., Rankmore, B., Hill, B., Griffiths, A. D., Stewart, A., & Grace, B. (2009). Fauna assemblages in regrowth vegetation in tropical open forests of the Northern Territory, Australia. *Wildlife Research*, 36(8), 675–690. doi:10.1071/wr08128
- Woodcock, B. A., Potts, S. G., Pilgrim, E., Ramsay, A. J., Tschulin, T., Parkinson, A., ... Tallowin, J. R. (2007). The potential of grass field margin management for enhancing beetle diversity in intensive livestock farms. *Journal of Applied Ecology*, 44(1), 60–69. doi:10.1111/j.1365-2664.2006.01258.x
- Wronski, T., Gilbert, K., Long, E., Micha, B., Quinn, R., & Hausdorf, B. (2014). Species richness and meta-community structure of land snails along an altitudinal gradient on Bioko Island, Equatorial Guinea. *Journal of Molluscan Studies*, 80, 161–168. doi:10.1093/mollus/eyu008
- Wu, J. H., Fu, C. Z., Chen, S. S., & Chen, J. K. (2002). Soil faunal response to land use: Effect of estuarine tideland reclamation on nematode communities. *Applied Soil Ecology*, 21(2), 131–147. doi:10.1016/s0929-1393(02)00065-3
- Wunderle, J. M., Henriques, L. M. P., & Willig, M. R. (2006). Short-term responses of birds to forest gaps and understory: An assessment of reduced-impact logging in a lowland Amazon forest. *Biotropica*, 38(2), 235–255. doi:10.1111/j.1744-7429.2006.00138.x
- WWF International (2014) Living Planet Report. p. 180.
- Yamaura, Y., Royle, J. A., Shimada, N., Asanuma, S., Sato, T., Taki, H., & Makino, S. (2012). Biodiversity of man-made open habitats in an underused country: A class of multispecies abundance models for count data. *Biodiversity and Conservation*, 21(6), 1365–1380. doi:10.1007/s10531-012-0244-z
- Yoshikura, S., Yasui, S., & Kamijo, T. (2011). Comparative study of forest-dwelling bats' abundances and species richness between old-growth forests and conifer plantations in Nikko National Park, central Japan. *Mammal Study*, 36(4), 189–198. doi:10.3106/041.036.0402
- Zaitsev, A. S., Chauvat, M., Pug, A., & Wolters, V. (2002). Oribatid mite diversity and community dynamics in a spruce chronosequence. *Soil Biology & Biochemistry*, 34(12), 1919–1927. doi:10.1016/s0038-0717(02)00208-0
- Zaitsev, A. S., Wolters, V., Waldhardt, R., & Dauber, J. (2006). Long-term succession of oribatid mites after conversion of croplands to grasslands. *Applied Soil Ecology*, 34(2–3), 230–239. doi:10.1016/j.apsoil.2006.01.005
- Zeidler, J., Hanrahan, S., & Scholes, M. (2002). Land-use intensity affects range condition in arid to semi-arid Namibia. *Journal of Arid Environments*, 52(3), 389–403. doi:10.1006/jare.2002.0990
- Zhang, J. N., Li, Q., & Liang, W. J. (2010). Effect of acetochlor and carbofuran on soil nematode communities in a Chinese soybean field. *African Journal of Agricultural Research*, 5(20), 2787–2794.
- Zimmerman, G., Bell, F. W., Woodcock, J., Palmer, A., & Paloniemi, J. (2011). Response of breeding songbirds to vegetation management in conifer plantations established in boreal mixedwoods. *The Forestry Chronicle*, 87(2), 217–224.

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

How to cite this article: Hudson, L. N., Newbold, T., Contu, S., Hill S. L. L., Lysenko, I., De Palma A., ... Purvis, A. (2017), The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project. *Ecology and Evolution*, 7: 145–188. doi: 10.1002/ece3.2579