

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/354968699>

Graduate Student Perspectives on Transforming Academia

Article in *Conservation Science and Practice* · September 2021

CITATIONS

0

READS

148

19 authors, including:



Seth Thomas Sykora-Bodie

National Oceanic and Atmospheric Administration

25 PUBLICATIONS 245 CITATIONS

SEE PROFILE



J Leah Jones

Columbia University

6 PUBLICATIONS 65 CITATIONS

SEE PROFILE



Zoe Hastings

University of Hawai'i at Mānoa

5 PUBLICATIONS 27 CITATIONS

SEE PROFILE



Michaela J. Barnett

University of Virginia

4 PUBLICATIONS 37 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Plant-virus interactions across the western North American mountains [View project](#)



Quantifying Nearshore Sea Turtle Densities: Applications of Unmanned Aerial Systems for Population Assessments [View project](#)

Graduate Student Perspectives on Transforming Academia

***Seth T. Sykora-Bodie¹, J. Leah Jones², Zoe Hastings³, Elizabeth Lomardi⁴, Michaela Barnett⁵, Olivia N. Davis⁶, Olivia M. Ferrari⁷, Vanessa Garcia Polanco⁸, Alexandra N. Hofner⁷, Brandon Hunter⁹, Tara Ippolito¹⁰, Will Krantz¹¹, Oscar Neyra^{11,12}, Omar Perez-Figueroa¹³, Kristin B. Raub^{14,15}, Jennifer Sou¹⁶, Edgar Virguez¹⁷, Tanner Waters¹¹, Julia Whitten¹⁷**

¹ *Division of Marine Science, Nicholas School of the Environment, Duke University, Durham, North Carolina 28516, United States*

² *School of Sustainability, Arizona State University, Tempe, Arizona, United States*

³ *Department of Botany, University of Hawai'i at Mānoa, Hawai'i, United States*

⁴ *Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, New York, United States*

⁵ *Department of Engineering Systems and Environment, University of Virginia, Charlottesville, Virginia, United States*

⁶ *School of Life Sciences, Arizona State University, Tempe, Arizona, United States*

⁷ *Center for Integrative Conservation Research and Department of Anthropology, University of Georgia, Athens, Georgia, United States*

⁸ *National Young Farmers Coalition, Washington, District of Columbia, United States*

⁹ *Department of Civil & Environmental Engineering, Duke University, Durham, North Carolina, United States*

¹⁰ *University of Colorado, Boulder, Colorado, United States*

¹¹ *Institute of the Environment and Sustainability, University of California, Los Angeles, California, United States*

¹² *NASA Jet Propulsion Laboratory, Pasadena, California, United States*

¹³ *Urban Planning and Public Policy, University of California, Irvine, Irvine, California, United States*

¹⁴ *Rubenstein School of Environment and Natural Resources, University of Vermont, Burlington, Vermont, United States*

¹⁵ *Gund Institute for Environment, Burlington, Vermont, United States*

¹⁶ *Department of Linguistics, University of Hawai'i at Mānoa, Hawai'i, United States*

¹⁷ *Nicholas School of the Environment, Duke University, Durham, North Carolina 28516, United States*

*Corresponding author: seth.sykora.bodie@duke.edu or sethsykorabodie@gmail.com; ORCID: 0000-0003-2757-8980

***Additional email addresses: Leah Jones <ljone48@asu.edu>, Zoe Hastings <zchastin@hawaii.edu>, Elizabeth Marcella Lombardi <eml239@cornell.edu>, Michaela Barnett <mjb8k@virginia.edu>, Olivia Davis <ondavis1@asu.edu>, Olivia Ferrari <olivia.ferrari@uga.edu>, "Garcia Polanco, Vanessa" <garci430@msu.edu>, Alexandra Nicole Hofner <a.hofner@uga.edu>, Brandon Hunter <brandon.hunter@duke.edu>, Tara Ippolito <taip7142@colorado.edu>, Will Krantz <willkrantz@g.ucla.edu>, Oscar Neyra Nazaret <neyranaz@g.ucla.edu>, Omar Perez-Figueroa <operezfi@uci.edu>, Kristin Raub <Kristin.Raub@uvm.edu>, Jennifer Sou <jsou@hawaii.edu>, Edgar Virguez <edgar.virguez@duke.edu>, Tanner Waters <tannerwaters@g.ucla.edu>, Julia Whitten <julia.whitten@duke.edu>

Keywords: graduate education, interdisciplinary research, socio-environmental science, sustainability, translational science

Abstract

Higher education institutions have long played a key role in solving society's most pressing problems. However, as the scale and complexity of socio-environmental problems has grown, there has been a renewed debate about the role that academic institutions should play in developing solutions and how institutional structures should be redesigned to encourage greater interdisciplinarity. In the following pages, we present a graduate student perspective on this debate, identify challenges facing interdisciplinary graduate student researchers, suggest ways for institutions to better prepare graduate students to be the next generation of leaders in this arena, and outline models for transformational change that will ensure research is focused on solving socio-environmental problems.

Introduction

Higher education institutions have long played a key role in solving society's largest and most complex problems. However, as the scale and complexity of socio-environmental problems grows, there has been a renewed debate about the role that these institutions should play in developing solutions (Holdren, 2008; Schlesinger, 2010). Within academia, this discussion has, to a large extent, focused on how to redesign institutional structures to encourage interdisciplinarity (National Academies, 2020a), ensure that research is focused on solving socio-environmental problems (Fisher, Wood, Bradford, & Kelsey, 2020), and better equip graduate students to support this vital work during and beyond their academic training (Brunson & Baker, 2015; National Academies, 2020b; Karasov-Olson et al., 2020; Keeler, Chaplin-Kramer, Guerry, & Addison, 2017).

Beyond the Academy is an international, impact-oriented research network that evolved out of this identified need to transform academia (Keeler et. al, 2017). One of the main focuses of Beyond the Academy's work is improving institutions' ability to prepare graduate students to be sustainability leaders. As part of this effort, the organizers of the Beyond the Academy network invited applications from interested graduate students and worked with external reviewers to select and construct a diverse group of 24 to participate in a three-day workshop in January 2020 titled "Graduate Students Charting the Course for the Future of the Academy" at the University of California, Los Angeles (UCLA). These students came from conservation, environmental policy, sustainability, biology, botany, and environmental engineering programs across the United States, Canada, and Great Britain, and the workshop focused on identifying barriers and solutions to interdisciplinary graduate research with real-world impact and provided an opportunity for sustainability leadership skill building.

Over the course of the workshop, the participants engaged in a survey, guided discussions, and informal conversations to identify common challenges facing interdisciplinary graduate students. One of the most challenging issues identified was the amount of extra work that graduate students are required to do to pursue interdisciplinary, action-oriented research. If graduate students hope to pursue interdisciplinary, action-oriented science, then they must take the initiative to build networks beyond academia, become fluent in multiple fields of theory, experiment with a range of methodological techniques, and generally do more than would be required in traditionally siloed fields ("Graduate STEM Education for the 21st Century," 2017; Vincent et al., 2015; Rhoten & Parker,

2004). While students work to make their own opportunities, structures outside of their control, such as the hierarchical nature of academic institutions and the unequal power dynamics that result, present challenges for doing so. These problems have been previously acknowledged (e.g., Rhoten & Parker, 2004), yet change is still needed to reorient and create structures that celebrate and enable interdisciplinary graduate student research.

As participants in the workshop, we realized that the interdisciplinary graduate student experience is not well represented in the discussion of academic transformations, which is important because graduate students are the largest constituency in graduate academic programs. This perspective paper gives voice to the graduate students pursuing interdisciplinary research at institutions that vary from 'traditional' research universities (i.e., siloed) to explicitly interdisciplinary programs. We are intimately familiar with the barriers impeding graduate students' ability to successfully bridge departmental divides and pursue actionable solutions to the myriad of socio-environmental problems facing society today (Whitmer et al., 2010). Here, we share lessons identified in the Beyond the Academy workshop organized as a collective graduate student perspective on the five areas of institutional innovation that Keeler et al. (2017) argue are needed to transform academia: producing future environment leaders; cultivating a culture that values use inspired research; moving ideas into action faster; centering environmental science around people; and reimagining academic structures to encourage innovation. Based on the discussions from the workshop, we identify challenges for each area of innovation that are unique to the graduate student experience and provide examples of how some institutions, departments, and programs are already reforming academic structures. Our intention is to recognize programs that have made progress in facilitating solutions-oriented academic research while also encouraging further institutional evolution to support interdisciplinary socio-environmental graduate student scholars.

1. Provide opportunities for leadership skills development

Higher-education institutions can more effectively address real-world environmental problems by providing support for graduate level environmental leaders. In their first point, Keeler et al. (2017) explicitly address the needs of graduate students who are facing increasingly competitive job markets and a world threatened by environmental catastrophe, and they call for formal training and hybrid skill development to be a part of research programs. This perspective acknowledges that

we, as graduate students, especially those in rigidly disciplinary programs, are often unsupported in working beyond the framing of traditional academic paths and must develop professional skills on our own (Brunson & Baker, 2015, Hernandez-Aguilera et al., 2021).

We acknowledge that systemic, top-down change to the structure of institutions is far more complicated than the scope of this article, and that faculty advisors may not be the best qualified to mentor environmental leaders (Whitmer et al., 2010). However, during the Beyond the Academy workshop, we identified examples of programs or award systems that could immediately benefit graduate students who seek leadership training, even in traditionally siloed programs. Opportunities and access to resources will vary across institutions, and we first and foremost encourage all academic mentors to support students who find creative ways to gain environmental leadership skills and experiences.

Examples of successful approaches to providing leadership training for graduate students include skill-based certificate programs in spatial analysis, leadership development courses, and institutional or lab partnerships with environmental organizations (Baron, 2016). Furthermore, providing funding or grant opportunities for graduate students to attend relevant external training programs, such as the Beyond The Academy workshop, will enable motivated graduate researchers to expand their networks and collaborate with others. Furthermore, the rise of science communication training and science/policy fellowships like AAAS' Mass Media Fellowships and Science & Technology Policy Fellowships, or Emerging Leaders Institutes (such as those at Duke University and Columbia University), are examples of programs that provide funding for students to gain science communication skills and develop political networks through which to learn, lead, and influence policy.

2. Support graduate student use-inspired research

Keeler and colleagues argue that use-inspired (applied and demand-driven) research needs to be valued within academia to address the complexity of global problems with the rigor of peer-reviewed research. We echo this call for increased opportunities to engage in interdisciplinary, use-inspired research. To shift academic culture towards valuing applied research, we need opportunities to gain skills for engaging with non-academic stakeholders and incentives to pursue use-inspired research.

Engaging in use-inspired research can be challenging in practice, especially for graduate students. There is often an institutional bias against applied research, especially in more traditional or siloed departments (Singh et al., 2019). Use-inspired research may not be considered by the dissertation committee as a contribution to new knowledge and such pursuits can thus become additional work outside of students' degree requirements. Incentives and support structures must be created to encourage graduate students to pursue use-inspired research opportunities more easily. For example, partnerships that bridge the space between academia and practice, such as between Conservation International and Arizona State University, provide opportunities for graduate students to build on their advisors' existing relationships, gain mentorship outside of academia, and collaborate on use-inspired research. Additionally, the value of use-inspired research should be reflected in the membership of search/hiring committees, as well as in the criteria against which early-career faculty members are judged when pursuing tenure.

3. Help students move ideas into action faster

If universities and graduate programs *do* begin to cultivate a culture that values use-inspired research, then they will also need to develop mechanisms, incentives, and budgets that allow graduate students to quickly mobilize science to address socio-environmental problems (Whitmer et al., 2010). The Beyond the Academy workshop made it clear to us that graduate students are increasingly aware of the mismatched timeframes on which science and policy operate and are working to overcome this barrier. While efforts to integrate scientific training and research with policymaking continues to be slow, haphazard, and inefficient, we do see evidence of a transformation. Interdisciplinary schools and programs, such as Duke University's Nicholas School of the Environment, were once rare but are gradually becoming more common (e.g., the recent creation of UCLA's Institute of the Environment and Sustainability). These programs encourage and reward collaborative engagement that includes stakeholders, policymakers, and academics to quickly identify and implement solutions.

Despite these positive trends, we identified a number of remaining barriers. The lack of policy-oriented mentorship, program structures that permit and reward collaborative projects and partnerships with non-academic institutions, and metrics for evaluation that reward products other than peer-reviewed publications (such as reports for NGOs or government agencies) all hinder our

capacity to move science into action. These incentives and structures must be in place from the start to create an environment in which graduate students can conduct applied research and develop policy-oriented products directly focused on solving existing socio-environmental problems without hampering their professional development.

Encouragingly, many government and non-government entities also recognize the importance of external support for and funding of fellowships and workshops that provide opportunities for graduate students to pursue and produce use-inspired research. For example, the World Wildlife Fund is partnering with Duke University on conservation and sustainability research, Arizona State University's Center for Biodiversity Outcomes, Conservation International, and the Nippon Foundation are collaborating to improve both human well-being and marine resource management, and ComSciCon seeks to train graduate students to better communicate science to the public, engage with policymakers, and use their expertise to inform policy planning and implementation. Many of us at the workshop have taken part in these or similar programs and found them to be valuable mechanisms by which to learn from and collaborate with policymakers outside of academia, and we suggest that universities encourage and reward students for doing so.

4. Foster the co-production of graduate student science

We agree with Keeler et al. (2017) that natural scientists must prioritize equal partnership with social scientists, researchers from diverse backgrounds, and stakeholders to ensure research takes into consideration the perspective of people who make decisions, shape policies, and face the consequences of environmental change. Processes for developing these partnerships and iteratively creating new knowledge together—like participatory action research, community-based research, or knowledge co-production (Norström et al., 2020)—are already well established. However, through the Beyond The Academy workshop discussions it became clear that the extra time, space, and energy needed to develop these partnerships and co-produce science with stakeholder communities is often undervalued by departments and is especially challenging for graduate students, who must complete their thesis within a short two- to six-year timespan. These challenges can disincentivize students from engaging in collaborative efforts.

Institutions, departments, graduate programs, and faculty advisors can further foster the interdisciplinary culture and skills necessary for building research partnerships within their graduate

students in a variety of ways (Brunson & Baker, 2015). For example, protocols for community engagement at the institutional level, like Kūlana Noi'i in Hawai'i, provide an important roadmap for graduate students to navigate the process of knowledge co-production respectfully (University of Hawai'i Sea Grant College Program, 2018). Community review boards, in which residents implement protocols to evaluate and determine the research that happens within their communities, can provide additional safeguards that help ensure ethical, co-produced research (Martin del Campo et al., 2013). One exemplar board is Residents for Respectful Research, which operates as a community-led companion to the University of Virginia's Institutional Review Board to ensure that research is beneficial to the community as well as researchers.

Additionally, graduate coursework can be an opportunity to learn and practice skills needed to center people in environmental research in a structured environment prior to undertaking independent research. Through the workshop we found that the time it takes to develop relationships with other scientists, individuals, and community members outside of one's department before even starting to discuss research is a significant barrier to co-producing graduate research. However, faculty advisors can develop and maintain relationships with a community partner, allowing graduate students to plug-in as short-term research agents. For example, a collaboration between a Hawaiian dry forest restoration project and a university faculty member has enabled three graduate students to gain experience with not only forest ecology methodology but also the process of knowledge co-production in the last ten years (Sato et al. 2021). Similarly, grants and awards specifically aimed at funding graduate students who are co-producing knowledge with communities, such as the Kūlana Noi'i Award (Biocultural Initiative of the Pacific, 2021), can provide an incentive to students and also cover the costs of materials common for developing relationships that are often excluded from conventional funding streams (e.g., food).

5. Reimagine academic structures to encourage innovation

Changing organizational structures, be it for small colleges or large research universities, requires stakeholders at all levels to innovate and revise expectations and objectives (Whitmer et al., 2010). To succeed in both academia and a changing global environment as interdisciplinary students, we need mentorship and structural support commensurate with our goals. Colleagues and mentors in multiple fields should encourage innovative dissertations and improve student networks such that

graduate work makes an impact in and of itself, and the students who lead the projects are well-supported and trained to carry on their work beyond the completion of their degree. To accomplish this, we suggest modifying or restructuring degree expectations and requirements so that both processes and outcomes address the call for rigorous, impact-oriented researchers. Examples of this include Duke University's Nicholas Institute for Environmental Policy Solutions Environmental Impacts Fellowship and the Illinois Transdisciplinary Obesity Prevention Program (I-TOPP). The former provides students the opportunity to explore a range of potential career paths via training focused on leadership, teaching, communication, and engagement (Duke University, 2021), while the latter requires participation in a broad spectrum of transdisciplinary classes and supervision by mentors from two or more disciplines (Keck et al., 2018). Synchronizing graduate benchmarks with interdisciplinary methodologies and goals would provide a structure through which we can pursue impact-oriented goals while also making progress towards completion of our degrees. For example, committees could include non-academic practitioners, but achieving this goal more broadly requires the practical implementation of points one through four.

Conclusion

Graduate students are ready for a new kind of academia that better equips its graduates to address complex socio-environmental problems through interdisciplinary, use-inspired research. As members of academia, graduate students have a key role to play in this transformation by taking responsibility for implementing a variety of bottom-up changes (Graybill et al., 2006). However, professors, administrators, and institutions have more power to implement the top-down structural changes that frequently keep graduate students from becoming environmental leaders, advancing interdisciplinary scholarship, and engaging in use-inspired research.

We recognize that many students are able to surmount these barriers. But the students who are able to do so are often the ones with access to the resources and types of support that we have outlined above such as funding, material resources, supportive mentorship, existing collaborative partnerships, and communication and leadership training (Vincent et al., 2015). Therefore, academic structures need to transform to provide support and opportunities so that all graduate students are able to solve the complex and varied socio-environmental problems facing society today.

In this article, we have presented challenges facing interdisciplinary graduate student researchers, outlined models for transformational change, and expressed hope that alternative strategies are attainable. While institutions and programs may tackle these barriers differently, it is critical that they commit to improving mentorship and providing leadership training opportunities, financial support, and academic recognition for interdisciplinary graduate students. These changes will directly improve graduate students' ability to pursue and practice impact-oriented research, impact policy- and decision-making, and develop the environmental leaders that society needs.

Author Contributions

SSB and EML conceived of the paper, SSB, JLJ, ZH, EML, MB, ONB, OMF, VGP, ANH, BH, TI, WK, ON, OPF, KBR, JS, EV, TW, and JW (all authors) participated in the workshop, SSB, JLJ, ZH, and EML wrote the paper, and all authors provided edits and revisions to the final manuscript.

Conflict of Interest Statement

The authors declare no competing interests.

References

- Baron, Nancy. (2016). So you want to change the world? *Nature* 540, 517-519. doi:10.1038/540517a
- Biocultural Initiative of the Pacific. (2021). Kūlana Noi‘i Award: Biocultural Community Engagement Funding. Retrieved from <https://manoa.hawaii.edu/biocultural/kulana-noi%CA%BBi-award/>
- Brunson, M. W., & Baker, M. A. (2015). Translational training for tomorrow’s environmental scientists. *Journal of Environmental Studies and Sciences*, 1–7. <http://doi.org/10.1007/s13412-015-0333-x>
- Duke University. Nicholas Institute for Environmental Policy Solutions (2021). Duke Environmental Impacts Fellowship. Retrieved from <https://nicholasinstitute.duke.edu/eif>
- Fisher, J. R. B., Wood, S. A., Bradford, M. A., & Kelsey, T. R. (2020). Improving scientific impact: How to practice science that influences environmental policy and management. *Conservation Science and Practice*, 2(7), 778–14. <http://doi.org/10.1111/csp2.210>
- Graduate STEM Education for the 21st Century. (2017). Graduate STEM Education for the 21st Century, 1–203. <http://doi.org/10.17226/25038>
- Graybill, J. K., Dooling, S., Shandas, V., Withey, J., Greve, A., & Simon, G. L. (2006). A Rough Guide to Interdisciplinarity: Graduate Student Perspectives. *BioScience*, 56(9), 757–763.
- Hernandez-Aguilera, J.N., Anderson, W., Bridges, A.L., Fernandez, M.P., Hansen, W.D., Maurer, M.L., Ilboudo Nébié, E.K., Stock, A. (2021). Supporting interdisciplinary careers for sustainability. *Nature Sustainability*, 4. 374-375. <https://doi.org/10.1038/s41893-020-00679-y>
- Holdren, J. P. (2008). Presidential Address: Science and Technology for Sustainable Well-Being. *Science*, 319(5862), 424–434. <http://doi.org/10.1126/science.1153386>
- Karasov-Olson, A., Bird, A. K., Collins, A. C., Graves, E. E., Shaw, J. A., Tymstra, E. F., et al. (2020). Bridging the knowledge-implementation gap between agency and academia: A case study of a graduate research experience. *Conservation Science and Practice*, 27, 23–10. <http://doi.org/10.1111/csp2.286>
- Keck, A.-S., Sloane, S., Liechty, J.M., Fiese, B.H., Donovan, S.M. (2018). Transdisciplinary PhD programmes produce more high-impact publications and foster increased collaborations. Retrieved from: <https://blogs.lse.ac.uk/impactofsocialsciences/2018/02/27/transdisciplinary-phd-programmes-produce-more-high-impact-publications-and-foster-increased-collaborations/>
- Keeler, B. L., Chaplin-Kramer, R., Guerry, A., & Addison, P. (2017). Society is ready for a new kind of science—is academia? *BioScience*, 67(7), 591–592. <http://doi.org/10.1093/biosci/bix051>
- University of Hawai‘i Sea Grant College Program. (2018). Kūlana Noi‘i. Retrieved from <https://seagrant.soest.hawaii.edu/kulana-noii/>
- Martin del Campo, F., Casado, J., Spencer, P., & Strelnick, H. (2013). The development of the Bronx Community Research Review Board: a pilot feasibility project for a model of community consultation. *Progress in community health partnerships: research, education, and action*, 7(3), 341–352. <https://doi.org/10.1353/cpr.2013.0037>
- National Academies of Science, Engineering, and Medicine. (2020a). Strengthening Sustainability Programs. In *Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels* (pp. 83–118). National Academies Press. <http://doi.org/10.17226/25821>

- National Academies of Science, Engineering, and Medicine. (2020b). Developing a Sustainability Workforce. In *Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels* (pp. 156–173). National Academies Press. <http://doi.org/10.17226/25821>
- Norström, A.V., Cvitanovic, C., Löf, M.F., West, S., Wyborn, C., Balvanera, P., Bednarek, A.T., Bennett, E.M., Biggs, R., de Bremond, A., Campbell, B.M., Canadell, J.G., Carpenter, S.R., Folke, C., Fulton, E.A., Gaffney, O., Gelcich, S., Jouffray, J.-B., Leach, M., Le Tissier, M., Martín-López, B., Louder, E., Loutre, M.-F., Meadow, A.M., Nagendra, H., Payne, D., Peterson, G.D., Reyers, B., Scholes, R., Ifejika Speranza, C., Spierenburg, M., Stafford-Smith, M., Tengö, M., van der Hel, S., van Putten, I., and Osterblom, H. (2020). Principles for Knowledge Co-Production in Sustainability Research. *Nature Sustainability*, 3. 1-9. <http://doi:10.1038/s41893-019-0448-2>
- Rhoten, D., & Parker, A. (2004). Risks and Rewards of an Interdisciplinary Research Path. *Science*, 306(5704), 2046–2046. <http://doi.org/10.1126/science.1103628>
- Sato, A. Y., Ticktin, T., Alapai, L., von Allmen, E. I., Brawner, W. P. I., Carter, Y. Y., ... Zahawi, R. A. (2021) Biocultural restoration of Hawaiian tropical dry forests. *Pacific Conservation Biology*. <https://doi.org/10.1071/PC20084>
- Schlesinger, W. H. (2010). Translational Ecology. *Science*, 329(5992), 609–609. <http://doi.org/10.1126/science.1195624>
- Singh, G. G., Farjalla, V. F., Chen, B., Pelling, A. E., Ceyhan, E., Dominik, M., et al. (2019). Researcher engagement in policy deemed societally beneficial yet unrewarded. *Frontiers in Ecology and the Environment*, 17(7), 375–382. <http://doi.org/10.1002/fee.2084>
- Vincent, S., Roberts, J. T., & Mulkey, S. (2015). Interdisciplinary environmental and sustainability education: islands of progress in a sea of dysfunction. *Journal of Environmental Studies and Sciences*, 6(2), 418–424. <http://doi.org/10.1007/s13412-015-0279-z>
- Whitmer, A., Ogden, L., Lawton, J., Sturmer, P., Groffman, P. M., Schneider, L., et al. (2010). The engaged university: providing a platform for research that transforms society. *Frontiers in Ecology and the Environment*, 8(6), 314–321. <http://doi.org/10.1890/090241>