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EDITORIAL

Co-designed ecological research for more effective management and conservation

1 | INTRODUCTION

Translational Ecology presents a call for ecologists to effectively translate and mobilize their research into significant action with an emphasis on encouraging cross-disciplinary partnerships to facilitate effective management and policy outcomes (Enquist et al., 2017; Schlessinger, 2010). One way to fully leverage those partnerships is through co-designed research, wherein projects are planned and carried out with significant input from individuals across multiple fields of interest and inquiry to maximize the effectiveness of a desired outcome (Chapin III, 2017). In the case of applied ecology, co-designed research between academics and practitioners can increase the uses, reach and scope of management data, allowing for all interested parties to use this information to its fullest potential and create the most robust conservation recommendations and outcomes.

For example, a co-designed activity designed to model scenarios to achieve the best outcomes for maximizing fire suppression in a forest in the western United States affected by climate change included landscape and climate ecologists from academia, local stakeholders and forest managers and landscape modelers with access to relevant long-term forest and fire regime data (Maxwell et al., 2020). The participants provided a diversity of expertise and relevant interests, access to data and direct links to forest management practitioners so the findings of their collaborative work could be applied directly to fire suppression management decisions.

There may be a perception that the hurdles to developing co-designed research are too high and not worth surmounting. However, the positive goals for co-designed applied ecology research are myriad and the barriers to entry for developing these partnerships are actually quite low once academic and practitioner scientists understand the great potential for realizing rewarding scientific discoveries and applying those toward better environmental and management outcomes. *Ecological Solutions and Evidence* is committed to the innovative progression of ecology as it applies to practical environmental management and conservation, and we encourage the creation and implementation of co-designed research projects to help achieve these goals.

Specifically, we are highlighting the benefits of co-designed applied research to encourage potential collaborators to 'reach across the aisle', dispel the perception of limitations and hurdles and detail aspects we have found helpful for maximizing the success of co-designed research.

2 | BENEFITS OF CO-DESIGNED APPLIED ECOLOGY RESEARCH

2.1 | Access

The creation of co-designed projects increases access to many types of resources for all parties involved. Practitioners gain access to a steady stream of professors, postdoctoral scholars and undergraduate and postgraduate students who are plugged into the university system with all its resources and who are highly motivated to produce cutting-edge science. In working with these postdocs and students, practitioners also gain valuable mentoring opportunities, which are linked to increased productivity in terms of scientific publications (Kwon et al., 2015; Wamala & Ssembatya, 2015), and are shown to increase personal satisfaction, institutional prestige and recognition and professional development (Kalpazidou Schmidt & Faber, 2016; Malmgren et al., 2010). Academics gain access to habitats, locations, ongoing interventions and species that are managed by practitioners. They also gain access to long-term data sets gathered and stored by resource managers who are tasked with tracking intervention outcomes along with monitoring habitats and species of conservation concern.

For example, northern fur seals (*Callorhinus ursinus*) in the United States are managed by scientists at the Marine Mammal Laboratory, a research group housed under the National Oceanic and Atmospheric Administration (NOAA), a U.S. government agency. The seals breed on islands in Alaska where access is limited, and NOAA scientists have been gathering data on this population for decades. Access to the rookeries on the islands, the animals and the long-term data are all largely controlled by NOAA scientists, and academics wishing to work with these species do best when co-designing projects in collaboration with the NOAA practitioners. In return, graduate students with projects aimed at answering questions about the U.S. fur seal population can be co-managed by NOAA practitioners and academics, which can increase the scientific output in terms of questions answered, field work performed and publication of scientific articles stemming from graduate student dissertations. Students also gain important career perspectives as they learn about working for a management agency and make connections for potential future employment.

Long-term monitoring and management of protected areas offers another clear example of the benefits of co-designed research. In the Bavarian Forest National Park in Germany, ongoing managed logging has occurred alongside mass tree mortality events from storms and bark beetle outbreaks. These opportunities have served as a fruitful impetus to assess how numerous disturbances influence diversity and function across multiple taxa and processes (Bässler et al., 2014, 2016; Thorn, Bässler, et al., 2016; Thorn et al., 2014; Thorn, Werner, et al., 2016). Here, scientists across many areas of expertise, including students and postdocs, have contributed to forest inventories and opportunistic study of stochastic events to reveal meaningful insights into the impacts of forest management on the conservation of at-risk species and the maintenance of important ecosystem functions.

2.2 | Expertise

Practitioners in management positions are especially well-versed in the natural history of the ecosystems and species they are tasked with managing as the mandates from their agencies require them to study, observe and quantify changes in populations and habitats over long periods of time, or assess the results of interventions such as captive releases or habitat restoration. Academics can also be outstanding natural historians, but more frequently, their primary interest is to evaluate more broad ecological questions using habitats and species with which they are less familiar. In addition, academics may hold more specialized knowledge in methodology or statistical analyses. For example, in a collaborative project designed to better understand risks to California condors (*Gymnogyps californianus*) foraging on dead marine mammals, academics well-versed in specialties such as stable isotope analysis, environmental toxicology and statistical modelling joined forces with practitioners steeped in California condor tracking, monitoring, capturing and natural history to build clear connections between ingestion of contaminated marine mammals and elevated levels of multiple pollutants and associated reproductive risks in condors (Kurle et al., 2016). In another example, monitoring of Lyme disease in the Thousand Islands National Park in Canada by government and academic researchers has provided important insights into the role of host diversity and dispersal on the spread of the *Borrelia burgdorferi* pathogen (Watts et al., 2018; Werden et al., 2014). Here, managers provided monitoring data, while the academic researchers used sophisticated analysis tools to assess the spatial influences of host–pathogen interactions and disease spread.

2.3 | Application

Scientists conducting applied ecological studies want their research to be used for increased management and conservation efficacy, and to inform policy. Academics alone can affect strong positive change; however, the most effective actions for environmental conservation are logically conducted by those tasked with managing biological resources and ecological systems. When applied ecologist academics combine forces with on the ground practitioners, it stands to reason that more management actions will result from the work, thereby increasing the chances for effective practical applications of the scientific research. For example, a highly collaborative project designed to determine the effects of invasive rats on island in Alaska involved practitioners from a government agency, two non-governmental organizations (NGOs) and several academics (Kurle et al., 2008). That work led to a multi-agency effort to eradicate rats from one of the islands, which in turn created the opportunity for a collaborative study detailing the relatively rapid ecological recovery of the island following rat removal (Kurle et al., 2021).

2.4 | Funding

Across developed nations, most scientific research is funded by government grants from specific agencies (van Dalen et al., 2014). In the United States, scientists working at government management agencies cannot apply for grants from other government agencies as their mandated management duties are expected to be funded by allocations from their own agency. However, both academics and practitioners can benefit from the funding received by the other. Practitioners can participate in grant writing with academics to fund students that can be co-advised or fund contributions to field work that takes place in conjunction with practitioners. Conversely, funding for field site maintenance, regular monitoring of habitats and species, and access to equipment and field support such as ship time are frequently included in practitioner budgets, especially those working for government agencies. Those regularly funded mechanisms can frequently easily be used to include additional researchers from academia.

Furthermore, there are funding mechanisms in some jurisdictions that explicitly require academic and non-academic research collaboration with a focus on deliverables that have direct management, process or policy outcomes. For example, Canadian funding agencies have programs that are only awarded to partnership projects that span academic research and industry, NGO or governmental needs. The National Sciences and Engineering Research Council of Canada funds Alliance grants that require non-academic partner organizations to contribute material support, expertise or matching funds to a research project. Further, a non-profit organization in Canada, Mitacs, provides funding and coordination to facilitate partnership research or application (Zawaly et al., 2020). One of their flagship programs supports postdoctoral researchers who bridge a university lab and non-academic partner, which can include government agencies or NGOs. For example, the Toronto and Regional Conservation Authority frequently partners with the University of Toronto using this program to facilitate applied ecological analyses, including invasive plant prioritization (Potgieter et al., 2022) and assessment of the conservation value of green roofs (Filazzola et al., 2019).

3 | KEYS FOR SUCCESSFUL CO-DESIGNED APPLIED ECOLOGY RESEARCH PROJECTS

3.1 | Clarity

When developing co-designed research projects, it is important to clearly delineate the specific roles and contributions of each party from the beginning, as well as the desired outcomes. This can be done informally via verbal discussion and agreement or formalized with memoranda of understanding (MOU) or agreement (MOA) or other explicit processes. At a minimum, there should be meetings organized early with all potential collaborators to determine feasibility and desirability of a potential project and to work out details of the collaboration. Formal and informal agreements can include details such as assignments of work for each phase of the project, specific contributions for funds, equipment, personnel time, field logistic support, new and archived data, lab space and so forth and authorship for all planned publications. A commitment to clarity from the start, and continued throughout the process, will help prevent potential difficulties or anxieties that may exist regarding data sharing, fairness in publication credit, transparency regarding funding, or any other issues that could come up during co-designed research efforts.

3.2 | Trust

Establishing clearly defined goals, outcomes and assignments, then following through on these agreements with transparency and goodwill, builds trust among collaborating entities, increasing the chances for continued co-designed research projects and potentially future funding to carry on the collaboration. Building trust contributes to increased familiarity and comfort with the processes required to propose new collaborations with other scientists working at universities and agencies. The positive experiences you and your partners create will build upon one another, leading to more projects.

3.3 | Bravery

One of the barriers for creating collaborative research among various types of scientists is shyness or a reluctance to reach out that could stem from any number of reasons. It is important to be brave and reach out to colleagues working in whichever realm—academia or a practitioner field—is different from your own. Do your homework and find colleagues conducting research that dovetails with and augments your own. Share your ideas for collaboration and see what comes back. In our experience, all parties are frequently relieved to have the added support from someone outside of their immediate colleagues and they welcome sincere inquiries for collaborative endeavours.

4 | CONCLUSIONS

As we have demonstrated, co-designed research can serve to maximize the benefits of practitioner-derived long-term data and information collection for managing species and ecosystems while also increasing the scientific productivity of all involved. We strongly encourage practitioners and academics alike to consider how best to broaden, deepen and otherwise extend the scope and positive application of their work via co-designed research projects. Then, go forth, be brave and start creating those opportunities.

For further information, please view the Applied Ecology Resources (AER) and Ecological Solutions and Evidence free workshop on Successful Co-Designed Research Opportunities from November 2021 that featured a discussion on the topic by Dr. Carolyn Kurle and Dr. Jeff Seminoff at https://www.youtube.com/watch?v=WbecMuJp6Ic.

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REFERENCES

Bässler, C., Ernst, R., Cadotte, M., Heibl, C., & Müller, J. (2014). Near-to-nature logging influences fungal community assembly processes in a temperate forest. *Journal of Applied Ecology*, *51*(4), 939–948. https://doi.org/10.1111/1365-2664.12267

Bässler, C., Müller, J., Cadotte, M. W., Heibl, C., Bradtka, J. H., Thorn, S., & Halbwachs, H. (2016). Functional response of lignicolous fungal guilds to bark beetle deforestation. *Ecological Indicators*, *65*, 149–160. https://doi.org/10.1016/j.ecolind.2015.07.008

Chapin, III, F. S. (2017). Now is the time for translational ecology. *Frontiers in Ecology and the Environment*, *15*(10), 539–539. https://doi.org/10.1002/fee.1737

Enquist, C. A., Jackson, S. T., Garfin, G. M., Davis, F. W., Gerber, L. R., Littell, J. A., Tank, J. L., Terando, A. J., Wall, T. U., Halpern, B., Hiers, J. K., Morelli, T. L., McNie, E., Stephenson, N. L., Williamson, M. A., Woodhouse, C. A., Yung, L., Brunson, M. W., Hall, K. R., … Shaw, M. R. (2017). Foundations of translational ecology. *Frontiers in Ecology and the Environment*, *15*(10), 541–550. https://doi.org/10.1002/fee.1733

Filazzola, A., Shrestha, N., & MacIvor, J. S. (2019). The contribution of constructed green infrastructure to urban biodiversity: A synthesis and meta-analysis. *Journal of Applied Ecology*, *56*(9), 2131–2143. https://doi.org/10.1111/1365-2664.13475

Kalpazidou Schmidt, E., & Faber, S. T. (2016). Benefits of peer mentoring to mentors, female mentees and higher education institutions. *Mentoring & Tutoring: Partnership in Learning*, *24*(2), 137–157. https://doi.org/10.1080/13611267.2016.1170560

Kurle, C. M., Bakker, V. J., Copeland, H., Burnett, J., Jones Scherbinski, J., Brandt, J., & Finkelstein, M. E. (2016). Terrestrial scavenging of marine mammals: Cross-ecosystem contaminant transfer and potential risks to endangered California condors (*Gymnogyps californianus*). *Environmental Science & Technology*, *50*(17), 9114–9123. https://doi.org/10.1021/acs.est.6b01990

Kurle, C. M., Croll, D. A., & Tershy, B. R. (2008). Introduced rats indirectly change marine rocky intertidal communities from algae- to invertebrate-dominated. *Proceedings of the National Academy of Sciences*, *105*(10), 3800–3804. https://doi.org/10.1073/pnas.0800570105

Kurle, C. M., Zilliacus, K. M., Sparks, J., Curl, J., Bock, M., Buckelew, S., Williams, J. C., Wolf, C. A., Holmes, N. D., Plissner, J., Howald, G. R., Tershy, B. R., & Croll, D. A. (2021). Indirect effects of invasive rat removal result in recovery of island rocky intertidal community structure. *Scientific Reports*, *11*(1), 5395. https://doi.org/10.1038/s41598-021-84342-2

Kwon, K.-S., Kim, S. H., Park, T.-S., Kim, E. K., & Jang, D. (2015). The impact of graduate students on research productivity in Korea. *Journal of Open Innovation: Technology, Market, and Complexity*, *1*(2), 21. https://doi.org/10.1186/s40852-015-0024-6

Malmgren, R. D., Ottino, J. M., & Nunes Amaral, L. A. (2010). The role of mentorship in protégé performance. *Nature*, *465*(7298), 622–626. https://doi.org/10.1038/nature09040

Maxwell, C. J., Serra-Diaz, J. M., Scheller, R. M., & Thompson, J. R. (2020). Co-designed management scenarios shape the responses of seasonally dry forests to changing climate and fire regimes. *Journal of Applied Ecology*, *57*(7), 1328–1340. https://doi.org/10.1111/1365-2664.13630

Potgieter, L. J., Aronson, M. F. J., Brandt, A. J., Cook, C. N., Gaertner, M., Mandrak, N. E., Richardson, D. M., Shrestha, N., & Cadotte, M. W. (2022). Prioritization and thresholds for managing biological invasions in urban ecosystems. *Urban Ecosystems*, *25*, 253–271. https://doi.org/10.1007/s11252-021-01144-0

Schlessinger, W. (2010). Translational ecology. *Science*, *329*, 609. https://doi.org/10.1126/science.1195624

Thorn, S., Bässler, C., Bernhardt-Römermann, M., Cadotte, M., Heibl, C., Schäfer, H., Seibold, S., & Müller, J. (2016). Changes in the dominant assembly mechanism drive species loss caused by declining resources. *Ecology Letters*, *19*(2), 163–170. https://doi.org/10.1111/ele.12548

Thorn, S., Bässler, C., Gottschalk, T., Hothorn, T., Bussler, H., Raffa, K., & Müller, J. (2014). New insights into the consequences of post-windthrow salvage logging revealed by functional structure of saproxylic beetles assemblages. *PLoS ONE*, *9*(7), e101757. https://doi.org/10.1371/journal.pone.0101757

Thorn, S., Werner, S. A. B., Wohlfahrt, J., Bässler, C., Seibold, S., Quillfeldt, P., & Müller, J. (2016). Response of bird assemblages to windstorm and salvage logging—Insights from analyses of functional guild and indicator species. *Ecological Indicators*, *65*, 142–148. https://doi.org/10.1016/j.ecolind.2015.06.033

van Dalen, R., Mehmood, S., Verstraten, P., & van der Wiel, K. (2014). Public funding of science: An international comparison (p. 124) (CPB Background Document). CPB Netherlands Bureau for Economic Policy Analysis.

Wamala, R., & Ssembatya, V. A. (2015). Productivity in academia: An assessment of causal linkages between output and outcome indicators. *Quality Assurance in Education: An International Perspective*, *23*(2), 184–195. https://doi.org/10.1108/QAE-01-2014-0002

Watts, A. G., Saura, S., Jardine, C., Leighton, P., Werden, L., & Fortin, M.-J. (2018). Host functional connectivity and the spread potential of Lyme disease. *Landscape Ecology*, *33*(11), 1925–1938. https://doi.org/10.1007/s10980-018-0715-z

Werden, L., Barker, I. K., Bowman, J., Gonzales, E. K., Leighton, P. A., Lindsay, L. R., & Jardine, C. M. (2014). Geography, deer, and host biodiversity shape the pattern of Lyme disease emergence in the thousand islands archipelago of Ontario, Canada. *PLoS ONE*, *9*(1), e85640. https://doi.org/10.1371/journal.pone.0085640

Zawaly, K., Hooper, K., & Somersell, N. (2020). Impact report: Evaluation of Mitacs internships (Technical report). Research Manitoba. https://mspace.lib.umanitoba.ca/xmlui/handle/1993/34571