Received: 1 June 2020 | Revised: 14 June 2021 | Accepted: 23 June 2021

DOI: 10.1111/csp2.493

CONTRIBUTED PAPER

Conservation Science and Practice
A journal of the Society for Conservation Biology
Open Access
WILEY

Pathways towards a sustainable future envisioned by early-career conservation researchers

Kaisa J. Raatikainen[1,2] | Jenna Purhonen[3] | Tähti Pohjanmies[2,4] | Maiju Peura[2] | Eini Nieminen[2] | Linda Mustajärvi[2] | Ilona Helle[2] | Yara Shennan-Farpón[5,6] | Pauliina A. Ahti[2,7] | Marco Basile[8,9,10] | Nicola Bernardo[11] | Michael G. Bertram[12,13] | Oussama Bouarakia[14,15,16] | Aina Brias-Guinart[17] | Thijs Fijen[18] | Jérémy S. P. Froidevaux[19,20,21,22] | Heather Hemmingmoore[23] | Sara Hocevar[2] | Liam Kendall[24,25] | Jussi Lampinen[26] | Emma-Liina Marjakangas[27,28] | Jake M. Martin[13] | Rebekah A. Oomen[29,30,31] | Hila Segre[32] | William Sidemo-Holm[24] | André P. Silva[33,34] | Susanna Huneide Thorbjørnsen[30] | Miquel Torrents-Ticó[17] | Di Zhang[35] | Jasmin Ziemacki[36]

[1]Department of Geography and Geology, Geography Section, University of Turku, Turku, Finland

[2]Department of Biological and Environmental Science & School of Resource Wisdom, University of Jyvaskyla, Jyväskylä, Finland

[3]Department of Music, Art and Cultural Studies, Department of Biological and Environmental Science & School of Resource Wisdom, University of Jyvaskyla, Jyväskylä, Finland

[4]Natural Resources Institute Finland, Helsinki, Finland

[5]ZSL Institute of Zoology, Zoological Society of London, London, UK

[6]UCL Department of Anthropology, University College London, London, UK

[7]Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UK

[8]Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

[9]Swiss Ornithological Institute, Sempach, Switzerland

[10]Chair of Wildlife Ecology and Management, University of Freiburg, Freiburg, Germany

[11]Doñana Biological Station – CSIC, Sevilla, Spain

[12]Department of Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, Umeå, Sweden

[13]School of Biological Sciences, Monash University, Clayton, Victoria, Australia

[14]SARChI Chair on Biodiversity Value and Change, University of Venda, Thohoyandou, South Africa

[15]Laboratory Biodiversity Ecology Genome, Research Center BIOBIO, Faculty of Sciences, Mohammed V University in Rabat, Rabat, Morocco

[16]Institut Systématique Evolution Biodiversité, MNHN, CNRS, Sorbonne Université, Paris, France

[17]Faculty of Biological and Environmental Science & Faculty of Social Sciences, Global Change and Conservation Lab, University of Helsinki, Helsinki Institute of Sustainability Science, Helsinki, Finland

[18]Plant Ecology and Nature Conservation Group, Wageningen University, Wageningen, The Netherlands

[19]Faculty of Natural Sciences, University of Stirling, Biological and Environmental Sciences, Stirling, UK

[20]University of Bristol, School of Biological Sciences, Bristol, UK

[21]Centre d'Ecologie et des Sciences de la Conservation (CESCO, UMR 7204), CNRS, MNHN, Sorbonne-Université, Station marine, Concarneau, France

[22]Dynafor, Université de Toulouse, INRA, INPT, INP-EI Purpan, Castanet-Tolosan, France
[23]Grimsö Wildlife Research Station, Department of Ecology, Swedish University of Agricultural Sciences, Riddarhyttan, Sweden
[24]Centre for Environmental and Climate Science, Lund University, Lund, Sweden
[25]University of New England, School of Environmental and Rural Science, Armidale, NSW, Australia
[26]Department of Biology & Biodiversity Research Unit, University of Turku, Turku, Finland
[27]Centre for Biodiversity Dynamics, Department of Biology, Norwegian University of Science and Technology, Trondheim, Norway
[28]The Helsinki Lab of Ornithology, Finnish Museum of Natural History, University of Helsinki, Helsinki, Finland
[29]Centre for Ecological and Evolutionary Synthesis, University of Oslo, Oslo, Norway
[30]Centre for Coastal Research, Department of Natural Sciences, University of Agder, Kristiansand, Norway
[31]Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada
[32]Human and Biodiversity Research Lab, Faculty of Architecture and Town Planning, Technion – Israel Institute of Technology, Haifa, Israel
[33]Department of Animal Ecology, Evolutionary Biology Centre, Uppsala University, Uppsala, Sweden
[34]Centre for Ecology, Evolution and Environmental Changes, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal
[35]School of Life Sciences, Peking University, Beijing, China
[36]Center for Development Research, University of Bonn, Bonn, Germany

Correspondence
Kaisa J. Raatikainen, Department of Biological and Environmental Science, University of Jyvaskyla, School of Resource Wisdom, P.O. Box 35, FI-40014 University of Jyvaskyla, Finland.
Email: kaisa.j.raatikainen@jyu.fi

Funding information
"la Caixa" Banking Foundation; Australian Government Research Training Program; Biotechnology and Biological Sciences Research Council; Deutsche Forschungsgemeinschaft; Emil Aaltosen Säätiö; James S. McDonnell Foundation; Koneen Säätiö; NSERC Discovery Grant; Suomen Kulttuurirahasto

Abstract

Scientists have warned decision-makers about the severe consequences of the global environmental crisis since the 1970s. Yet ecological degradation continues and little has been done to address climate change. We investigated early-career conservation researchers' (ECR) perspectives on, and prioritization of, actions furthering sustainability. We conducted a survey ($n = 67$) and an interactive workshop ($n = 35$) for ECR attendees of the 5th European Congress of Conservation Biology (2018). Building on these data and discussions, we identified ongoing and forthcoming advances in conservation science. These include increased transdisciplinarity, science communication, advocacy in conservation, and adoption of a transformation-oriented social–ecological systems approach to research. The respondents and participants had diverse perspectives on how to achieve sustainability. Reformist actions were emphasized as paving the way for more radical changes in the economic system and societal values linked to the environment and inequality. Our findings suggest that achieving sustainability requires a strategy that (1) incorporates the multiplicity of people's views, (2) places a greater value on nature, and (3) encourages systemic transformation across political, social, educational, and economic realms on multiple levels. We introduce a framework for ECRs to inspire their research and practice within conservation science to achieve real change in protecting biological diversity.

KEYWORDS
Anthropocene, biodiversity loss, climate change, global change, leverage points, new conservation, radicalism, reformism, sustainability, world Scientists' warning to humanity

1 | INTRODUCTION

The frequency and severity of dire messages concerning the state of the Earth have escalated over the past decades. Scientists have produced repeated evidence to quantify the magnitude of increasing degradation of the environment and climate change (e.g., Barnosky et al., 2012; IPBES, 2019; Newbold et al., 2015; Rands

et al., 2010; Ripple, Wolf, & Newsome, 2019), including unprecedented rates of species loss (IPBES, 2019), mass coral bleaching (Sully, Burkepile, Donovan, Hodgson, & van Woesik, 2019), drastic increases in pollution in aquatic environments (Eerkes-Medrano, Leslie, & Quinn, 2019; Lindeque et al., 2020; Saaristo et al., 2018), and worldwide changes in insect abundance (Wagner, Grames, Forister, Berenbaum, & Stopak, 2021). Following the Rio Summit of 1992 (UNCEP, 1992), the Union of Concerned Scientists published the first "World Scientists' Warning to Humanity," cautioning that human population growth and profligate use of natural resources were shifting the state of the Earth's systems towards a scenario detrimental to human well-being and the survival of many species (Union of Concerned Scientists, 1993). Broadly understood as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 2020; WCED, 1987), sustainable development and the associated UN Sustainable Development Goals (SDGs) have been widely incorporated into policy and private sector decision-making to guide societies towards more sustainable paths (Adams, 2020). However, the interventions made have been unable to lever a transformative change towards sustainability, both in societies and in research (Abson et al., 2017; Reyers & Selig, 2020).

In 2017, the globally acknowledged "World Scientists' Warning to Humanity: A Second Notice" (Ripple et al., 2017) highlighted that, with the exception of stabilising the stratospheric ozone layer, humanity has failed to solve our major environmental challenges. Instead, most of the challenges identified in the first "World Scientists' Warning to Humanity" (1993) have intensified (Ripple et al., 2017, 2019). In this regard, anthropogenic factors such as agricultural intensification (Zabel et al., 2019), unsustainable extraction of natural resources (IPBES, 2019), and the expansion of invasive species (Szabo, Khwaja, Garnett, & Butchart, 2012) continue to drive biodiversity loss. It is thus not surprising that conservation researchers, as practitioners working towards long-term protection of biodiversity, are extremely concerned about the global ecological crisis and the lack of progress in effectuating its counteractions (Adams, 2020; Soulé, 1985). For early-career conservation researchers (hereafter, ECRs), it is further troubling that their voices are often not involved in building the solutions for a more sustainable future (Rana et al., 2020). Public conservation discussions need accounts from marginalized groups (Milner-Guilland, 2021). Hence, the current paper, collaboratively written by 30 ECRs, aims to capture voices from this group and explore potential innovations that incorporate conservation perspectives to aid the transition towards sustainability.

Western environmentalism and conservation movements arose throughout the 1960s and 1970s, mostly across North America and Europe, holding species protection as their flagship. The 1990s saw a merging of conservation and sustainability thinking under the umbrella of sustainable development, which broke through other sectors of society, such as business, governance, and education, in many parts of the world (Adams, 2020). Thus, most ECRs have grown up with a belief that the global environmental crisis can be ameliorated with sustainable development, an ideology that gained traction and mainstream recognition throughout the 1990s following the publication of *Our Common Future* (WCED, 1987), *Agenda 21* as the main output of the Rio Earth Summit in 1992, and the first and second *IPCC Assessment Reports* (Adams, 2020). After their establishment in 2015, the SDGs have become central to the development and teaching of conservation science, along with other international protection targets and policies (Adams, 2020; IPBES, 2019). In parallel, social sciences have gained ground within conservation research and are now recognized as a source of new solutions (Bennett et al., 2016, 2017; Soulé, 1985). Building on the cumulative and increasingly interdisciplinary work done by previous generations of conservation scientists, as well as on education and the everyday emotional engagement with environmental issues (Adams, 2020; Bennett et al., 2016; Carmi, Arnon, & Orion, 2015), ECRs have great potential to create novel, holistic visions that challenge the prevalent socio-political interpretation of sustainability (Rana et al., 2020).

Tasked with developing innovative solutions to the global environmental crisis, and in light of the lack of progress on halting environmental degradation, our study evaluates the list of evidence-based "sustainability actions" presented by Ripple et al. (2017) (Table 1), and asks: Which sustainability actions do ECRs prioritize today? Further, our broader interest was to go beyond Ripple et al. (2017), asking: Are there additional steps towards sustainability that emerge from ECR innovation? We brought together a group of ECRs to reflect on the roles of society, politics, and the economy in shaping environmental change. We discuss the differences and similarities among ECRs' views, while critically assessing our role and position within society. We emphasize the potential of socially oriented approaches in solving the biodiversity crisis, including participatory research, socio-political movements, and degrowth (e.g., Adams, 2020; Bennett et al., 2017; Kallis, Kerschner, & Martinez-Alier, 2012). Further, we present potential pathways and a framework of priority steps to push for real change towards sustainability. Hence, this article is targeted at researchers and practitioners of conservation and sustainability, and specifically other ECRs. Our methodology is built on a

TABLE 1 Actions humanity can take to transition to sustainability, not in order of importance or urgency (according to Ripple et al., 2017). To ease reading, short descriptions are referred to in Section 3 of the current article; the data were collected using the original wording of each action

Sustainability action	Short description
Prioritizing the enactment of connected well-funded and well-managed reserves for a significant proportion of the world's terrestrial, marine, freshwater, and aerial habitats.	Reserves
Maintaining nature's ecosystem services by halting the conversion of forests, grasslands, and other native habitats.	Halting conversion
Restoring native plant communities at large scales, particularly forest landscapes.	Restoration
Rewilding regions with native species, especially apex predators, to restore ecological processes and dynamics.	Rewilding
Developing and adopting adequate policy instruments to remedy defaunation, the poaching crisis, and the exploitation and trade of threatened species.	Remedy defaunation
Reducing food waste through education and better infrastructure.	Reducing food waste
Promoting dietary shifts towards mostly plant-based foods.	Plant-based foods
Further reducing fertility rates by ensuring that women and men have access to education and voluntary family-planning services, especially where such resources are still lacking.	Reducing fertility rates
Increasing outdoor nature education for children, as well as the overall engagement of society in the appreciation of nature.	Appreciation of nature
Divesting of monetary investments and purchases to encourage positive environmental change.	Divesting of monetary investments and purchases
Devising and promoting new green technologies and massively adopting renewable energy sources while phasing out subsidies to energy production through fossil fuels.	Green technologies
Revising our economy to reduce wealth inequality and ensure that prices, taxation, and incentive systems take into account the real costs which consumption patterns impose on our environment.	Revising the economy
Estimating a scientifically defensible, sustainable human population size for the long term while rallying nations and leaders to support that vital goal.	Human population size

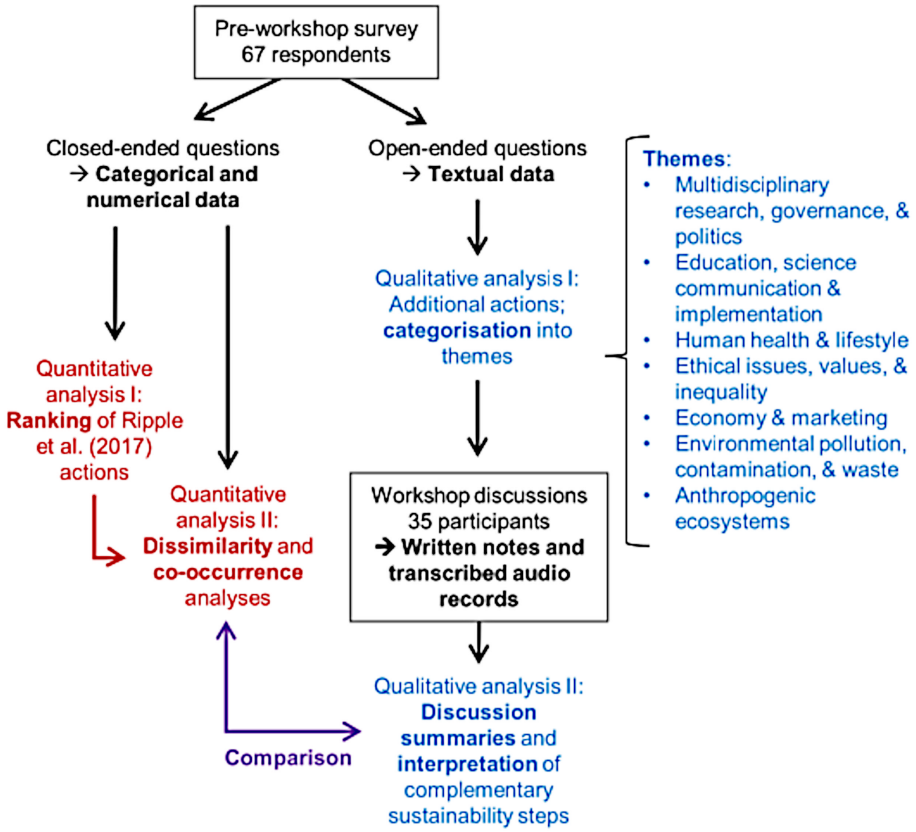
bottom-up approach that is repeatable for other groups of participants. We hope to evoke broader discussion on ways to advance sustainability that combine conservation with cultural, geopolitical, and economic viewpoints.

2 | METHODS

2.1 | Data collection

ECR perspectives were collected through a survey and workshop discussions (Figure 1). In May 2018, a web survey was sent to all graduate students (i.e., doctoral students and year 2018 doctoral graduates) registered to the 5th European Congress of Conservation Biology (ECCB2018; 12th–15th of June 2018, Jyväskylä, Finland). The survey included four questions on each respondent's background (details in Supporting Information). Next, Ripple et al.'s (2017) thirteen sustainability actions were provided and the respondents were asked to choose the three most important actions, from their own perspective (see Figure 2). The respondents could also suggest additional actions and write comments.

Preliminary results from the survey data were derived prior to the workshop. The respondents' background information was summarized, and the textual answers were thematically grouped by two organizers. The resulting seven themes were given preliminary headings in order to provide a basis for group discussions in the workshop (Table S1). A participatory workshop was held at ECCB2018 in which 35 participants further discussed how a change towards a more sustainable world could be supported. The workshop was divided into three rounds of 20 min group discussions with 3–7 people in each group. With each new round, the participants changed groups and chose one of the seven themes. The participants were advised to "consider new and practice-oriented ideas for moving towards a more sustainable world as researchers" relevant to the allocated theme. Participants provided written notes about the proposed ideas and solutions answering the question: "What should ECRs avoid, be careful about, and focus on while continuing their scientific careers with the aim of guiding or advancing sustainability?" Theme-wise survey responses were provided as printouts to be used as starting points for the discussion, if needed. After the final discussion round, each group



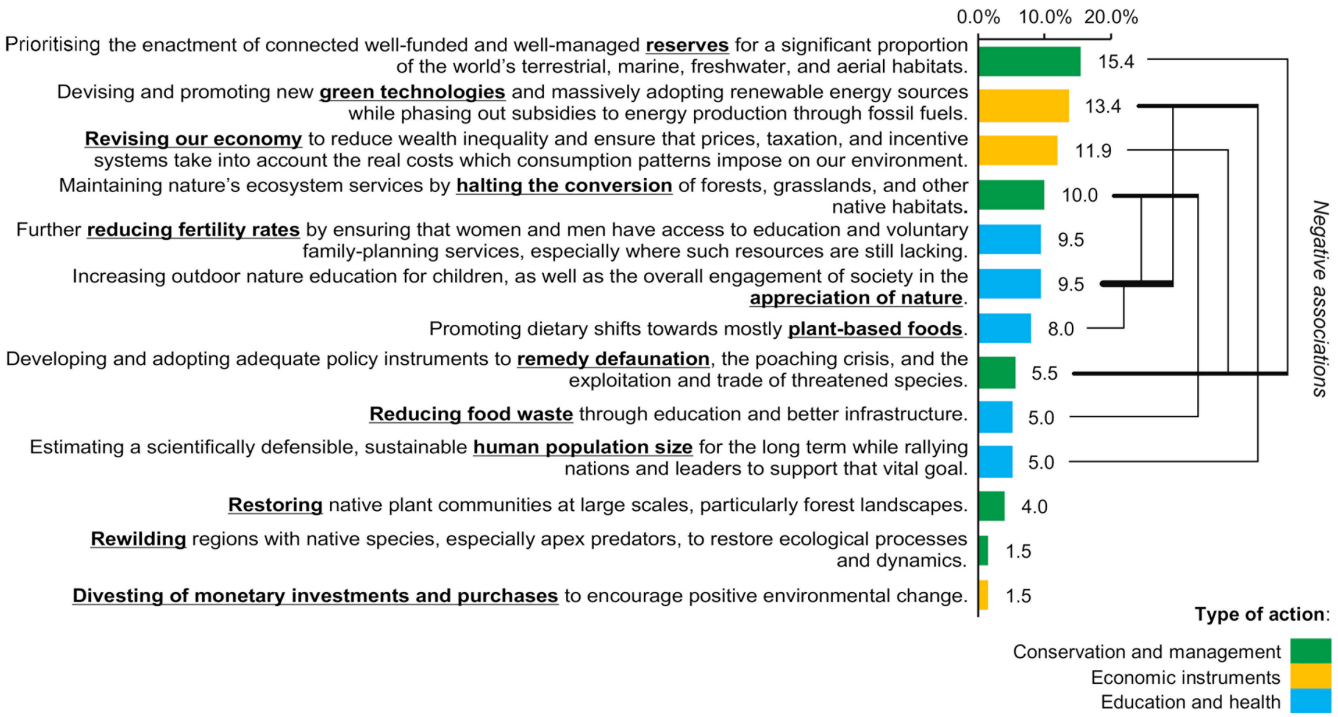


FIGURE 1 Flowchart describing the mixed-methods approach used in this study. The research process started with a quantitative scrutinization of known sustainability actions as presented by Ripple et al. (2017) (on the left side of the figure). In parallel, emerging complementary steps towards sustainability were investigated qualitatively (on the right). Detailed descriptions of data collection, the data, and analyses are available in Supporting Information

FIGURE 2 The perceived importance of Ripple et al.'s (2017) 13 actions towards sustainability as ranked by survey respondents ($n = 67$). The bars show the percentage of votes given to each action, with each respondent having voted for three actions. Bars are categorized into three main action types by the authors of the current article. Seven pairs of actions were rarely prioritized together, indicating resistance among certain actions. These non-random negative associations are shown with line connectors. The width of the horizontal line signifies the number of negative associations (3, 2, or 1; from the thickest to the narrowest lines, respectively) for the corresponding action. The vertical lines connect the resistant actions to each other

provided a short summary of their current theme, based on the available material produced during all discussion rounds.

The workshop outcomes were documented for qualitative analysis by collecting and photographing the written notes, and by audio-recording the summaries, with the informed consent of the participants. All participants were given the opportunity to contribute to the qualitative analysis of the workshop documentation and the writing process of the current paper. Data collection and analyses were conducted in accordance with the European Code of Conduct for Research Integrity (ALLEA, 2017), the Ethical Principles of Research with Human Participants in Finland (TENK, 2018), and the recommendations of the General Data Protection Regulation. The Ethical Committee of the University of Jyväskylä assessed on September 5th 2019 that the current study does not require an ethical review and statement of the committee.

Both the surveyed action rankings and the workshop documents were examined, and we refer to the survey and workshop contributors as "respondents" and "participants," respectively. As most authors took part in the survey and all attended the workshop, derived arguments are discussed in the first-person.

2.2 | Quantitative and qualitative analyses

We conducted quantitative analyses to find potential patterns within Ripple et al.'s (2017) actions as ranked by the survey respondents. We calculated the average dissimilarity among the selections by computing a matrix of pairwise dissimilarities using the function *vegdist* of the *vegan* package for R 3.5.0 (Oksanen et al., 2018; R Core Team, 2018), and then calculated the average over unique pairs of rankings. Furthermore, we tested non-random co-occurrence of the actions with the function *cooccur* from the *cooccur* package (Griffith, Veech, & Marsh, 2016). The output of this method indicates whether certain pairs of actions co-occurred in the rankings significantly more or less frequently than expected.

We analyzed the content of the qualitative material, that is, textual survey answers, transcripts, photographs, and theme-specific notes, under the workshop themes (following Holliday, 2007; Elo & Kyngäs, 2008). Groups of 3–5 authors read through the material and documented analytical thoughts, interpretations, and subjective summaries of the textual data as additional writing. We produced concise summaries of each theme, using three guiding questions to derive and explore each of the topics: (1) Which global perspectives emerged that are not acknowledged by "World Scientists' Warning to Humanity: A Second Notice?", (2) Which topics should conservation science focus on and how should the research be carried out?, and (3) What is the role of researchers in the future? Details on the analyses are included in Supporting Information.

Finally, the findings were drawn together by detecting key steps that complement Ripple et al.'s (2017) action list. The emergent framework of sustainability steps was organized in relation to the workshop themes and according to a varying level of reformism or radicalism. We utilized the leverage points framework (Abson et al., 2017; Meadows, 1999) to relate our results to existing theoretical literature on sustainability interventions.

3 | RESULTS

3.1 | Survey: Prioritization of the known sustainability actions

A total of 68 respondents (out of 139 graduate students that had registered to ECCB2018) contributed to the survey. One respondent was removed, as they did not meet the criteria of an ECR, leaving a response rate of 47.9% ($n = 67$). A total of 54% of respondents had received or anticipated to receive their doctorate either in 2018 or 2019, with others planning to graduate later (summarized in Figure S1). Of the respondents, 76% had a natural sciences background, 9% a social sciences background, and 15% a multidisciplinary background. The mean age of the respondents was 30 years (min. 24, max. 44 years, $n = 67$).

All actions received votes in the survey (Figure 2). Yet there were differences in their relative support, as exemplified by the following comment: "All 13 actions humanity can take to transition to sustainability are relevant. However, we should primarily prioritize the most achievable rather than the most important ones" (respondent 32). Although the respondents used different logic in their rankings, the two most valued actions represented a more conventional course, with the first being establishing reserves and the second being promoting green technologies. The third most valued action encouraged revising the economy.

Based on pairwise comparisons, the respondents prioritized different combinations of actions. The co-occurrence analysis further revealed that, on average, any two respondents prioritized one shared action, but prioritized the other two actions differently (respondents dissimilarity = 0.69). The majority of pairwise associations followed a random pattern. However, seven pairs of actions occurred together significantly less frequently

than expected (Figure 2, Figure S2). For example, supporting appreciation of nature was rarely voted together with actions on green technologies, halting habitat conversion, or promotion of plant-based foods.

3.2 | Workshop: Discussions of individuals' actions towards global systemic change

The aim of the workshop was to develop sustainability steps that extend beyond the actions listed in the survey. The emergent key topics are presented in Figure 3, where they are included into a multi-tier framework of proposed steps. Most of the steps covered multiple levels of agency (individual, discipline, and global), which is illustrated in Figure 3 and exemplified by selected excerpts in Table S2.

The starting point of the workshop discussions was the concern over environmental degradation and the urgent need to find solutions to global problems, namely biodiversity loss, climate change, and pollution and waste issues. The identified changes were seen as resulting from deeper systemic processes. Participants connected the measurable degrees of global warming (a parametric system character) to drivers on the levels of systemic feedbacks, design, and intent, such as people's lifestyles, transport, and consumerism (Figure 3). Acting upon the root causes was also discussed to decrease waste through minimizing consumption: "There is a big demand on buying less, promoting people to buy less" (excerpt from a thematic summary).

In general, participants encouraged several individual-level steps, including favoring sustainable, durable, and local products, having fewer or no children, having fewer pets, reducing flying and other carbon-heavy modes of transport, increasing the use of digital communication, and enjoying nearby nature. The synergies between human and ecosystem well-being were highlighted. An overall equalization of ecological burden resulting from people's lifestyles was called for, taking into account the impacts of per capita consumption and population growth, which were seen as important parameters of global change.

Pro-environmental choices were seen to be encouraged by an environmentalist attitude that builds on scientific knowledge, and participants strongly advocated for additional training and better resources in science communication. Participants further pointed out that educational reach in environmental matters should go beyond family planning education for adults and outdoor nature education for children. Participants called for everyday learning experiences that would support individuals in building a personal relationship with nature, and noted

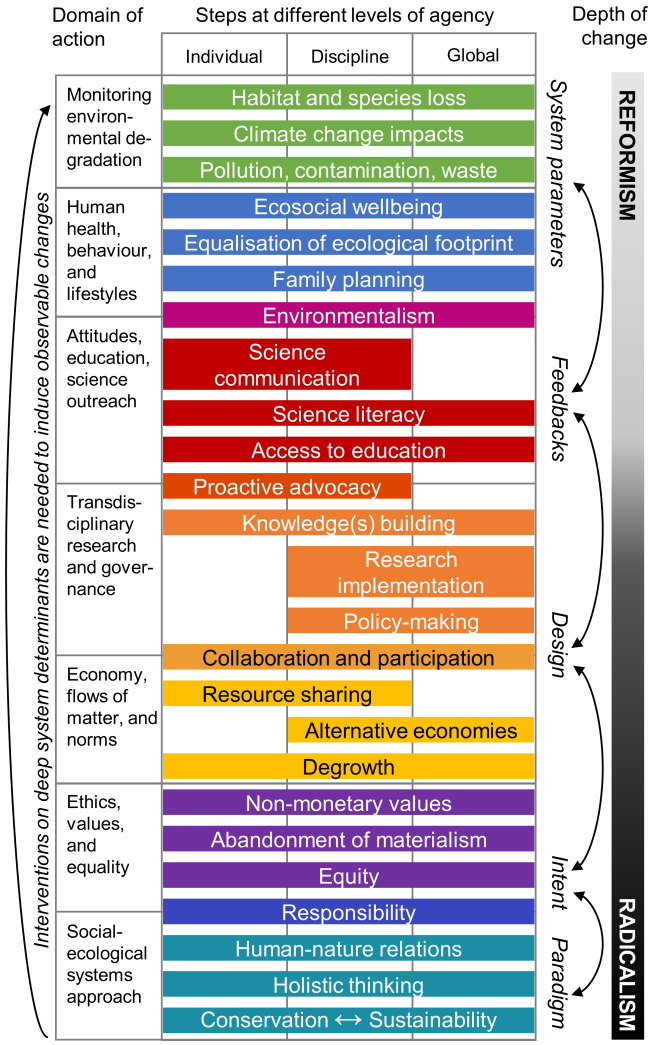


FIGURE 3 The sustainability steps emphasized in the ECR workshop (colored bars). The broad discussion themes are shown on the left side of the figure as domains of action. The columns in the middle section show the three levels of agency utilized in the qualitative analysis. The width of the colored bars indicates the applicability of each step in relation to the levels of agency, which were found to be interconnected, as interpreted from the discussions. Some of the steps lie at the border of intervention domains, illustrating thematic overlap in discussions. At the right-hand side, the continuum from reformism to radicalism is depicted together with corresponding categories of shallow to deep system characteristics (*italicized*; according to Abson et al., 2017), according to which the steps are ordered. Many reformist interventions, such as monitoring of species extinction rates, target shallow system properties (e.g., parameters) and are incapable of causing real change in factors driving the system behavior (intent, paradigm). Yet reformist steps combined with more radical ones may launch cascading effects on the system, which is implied by the double-headed arrows

that the opportunity to develop nature connectedness should be provided for people independent of their background: "It should be normal to get nature education, or

when you do it in your spare time [...] like, you should not feel being weird for going out watching the birds. We really have to think how we can mainstream doing things in nature" (excerpt from a thematic summary).

Conflicting opinions began to emerge when discussions moved into the realm of governance and politics. All workshop participants called for more effective implementation of scientific findings but differing approaches were suggested. Some participants argued that the science community should directly advocate for evidence-based policies to guide or restrict human behavior. Other participants noted that this call for an increasingly larger political role for conservation scientists challenges the aspiration to neutrality and objectiveness as the fundamental basis for credible science, and defended a more traditional, advisory way for scientists to inform society. In addition to proponents of natural scientific evidence, there were participants that valued local and traditional knowledge and highlighted the inclusion of communities, Indigenous peoples, and marginalized groups. These latter participants considered that conservation scientists need to be open to a multiplicity of worldviews, within conservation and beyond. They described research implementation and policy-making as delicate processes of finding common ground among scientists, decision-makers, and stakeholders, to enable more proactive approaches to solving environmental issues. After the challenges of research outreach and implementation were laid out, concerns arose about the realistic possibilities to engage in this complex process: "How can we actually get involved in the society, communicate our science, talk to or get involved with decision-makers and everything, when we are always running out of funding?" (excerpt from a thematic summary).

The overall work burden of individual researchers was seen as highly demanding, including both the actual research and outreach-related tasks. Job security, resource sharing, and increased collaboration were presented as potential solutions. Participants recognized that, to embrace the multiplicity and complexity of both ecosystems and societies, collaboration between disciplines and with people from different social and cultural backgrounds is required. Some participants voiced concerns about the lack of an analytical understanding of values, emotions, thoughts, and motivations that encourage conservation. They considered that collaboration with psychological and social sciences is a prerequisite for advancing sustainable coexistence with nature.

Most participants felt they lacked training in social sciences and humanities, pointing out that the current academic system still does not sufficiently encourage crossing disciplinary boundaries. More cautious accounts were also given. For example, it was argued that "multidisciplinarity should not be the goal, it should be a tool" (excerpt from a thematic summary). Some participants stressed that the type of research that is needed differs from traditional conservation science by being simultaneously multidisciplinary, participatory, and holistic: in practice, they referred to transdisciplinary research. It was acknowledged that transdisciplinarity may have an analytical cost due to the broadness of its scope, and that unidisciplinary research remains indispensable as it allows researchers to study certain phenomena in greater depth.

A consensus was again achieved when systemic intent was discussed. Intent is defined as the emergent direction or trajectory according to which a system of interest is oriented (Abson et al., 2017). The participants identified economic growth and the culture of self-interest as widespread driving forces in developed societies and saw them as problematic. People's obsession and right to continue exploiting and overconsuming natural resources was questioned. Several participants repeatedly said that continuing with "business as usual" is not an option: "We cannot live in a more sustainable world in this current economic system. Basically, we need to disconnect from the idea of capitalism and growth as one of the main achievements in our lives" (excerpt from a thematic summary).

The current neoliberal market economy, which builds on capitalism and continuous growth in supply and demand, was heavily criticized for exploiting ecosystems and maintaining inequality. Many participants placed the responsibility of the environmental crisis on wealthy countries, which have benefited the most from economic growth and globalization. They called for economic and social equity, both within and between countries. It was also considered important that developed and developing countries' perspectives be addressed in the quest for sustainability. Some participants warned that the sustainability agenda is not harmless by pointing out that "sustainability may be a source of inequality, so that only some people can afford to be sustainable and others cannot" (excerpt from a thematic summary). There were arguments that wealthy countries should not restrict less affluent countries' possibilities for economic development and social improvement, as reducing inequality and achieving an environmentally sustainable economy would benefit conservation efforts. Some participants insisted that the main costs of conservation efforts should be borne by developed nations, and that the implementation of conservation actions should not jeopardize improvements in well-being in developing countries.

Amongst the discussions, the participants expressed ideas on how people and nature are connected, and how sustainability and conservation actions are tied together.

The systemic view of social–ecological interactions was distinctive: "There was a debate [...] about whether to consider nature and humans together or to consider a complete separation of humans and nature, the latter of which we considered to be impossible. [...] We saw most if not all ecosystems as under anthropogenic influence, for example indirectly by pollution and climate change" (excerpt from a thematic summary). The nexus between people and nature was seen as central in all aspects of the global environmental crisis, and the responsibility to take action in order to achieve both ecological and social improvement was brought up as spanning all social levels, from individuals to the global population.

4 | DISCUSSION

4.1 | Multiple views on how to achieve sustainability

The variation seen in both the survey respondents' and the workshop participants' accounts suggests multiple views on how to achieve sustainability. They were not, however, exclusionary. Instead, this multiplicity can be seen as a strength, given that the conservation community benefits from learning of and reconciling differing perceptions (Bennett et al., 2016, 2017). Value plurality among conservation professionals seems to be widespread, and our finding on survey respondents prioritizing different combinations of sustainability actions despite having fairly uniform backgrounds is in line with earlier studies (e.g., Sandbrook, Fisher, Holmes, Luque-Lora, & Keane, 2019; Sandbrook, Scales, Vira, & Adams, 2010). This multiplicity is likely underlaid with differences between individualism and collectivism, ecocentrism and anthropocentrism, and intrinsic and utilitarian valuations of nature, which have a long and acrimonious history in conservation (Sandbrook et al., 2019; Soulé, 1985; Vucetich, Bruskotter, & Nelson, 2015). Similarly, the workshop participants held multiple views regarding the role of scientists and the kinds of changes they ought to be advancing. This, too, reflects wider debates within the field of conservation that have led to confrontations between the legacy of natural sciences and people-oriented conservation approaches, which emerged in the 1990s (Doak, Bakker, Goldstein, & Hale, 2014; Holmes, Sandbrook, & Fisher, 2017). Our results support the conclusion that conservation practitioners differ in their values and opinions in relation to their work, while sharing the goal of conserving the diversity and functions of nature.

The common goal of conservation was reflected in the respondents' tendency to prioritize counteracting biodiversity loss and climate change. Deterioration of biosphere integrity and climate change is acknowledged as the two key human perturbations that can destabilize the global Earth system (Steffen et al., 2015). Many respondents viewed reserves as a primary action towards sustainability (Watson, Dudley, Segan, & Hockings, 2014). This reflects a "traditional conservation" approach, which is connected to a science-led, ecocentric worldview and values nature for intrinsic reasons (Doak et al., 2014; Sandbrook et al., 2010; Sandbrook et al., 2019; Vucetich et al., 2015). The establishment of reserves is complemented with halting the conversion of natural habitats, an action directly targeting one of the main drivers of biodiversity loss (Newbold et al., 2015). Regarding climate change mitigation, the emphasis on green-tech innovation and renewable energy reflects the technocentric pathway taken by the sustainable development agenda since the Millennium Ecosystem Assessment (2005) and the global financial crisis of 2007–2008 (Kallis et al., 2012; Mol, Sonnenfeld, & Spaargaren, 2009), and is a globally growing field of development (Adams, 2020). The division into technocentric and ecocentric environmentalism has long roots (e.g., Adams, 2020) and we suspect this dualism is seen in our data as well. We also observed tendencies towards more people-centered thinking (as did Sandbrook et al., 2010, 2019) in the high rankings of certain economic and social actions, which we discuss later in more detail.

Disagreement among the respondents was observed in negative associations among middle-ranked sustainability actions. For example, we found that respondents who voted for promotion of green technologies rarely prioritized increasing nature appreciation or reducing fertility rates. The disparity in attitudes towards technology has not been brought up in recent studies on conservationists' values (e.g., Holmes et al., 2017; Sandbrook et al., 2010; Sandbrook et al., 2019) but was found to be important for sustainability science ECRs (Rana et al., 2020). As compared to technological solutions, actions strengthening nature appreciation may seem feeble for ECRs trained in natural but not in social sciences (Bennett et al., 2017; Moon et al., 2019). Reducing fertility rates aims for the stabilization of the human population, the growth of which has largely been enabled by technological innovations including the agricultural Green Revolution, and which became a major concern of sustainable development and conservation agendas in the 1980s (e.g., Adams, 2020; IUCN, 1980; Ripple et al., 2017, 2019; Union of Concerned Scientists, 1993). The ecological impacts of population growth were further discussed in the workshop and acknowledged as highly sensitive topics. We return to the subject in the section "Calling for a radical systemic change."

Some participants highlighted that the workshop's collective understanding of the complexity of population growth and other global issues remained limited due to a lack of the input and perspectives of knowledge holders in developing countries. This limitation is true and our results are not representative of all ECRs, yet we hope our work can spark further discussion.

4.2 | Reformist steps are needed to launch the sustainability transition

Most of Ripple et al.'s (2017) actions are reformist, taking place within or proposing revisions to the current politico-economic system and its structures. This view also applies to many of our workshop discussions. We identified adopting and encouraging sustainable lifestyles in developed societies as an important element for the reformist pathway to sustainability. Participants discussed several individual-level and local actions that included shifting consumption to plant-based foods and family planning, as suggested by Ripple et al. (2017), and emphasized synergies among downshifting, individual well-being, and a healthy environment. A key aspect of the discussions was reducing the ecological footprint of the Western lifestyle by changing behavior and individual choices (Figure 3). Downshifting and experimentation with non-capitalist practices seem to be surprisingly widespread and could pave the way for sharing-based economic cultures (Kallis et al., 2012). Yet we recognize that not all people have equal opportunities or the will to make pro-environmental decisions in their lives. Even the most privileged and knowledgeable individuals fail in this, including those within the conservation field (Balmford, Cole, Sandbrook, & Fisher, 2017). The barriers of behavioral change are considerable and we argue that they are often tied to deeper systemic structures and goals such as cultural values and norms, access to resources and information, and contradictory policies.

The workshop revealed a narrative of scientists as experts guiding societies towards a sustainable path, participating in science communication, and providing the necessary advice to help people adopt more sustainable lifestyles—a proposition echoing the reformist sustainable development discourse (Adams, 2020; Dryzek, 2013; Junyent & De Ciurana, 2008). Optimism was identified as an important feature in communication (Swaisgood & Sheppard, 2010; McAfee, Doubleday, Geiger, & Connell, 2019; but see Kidd, Bekessy, & Garrard, 2019). Clarity and realism were also emphasized, as unfounded optimism can be damaging if it leads to denialism of environmental issues (McAfee et al., 2019).

Active participation of citizens, stakeholders, and decision-makers in scientific projects was encouraged, and some participants highlighted the need for action-oriented, transdisciplinary conservation research. Transdisciplinary research integrates not only academic disciplines but also researchers and practitioners, and allows for addressing complexity as an intrinsic feature of many pressing environmental issues (Angelstam et al., 2013). There is increasing acknowledgement of the importance of Indigenous and traditional knowledges in informing sustainability (IPBES, 2019; Wiedmann, Lenzen, Keyßer, & Steinberger, 2020). Although the goals of conservation research and practice have become inevitably linked to the role of people in the environment (Holmes et al., 2017; Rands et al., 2010), true transdisciplinarity that builds on various knowledge types is still relatively rare in conservation science (Holzer, Carmon, & Orenstein, 2018; Rands et al., 2010). Transdisciplinary research requires conservation scientists to open up to profoundly different perspectives, which can lead to challenging philosophical conflicts among research traditions with differing ontologies, epistemologies, and methodologies (Bennett et al., 2016; Chapman et al., 2015; Moon et al., 2019).

4.3 | Calling for a radical systemic change

In addition to the reformist steps, more radical propositions emerged, demanding that the whole societal system needs to be redefined and redesigned to find sustainable solutions to the global environmental crisis (Abson et al., 2017; IPBES, 2019; Meadows, 1999). Both superficial (reformist) and transformational (radical) interventions can contribute to pushing the current system towards desirable change (Figure 3; Abson et al., 2017). Thus, reformism and radicalism are not exclusionary, although they hold opposite positions in their demand for systemic transformation. For example, radical participants encouraged scientists to enter political arenas in a way that goes beyond their reformist role as advisors, reframing conservation scientists as knowledge holders whose perspective is currently underrepresented in policy-making. Adoption of a more active societal role supports the arguments for scientist advocacy (Nelson & Vucetich, 2009) and putting scientists into positions of political power (Dror, 2018). This development is ongoing as many scientists already engage in advocacy and activism when they are supporting, defending, and/or raising public awareness of issues (Parsons, 2016). This view, however, was also criticized for representing scientists as the ones with the ability to hold "true" and legitimate knowledge.

Importantly, the radical pathway to sustainability identified deep social structural issues as the real source of environmental problems. Revising the current economy is at the radical end of Ripple et al.'s (2017) actions, and gained support from those survey respondents who emphasized tackling economic inequality and unregulated production and consumption as being key to solving environmental issues. Radicalism-oriented workshop participants saw current pro-environmental economic measures, like environmental taxation or incentive systems, as insufficient because they ignore the root causes of the global environmental crisis. Such reformist economic instruments have been criticized for failing to address the limits of a growth-based economy (e.g., Pacheco, Altrichter, Beck, Buchori, & Owusu, 2018); instead, they enable the pursuit of growth (Kallis et al., 2012). Thus, the radical framing of sustainability differed from the mainstream sustainable development discourse by demanding the abandonment of growth-based ideology, agreeing with evidence from ecological economics that shows how an unprecedented level of degrowth is necessary in averting climate change and ecological collapse (Kallis et al., 2012). However, such an economic downturn does not necessarily need to be to the detriment of society (Kallis et al., 2012). As participants said, there are also non-monetary values to build societies on which need to be investigated and considered (e.g., equity and responsibility).

Concerns about the impacts of human population growth were raised in the workshop, particularly when accompanied by increasing individual-level consumption and a growing ecological footprint. Possible solutions mentioned by the participants included increasing people's opportunities and will to have less children through family planning and access to birth control. Factors influencing fertility rates were discussed in the context of reformist and radical arguments alike, while participants differed in their level of concern in relation to population growth. In general, the environmental crisis is considered to be driven by population growth, unsustainable use of natural resources, and overconsumption (The Union of Concerned Scientists, 1993; Schramski, Gattie, & Brown, 2015; Ripple et al., 2017; IPBES, 2019). Radical participants linked these drivers also to economic growth and increasing global inequality, and considered that the uneven distribution of power and wealth between individuals, communities, and countries, should be remedied to enable family planning and curb population growth. The situation is complex. Access to birth control continues to be a privilege on a global level, although it is an important tool to restrain population growth. Fertility rates do decline in developing countries but, among highly developed countries, fertility rates can start to increase again despite family planning services (Myrskylä, Kohler, & Billari, 2009). Having children significantly increases an individual's ecological footprint in developed countries (Wynes & Nicholas, 2017), and a growing population supports economic growth on national level (e.g., Adams, 2020). Thus, some participants perceived hypocrisy of the wealthy West in the demand for global population stabilization. They argued that despite the growing populations in some developing countries, it is the less numerous people living in the affluent developed countries that consume the most, driving climate change and biodiversity loss (IPBES, 2019; Wiedmann et al., 2020). These participants made a case for lowering the living standards of the wealthy to transition to sustainability.

Together with a growth-based socio-economy, values and worldviews tied to consumerism were identified as major sources of environmental problems (see Abson et al., 2017; Fischer & Riechers, 2019; Meadows, 1999). Socially constructed perceptions that occur on the individual level are rooted in systemic structures and intentions (Figure 3). Following this logic, some participants linked biodiversity loss to prevailing ideologies resulting in profligate materialism, corruption, and human rights abuses. Radical participants claimed that scientists should reveal underlying paradigms that affect the way people think and social systems function (Abson et al., 2017; Ives & Fischer, 2017). A path away from the dominance of materialism is required, as well as a cross-societal focus and acknowledgement of the dependence of human health and welfare on the health and integrity of nature. Social and economic equality, the democratic core values in sustainability transition, do not fit well with the principles and practices of neoliberal market economy. Therefore, alternative economies based on resource sharing and degrowth, coupled with the avoidance of every kind of inequality within and between countries, should be sought for.

4.4 | A crossing of reformist and radical pathways

With the focus on linking conservation and global sustainability, we highlight a growing need for change within societal values, mainly in the Western developed countries. We, a group of ECRs, believe that there is potential to advance the inclusive co-existence of people and nature. Transforming value systems accordingly comes with many challenges, ranging from global inequality to the changing role of researchers within the sustainability transition. Based on our analysis, sustainability transformation needs to be managed in a just manner, with leadership that is based on collaboration and acknowledgement of the impacts people's mindsets

and actions have on nature. We need to holistically reconsider the ecological footprints of our lifestyles and societies using a transdisciplinary research approach.

We detected confluences between the reformist and radical approaches to sustainability. The workshop discussions invoked the paradigm of social-ecological systems, which sees human societies and ecosystems as intertwined (Folke, Hahn, Olsson, & Norberg, 2005; Holzer et al., 2018). Therefore, we argue that true sustainability can only emerge from a holistic system change that builds on a range of interacting steps operating on different scales, and conservation science can contribute to such sustainability transformation if a broader variety of views and research methodologies is adopted (Bennett et al., 2016, 2017). In practice, it is necessary to improve societal understanding of sustainability and its implications. This includes informing people of the lack of a universal causality between human well-being and the consumption of goods and services, and promoting acceptance of pro-environmental degrowth economies (Kallis et al., 2012). In addition to education, people base their behavior on various information sources together with social, cultural, and psychological factors (Balmford et al., 2017; Cinner, 2018; Swaisgood & Sheppard, 2010), among which environmental emotions play a crucial role (Carmi et al., 2015). Also, cognitive biases and social influence have complex effects on pro-environmental behavior (Cinner, 2018). As the effectiveness of education and public awareness was questioned by some participants, regulatory policies, either reformist or radical, were also proposed to steer the sustainability transition.

Research on multi-level social-ecological interactions is crucial in facilitating the sustainability transition. Our findings suggest that ECRs with a conservation background identify also with elements of critical social science (e.g., Massarella et al., 2021), showing a deep level of transdisciplinary awareness. Considering researchers as active practitioners and members in communities, the participants acknowledged a merging of researchers' professional, political, and private lives. They further argued that researchers have a moral obligation to act in all domains, while actively mobilizing people around them (as do Nelson & Vucetich, 2009). A discourse of responsibility for humanity's impact on Earth, ranging from the individual to the global level, was independent of the degree of reformism or radicalism. We argue that the idea of responsibility encourages action, and it can empower future conservation researchers to advance sustainability beyond the current practices. The steps that lead to deep changes pave multiple pathways towards sustainability, and even the reformist paths become more radical as the transition proceeds. We, a group of ECRs, invite others to join the journey towards radical systemic transformation.

ACKNOWLEDGMENTS

The authors thank Florence Damiens, Stefanie Heinicke, and Peter Kullberg for their valuable input, and the reviewers and editor for their constructive feedback. R. A. O. was supported by the James S. McDonnell Foundation and an NSERC Discovery Grant to J.A. Hutchings; J. S. P. F. by the Biotechnology and Biological Sciences Research Council; J. M. M. and M. G. B. by Australian Government Research Training Program Scholarships; M. G. B. by a Swedish Research Council Formas Mobility Grant (2020-02293); E. N. and L. M. by the Kone Foundation; N. B. by "la Caixa" Banking Foundation; J. P. by the Finnish Cultural Foundation; P. A. A. by the Emil Aaltonen Foundation; and M. B. by the Deutsche Forschungsgemeinschaft (DFG), as part of the GRK 2123/1 ConFoBi.

CONFLICT OF INTEREST

There are no conflicts of interest to disclose.

AUTHOR CONTRIBUTIONS

Conceptualization of the research was done by Kaisa J. Raatikainen, Jenna Purhonen, Tähti Pohjanmies, Maiju Peura, Eini Nieminen, Linda Mustajärvi, and Ilona Helle. All authors were involved in data collection and analysis, participated in the writing process, and provided comments to the revised versions of the manuscript. Kaisa J. Raatikainen organized the overall workflow and curated the data. Kaisa J. Raatikainen and Yara Shennan-Farpón crafted the visualizations of the results. Kaisa J. Raatikainen and Jenna Purhonen carried the main responsibility of revising and editing the manuscript.

ETHICS STATEMENT

Data collection and analyses were conducted in accordance with the European Code of Conduct for Research Integrity (ALLEA, 2017), the Ethical Principles of Research with Human Participants in Finland (TENK, 2018), and the recommendations of the General Data Protection Regulation. The Ethical Committee of the University of Jyväskylä assessed on September 5th 2019 that the current study does not require an ethical review and statement of the committee.

DATA AND SUPPORTING INFORMATION

Description of methodology and anonymized data informing this article are available as Supporting Information.

ORCID

Kaisa J. Raatikainen https://orcid.org/0000-0002-3099-8962

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Raatikainen, K. J., Purhonen, J., Pohjanmies, T., Peura, M., Nieminen, E., Mustajärvi, L., Helle, I., Shennan-Farpón, Y., Ahti, P. A., Basile, M., Bernardo, N., Bertram, M. G., Bouarakia, O., Brias-Guinart, A., Fijen, T., Froidevaux, J. S. P., Hemmingmoore, H., Hocevar, S., Kendall, L., … Ziemacki, J. (2021). Pathways towards a sustainable future envisioned by early-career conservation researchers. *Conservation Science and Practice*, *3*(9), e493. https://doi.org/10.1111/csp2.493