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RESEARCH ARTICLE

Awareness and use of the Society for Ecological Restoration's International Principles and Standards for the Practice of Ecological Restoration in Canada

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The Society for Ecological Restoration (SER) published the second edition of its International Principles and Standards for the Practice of Ecological Restoration in 2019. We conducted a pan-Canadian study using semi-structured interviews with restoration professionals to explore the extent to which restoration practitioners are aware of the document and use it. Overall, we found that direct uptake of the document by practitioners was lower than expected, with approximately 37.7% of all participants that were both aware of and consulting the publication for guidance in their practice of ecological restoration. This is due in part to low awareness of the document itself, with only a small majority (56.5%) of interviewees being aware of it. Other reasons listed by practitioners such as the structure of the publication, its added value, and its suitability for on-the-ground work revealed why some individuals aware of the existence of the document still failed to consult it. Here, we present a more nuanced assessment of these observations and share our findings with the ecological restoration community to address this disconnection. With intensifying pressures to achieve restoration success internationally, SER's guidance is critical. We analyze why it seems guidance from SER is not being taken up as fully as it might, and ways in which future versions may be improved.

Key words: adoption of principles, professional practice, restoration community, standards

Implications for Practice

- Standardized guidance for ecological restoration should be accessible to everyone engaging with the work, regardless of level of training or familiarity with the discipline.
- Principles and Standards for ecological restoration should be concise, flexible, and allow for integration of all activities conducted under the restoration spectrum.
- Additional efforts should be undertaken to evaluate how best to disseminate this guidance to people engaging with ecological restoration.
- Communication regarding the added value of this publication should express how its application would go beyond integrating existing concepts.

Introduction

Given the rate at which human activity has increased over the last century (Steffen et al. 2015), simply preventing further environmental degradation is insufficient considering the extent of change across habitats and ecosystems (Vitousek et al. 1997). The time is now to focus efforts on recovering the structure and function of degraded ecosystems (Jones et al. 2018; Perring et al. 2018; Cross et al. 2019). Indeed, the United Nations (UN) just launched the Decade on Ecosystem Restoration (https://www.decadeonrestoration.org/), and while concerns were raised about its implementation (Cooke et al. 2019), it nonetheless provides an important impetus to restoration efforts (Young & Schwartz 2019). The inherent urgency of addressing the biodiversity crisis and ecosystem degradation (Ripple et al. 2017) in a manner that encourages adaptive capacity in the face of climate change (Harris et al. 2006), combined with limited resources for restoration (Holl & Howarth 2000), means that restoration efforts that fail are costly in many ways (Suding 2011; Perring et al. 2018). And the failures are rather

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common (Hilderbrand et al. 2005) despite relatively few efforts to assess restoration success (Wortley et al. 2013). Even when projects declare that they were "successful," the basis for that success is often unclear and subjective such that the validity of that success is unknown (Zedler 2007). Accordingly, and despite repeated commitments to ecological restoration (Suding et al. 2015; UN Decade on Ecosystem Restoration), it is essential that restoration investments achieve their intended outcomes (Cooke et al. 2018).

Ecological restoration is most effective when conducted in a systematic manner—from planning to execution to monitoring (Nilsson et al. 2016)—ideally embedded within a conceptual framework that is inclusive of multiple knowledge sources (Hobbs & Norton 1996). The Society for Ecological Restoration (SER) has played an instrumental role in creating a community with common interest in the science and practice of ecosystem restoration. To support practitioners in restoration the SER developed a primer on ecological restoration (see SER 2004). The primer was a useful document but had some limitations (see Hallett et al. 2013; Shackelford et al. 2013), and various jurisdictions created separate guidance. For example, in 2008 Canada released the first nationwide "principles and guidelines" for restoration in the world (Parks Canada and the Canadian Parks Council 2008). This document informed a major program to support and recover ecological integrity in Canada's national parks and protected areas. The guidance was developed to support on-the-ground restoration, recognizing the diversity of ecosystems and administrative and governmental requirements. The three core "Canadian principles"—effective, efficient, and engaging—were adopted for the first international guidance on restoration jointly developed by SER and the World Commission on Protected Areas in 2012 (Keenleyside et al. 2012).

Meanwhile, and after much effort and debate (Gann et al. 2018; Higgs et al. 2018*a*, 2018*b*), SER's Primer was reborn initially in 2016 (McDonald et al. 2016) and later in a significantly revised second edition as the "International Principles and Standards for the Practice of Ecological Restoration" (hereafter "Principles and Standards"; Gann et al. 2019). The document is intended to serve as a contemporary framework for restoration projects to achieve intended goals. The standards are underpinned by eight principles that anchor ecological restoration, which derive in part from the Keenleyside et al. 2012 international restoration guidance. By all accounts, this Principles and Standards document is intended to be a key resource to support those engaging with ecological restoration worldwide. Two years after the document was published it has been cited over 300 times (according to Google Scholar on 20 December 2021), although that presumably fails to reveal the extent to which it has actually been consulted and embraced by practitioners who are unlikely to publish findings in peer reviewed outlets. In Canada, restoration scientists and practitioners have been active in restoration of the diverse ecosystems in this large nation, from deserts to tundra, temperate rainforests to vast boreal forests, extensive coastlines to freshwater lakes, marshes to peatlands, prairies to mountains. Canadians have also been active as leaders in the SER, hosting several international conferences, and contributing to international scientific research on restoration. To that end, we interviewed restoration professionals in Canada and asked them about their knowledge and habits related to the consultation of this document.

Methods

Method Selection

Significant information on ecological restoration is not readily available in databases or peer-reviewed publications as many restoration professionals share their knowledge through informal networks (Cabin et al. 2010). Semi-structured interviews are a technique within mixed-methods research that allows to capture information which may not be found in traditional publishing outlets (McIntosh & Morse 2015). This method uses a mix of closed and open-ended questions to build a dialogue with participants that enables researchers to gather more in-depth information on a particular subject (Brown & Danaher 2019). Semi-structured interviews were shown to be more engaging and facilitate communication between the interviewer and participants, while also providing avenues to explore potentially unknown issues (Adams 2015; O'Keeffe et al. 2016). As such, we selected this method to capture nonacademic knowledge about restoration work underway in Canada, current resources and gaps, and perceptions of best practices and opportunities.

Participant Selection and Interview Structure

Semi-structured interviews were conducted with restoration professionals between October and December 2020. Participants were adults and were selected based on a minimum of 5 years of relevant professional experience with ecological restoration science, practice, or policy in Canada. Initial recruitment was based on purposeful sampling (Gentles et al. 2015; Palinkas et al. 2015) of a diverse group of key informants. Those interviewees were queried for suggestions of other individuals to contact. The total sample size of this study was 69 participants (response rate of 81% for all individuals contacted and a participation rate of 87% for all individuals who responded to our invitation). Both sample size and response rate were assessed as adequate to allow for data saturation for a qualitative study of this type given the conditions, scope, and design of the study (Kelley et al. 2003; Morse 2015; Malterud et al. 2016). Informed consent was obtained from all participants included in this project and all procedures performed in this study were in accordance with the ethical standards of the University of Victoria Human Research Ethics Board (approved protocol number 20-0398; see Supplement S1).

The interview process consisted in a pre-interview questionnaire for demographic data collection, along with the main interview itself containing 14 questions divided into four themes addressing both policy and practice aspects of the discipline (see Supplement S2). The interviews lasted approximately 60 minutes per participant and were conducted in either of Canada's two official languages, English and French. All interviews were conducted remotely due to restrictions imposed by the COVID-19 pandemic. In this article, we only report findings

specific to our objective that arose from asking the following question: "At the end of 2019, the Society for Ecological Restoration published the second edition of its International Principles and Standards for the Practice of Ecological Restoration. Are you aware of this document, and have you consulted it?"

Data Analysis

Interview audio files were imported into the Otter.Ai transcription software and manually corrected for accuracy. Corrected transcripts were then imported into the ATLAS.ti software for content analysis. A coding scheme was developed, whereby emerging themes were organized based on a combination of deductive and inductive approaches (Hsieh & Shannon 2005; Elo & Kyngäs 2008). Transcripts were segmented into data units in a conceptual manner, which allowed for individual lines or sentences to be grouped together based on their overall narrative and the cohesiveness of proposed ideas (O'Connor & Joffe 2020). Coding was performed until data saturation, when themes were fully developed and no new codes would emerge (Corbin & Strauss 2008; Fusch & Ness 2015). A hierarchical coding frame was adopted to organize the codes based on their relationship with one another and facilitate the development of a thematic narrative (Fig. 1).

Intercoder reliability (ICR) was performed by two coders on a sample of the interviews (n = 11, 15%) for the specific interview question that was analyzed. ICR was assessed using Krippendorff's alpha test (Hayes & Krippendorff 2007), and was determined to be relatively high ($\alpha = 0.8805$).

Results

Sample Characteristics

A total of 69 participants (38 males, 31 females) were interviewed from nine Provinces and two Territories in Canada. A considerable number of interviewees originated from Western Canada, in particular British Columbia ($n = 24$, 34.8%). Most of the participants worked in three sectors: Environmental Non-Governmental Organizations (ENGOs) (n = 26, 37.7%), government (n = 22, 31.9%), and private industry (n = 16, 23.2%). Common roles they occupied within their respective organizations were focused on program management (n = 22, 31.9%), direction and supervision (n = 13, 18.8%), and fieldwork (n = 11, 15.9%). Participants were highly educated and quite experienced: a majority had obtained a master's degree (n = 36, 52.2%) and on average had been working in the field of ecological restoration for 17 years (SD = 11 years). However, most interviewees had not completed specialized training in ecological restoration (n = 53, 76.8%) and did not belong to any ecological restoration society prior to participating in the interview (n = 39, 56.5%). Table 1 outlines demographic information collected from all study participants.

Awareness and Consultation of SER's International Principles and Standards

Participants were asked if they were aware of SER's International Principles and Standards for the Practice of Ecological Restoration document, and if yes, had they consulted it since its publication in 2019. Overall, a small majority of all respondents replied that they were aware of the publication (Table 2, n = 39, 56.5%). Interviewees aware of the publication were given the opportunity to elaborate and comment on its relevance to their own practice and work in ecological restoration. Those responses were first coded into two broad themes: (1) reasons for using the document and (2) reasons why the document was not consulted and adopted. Within this latter theme, two subthemes were developed: (1) issues with the document itself and (2) other reasons which prevented or hindered consultation. Information about code frequency, along with the hierarchical coding framework developed to analyze this question, can be found in Table 2 and Figure 1.

Reasons for Using the Document

Participants identified three main reasons in their use of the publication.

Consistency and Standardization. The most common benefit interviewees attributed to consulting the SER Principles and Standards was the consistency and standardization provided by

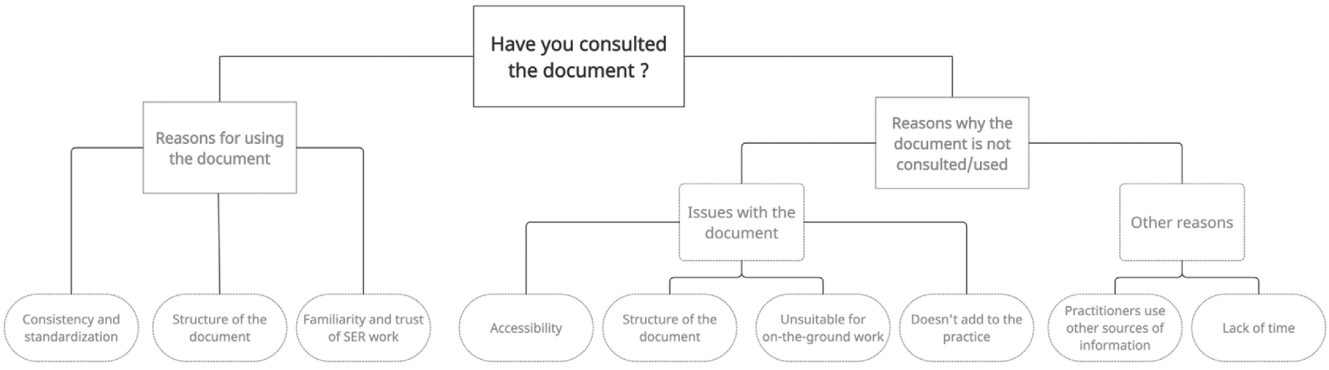

Figure 1. Hierarchical coding scheme for the analysis of participants' use of SER's International Principles and Standards for the Practice of Ecological Restoration.

Table 1. Aggregated demographic variables of interview participants ($n = 69$). [a]Environmental non-governmental organizations. [b]Includes participants working at regional, municipal, provincial, and federal government levels. [c]An organization partially funded by the government while maintaining a level of management similar to the private sector. [d]Refers to training specifically focused on ecological restoration. [e]Denotes membership to a society or group focused on ecological restoration work.

	Frequency	*Percentage (%)*
Province		
Alberta	9	13.0
British Columbia	24	34.8
Manitoba	2	2.9
New Brunswick	3	4.3
Nova Scotia	2	2.9
Northwest Territories	1	1.4
Ontario	8	11.6
Prince Edward Island	2	2.9
Quebec	12	17.4
Saskatchewan	5	7.2
Yukon	1	1.4
Sector of employment		
Academia	3	4.3
ENGO[a]	26	37.7
Government[b]	22	31.9
International	1	1.4
Parapublic[c]	1	1.4
Private industry	16	23.2
Sex		
Male	38	55.1
Female	31	44.9
Role within organization		
Communications	4	5.8
Direction and supervision	13	18.8
Field/technical	11	15.9
Policy/regulations	6	8.7
Program management	22	31.9
Project planning	8	11.6
Research and education	5	7.2
Highest level of education		
No formal training	1	1.4
College/Cégep diploma	3	4.3
Bachelor	17	24.6
Master	36	52.2
Doctoral	12	17.4
Specialized ER training[d]		
Yes	16	23.2
No	53	76.8
Years of experience working in ER		
<10	18	26.1
10–20	23	33.3
20–30	20	29.0
≥30	8	11.6
Number of ER societies/groups participants belong to[e]		
0	39	56.5
1	8	11.6
2	11	15.9
3	7	10.1
4	3	4.3
6	1	1.4

Table 2. Code frequency[a] for participants' awareness, consultation, and perception of the SER document. [a]Frequencies are reported for each theme according to the number of data units (i.e. quotations) coded per theme. [b]Reasons for using or not using the document are based on responses from participants that were both aware and consulted the document and those that were aware but did not consult it (i.e. 39 participants).

	Frequency	*Percentage (%)*
Awareness and consultation ($n = 69$)		
Not aware and not consulted	30	43.5
Aware		
Aware and consulted	26	37.7
Aware but not consulted	13	18.8
Reasons for using the document[b] ($n = 34$)		
Consistency and standardization	23	67.6
Structure of the document	4	11.8
Familiarity and trust of SER work	7	20.6
Reasons why the document is not consulted/used[b] ($n = 123$)		
Issues with the document		
Accessibility	21	17.1
Structure of the document	17	13.8
Unsuitable for on-the-ground work	12	9.8
Doesn't add to the practice	14	11.4
Other reasons that might hinder use		
Lack of time	12	9.8
Practitioners use other sources of information	47	38.2

the document (Table 2). Interviewees stated that the publication provides consistent terminology, concepts, and approaches to restoration across projects and jurisdictions. Several interviewees (5 out of 39, 12.8%) noted that this consistency is particularly important as restoration practice is relatively new and evolving in Canada.

> *"Yes, I think it's very important to have those guidelines because the field is relatively young. It evolves a lot, there are lots of things that are added quite frequently, in terms of concepts, terminology, etc. So I think it's important to know this well".* (Restoration specialist, Federal government, AB)

Within this theme, interviewees also stated that the document provided a useful conceptual and procedural framework to guide their work. From early project development to monitoring, the SER Principles and Standards provide a structure that is helpful for the decision-making process.

> *"The SER standards have been really nice to have, because it just makes sure that we're consistent with what a restoration specialist out of Edmonton or Vancouver would look at and they know what we're talking about".* (Restoration ecologist, Federal government, AB)

Structure of the Document. Some interviewees (4 out of 39, 10.2%) identified that the document codifies and brings a good level of detailed information to a complex field, while also providing a realistic expectation of what restoration organizations are striving for and can achieve in their work.

> *"I think their [principles and standards] are quite realistic and typical of what any agency involved in restoration is trying to achieve"*. (Habitat conservation specialist, ENGO, MB)

Familiarity and Trust of SER Work. Interviewees also stated that their familiarity with SER and the organization's previous publications generated trust in the organization's work and gave them confidence in using the Principles and Standards document. These interviewees (6 out of 39, 15.3%) felt that it was a good working document, as it provided a framework with the potential to provide direction and inspiration for work being undertaken in the field of ecological restoration.

> *"I actually wrote to the UN for ecological restoration [sic]. They were asking people to write in and I said: your best bet is just to follow the guidelines and the primer that they've [SER] set up because of all the experts that have had so much input into it, all of us that have had input into it. I've been a member [of SER] since 1992"*. (Field biologist, Private sector, ON)

Reasons for Not Adopting or Using the Document

Interviewed restoration professionals discussed the following issues which may have contributed to lower consultation rates of the document.

Accessibility. One of the main issues participants expressed about the SER publication revolved around accessibility. Several interviewees (4 out of 39, 10.2%) felt that the document was very North American centered and that it would more likely be embraced by people in wealthy developed nations. One participant noted that developing countries have different and competing priorities, which may not align with the proposed principles. This respondent also described the influence Canadian practitioners and policymakers have on the SER, which may have contributed to its North American focus:

> *"Yeah, I think even though attempts have been made to make it more inclusive, internationally, it still appeals mostly to us in wealthy Western countries. That there's a lot of assumptions in restoration that in other countries that just may not be a priority. They're dealing with so many other social issues or economic development, that restoration work is often minimized in importance, or it only happens with outside investment, maybe from another, from a wealthy, industrialized country. So I don't see it as a limitation or a difficulty for us in Canada. I'm actually more concerned about how it's interpreted in other countries. And Canadians have had an inordinate influence on the Society for Ecological Restoration. We have a lot of people that influence SER"*. (Wildlife stewardship professional, Federal government, BC)

Discussions with participants also brought forth issues with expertise bias, where they felt that the publication was mostly accessible to professionals with a strong background and significant experience in this field, whereas many people who actually participate in restoration work, such as volunteers, community groups, and students, do not have this experience. An interviewee reflected that the target audience for the document was the professional with already-acquired expertise:

> *"It's geared to the professional. And it's geared to a professional that already has a strong background in all how all these other disciplines link together in there and how they do their work"*. (Biologist, ENGO, ON)

Conversations revolving around topics such as inclusivity and the democratization of restoration arose during some of the interviews. In these discussions, participants highlighted that a common vision for restoration should include volunteers and community members who end up doing much of the on-the-ground work:

> *"My concern is the professionalization of restoration, because of the … It's not a bad thing, to set standards and principles and some kind of framework. But I worry that it will lead to professionalization in a sense that's exclusive. And I see so much restoration that's going on in the broad scope of how I view restoration as being by people who won't ever professionalize and shouldn't be forced to professionalize to be able to work"*. (Adjunct professor, Academia, BC)

Structure of the Document. Some of the interviewed practitioners (11 out of 39, 28.2%) commented that the structure of the document may constitute another barrier towards accessibility by a broad audience. Here, an interviewee explained that the length of the document and breadth of presented concepts may be difficult to navigate for the general community of restoration practitioners:

> *"If anything, the new guidelines are more complicated than the older primer on ecological restoration. The primer as some people call it, was a shorter and simpler document. And I think it was*

> *more accessible to a lot of people, because it was short and simple. So the longer and more complicated things get, especially like that restoration wheel concept. I think that starts to get really complicated for people who are not doing this kind of work every day"*. (Wildlife stewardship professional, Federal government, BC)

Participants also highlighted that many publications presenting principles or guidelines for restoration have already been published by different organizations. In these documents, similar terminology is often used, making it difficult for the partitioner to distinguish the benefits of using one publication versus another:

> *"I don't know if it's a problem, or if it's something good, but often there is repetition of the same information under different formats. And this is a really good example of it. There are so many organizations that do their own guidelines, and it's all very similar, but sometimes in terms of communication it's not always optimal. So people ask themselves what's the difference between this one and that one?"* (Restoration specialist, Federal government, AB)

Unsuitability for on-the-ground Work. The practical aspect of the publication was raised by some participants (9 out 39, 23.1%). As the practice of ecological restoration involves interventions to affected ecosystems, its suitability for "on-the-ground" work was addressed by practitioners. One interviewee felt that the document did not meet the needs of restoration workers that were engaging directly with this work:

> *"You know, it doesn't meet the needs of practitioners and if practitioners were involved they'll be like, you guys have never done this work on the ground. It's great that you have this framework, it's not actually practical"*. (Conservation scientist, ENGO, AB)

The issue of applying the principles to concrete situations was further discussed. A participant mentioned that while the SER Principles and Standards document may provide guidance to practitioners on what to consider when initiating a project, it does not actually inform them on how that can be achieved:

> *"But they're principles, they're like motherhood statements. And so, you know, sure, lots of projects are engaging and effective and aiming to be efficient, or at least that they aspire to be those things. You know, honestly, when people ask me or are looking for guidance, they're looking for something much more specific. And so I do point them towards the standards, that document, but I point them towards the specific tables, or the elements that are, you know, are more often what I hear practitioners are looking for and that is, like, okay, I can follow, I can consider climate change in my project, you know, like, that's a principle. But then they're like, well, how do I do that? And then there's nothing in the principles that says how to do that"*. (Ecological restoration specialist, Federal government, BC)

Doesn't Add to the Practice. Another subtheme that emerged during the thematic analysis was the value the SER publication brought to the practice of ecological restoration as a whole. Similarly to previous comments that addressed the repetitive nature of some of the presented concepts, some participants (10 out of 39, 25.6%) felt that they were already engaging in their work with most of the principles described in the document:

> *"I have, I am aware of the document, I have read through it, but I can't say that it's … something that we mmm … I … In reading it, and I didn't feel like we were outside of that, that we were operating outside of those general principles. So it didn't require, you know, continuous consultation of the document"*. (Senior biologist, ENGO, QC)

In this sense, interviewees felt that the publication did not add any new or relevant information to their practice, for which they would see a benefit of continual use:

> *"I'm aware of it. And I might have flipped through it before, or I might have just flipped through a previous version. I remember seeing open standards for ecological restoration, the previous version of it presented at a conference once. But it hasn't struck me as something that would be, would add value to what I do"*. (Forestry officer, Federal government, BC)

Other Reasons which Prevented or Hindered Consultation

Our analysis revealed other reasons, unrelated to the publication itself, which may have contributed to lower consultation rates.

Practitioners Use Other Sources of Information. Lower consultation rates may be explained by practitioners' use of other sources of information to guide their ecological restoration work. A common source of information discussed by participants was the reliance on their own personal expertise and experience. This was a particularly widespread response from restoration practitioners (Table 2), who noted that they relied on personal experience and knowledge acquired from implementing projects and dealing with system-specific issues relevant to their work:

> *"I'm aware of it but no I haven't consulted it. I just got so much experience in the narrow area of my interest that, you know, broader guidelines just aren't, you know, I just don't see the need for them"*. (Conservation biologist, Private sector, BC)

Participants also highlighted their use of basic ecological principles and community partnerships in guiding their restoration work. One interviewee discussed that while the SER publication is useful in providing general information, most often restoration practice is tailored to community and ecosystem needs:

> *"You know, like, it's not like I treat it like some kind of manual or something. It's something that informs what I do, but what I do is guided more by, like I said, whoever owns the land, and whatever the community wants to do. And I'm following basic principles of ecology, right, I mean, that's there. So that's not really an SER guideline. It's just how ecosystems work, and that's what we're looking at"*. (Professor emeritus, Academia, BC)

Finally, reliance on peer-reviewed research was also brought forth by some study participants (5 out of 39, 12.8%) both in terms of restoration practitioners working in the field as well as policymakers. Interviewees trusted in academic research to supply information needed for specific projects:

> *"You can't [read everything] I mean, it's like when you're making on the, on-the-ground decisions, and particularly in forest management like that, peer review research is what you go to immediately. That's going to give you the answers that you want that are site specific"*. (Executive director, ENGO, NS)

Lack of Time. A final reason provided by restoration professionals in this study that may have had an impact on consultation rates was lack of time. This reason is not related to the document itself, but more to the demands of the practice, that often leave practitioners struggling to meet competing deadlines for multiple projects:

> *"I'm in the private sector, I work for a consulting engineering firm, so we don't have that many discussions with academics because we have projects and we only have time to complete them and that's it. We don't have too many opportunities to discuss, unless we have really specific issues, and we need to discuss them if the project is not confidential"*. (Senior biologist, Private sector, QC)

Some interviewees (9 out 39, 23.1%), especially those working within ENGO and private sectors, mentioned that it was hard to stay updated on the latest information, even if that information could ultimately improve their practice:

> *"I would love there to be built-in time for just keeping abreast of the field of study that we're in and we're working. As a practitioner, I know that there's knowledge creation happening all the time. And I only have small moments to get access to it"*. (Restoration coordinator, ENGO, BC)

Addressing this issue is beyond the scope of this project, but it is important to acknowledge and reflect on potential solutions which could encourage practitioners to incorporate documents such as these SER Principles and Standards into their practice.

Discussion

Clear, supportive, and consistent guidance is needed to support those engaging in the practice of ecological restoration. Although various organizations at the national and international level have developed different forms of guidance over the years, the SER has taken a leadership role in building a community for restoration practitioners rooted in the science and practical application of the discipline since its inception in 1988 (Davis & Slobodkin, 2004). Over the last two decades, SER has published a Primer on Ecological Restoration (SER 2004), the 2012 Ecological Restoration in Protected Areas guidance document (Keenleyside et al. 2012), and more recently a first and second edition of Principles and Standards (McDonald et al. 2016; Gann et al. 2019). Although criticisms and debate arose around these documents (Shackelford et al. 2013; Gann et al. 2018; Higgs et al. 2018*a*, 2018*b*) these publications were designed to meet the needs of practitioners for coherent guidance, standardization of terminology across ecosystems, and increasing the likelihood of restoration success.

To our knowledge, the present study represents the first assessment of awareness and consultation of SER's 2019 Principles and Standards using data from a diverse group of restoration professionals and policymakers. Our analysis revealed that uptake of the publication among our sample of Canadian restoration practitioners was low (37.7%). Although we focused on restoration professionals in Canada, we assume that in regions with fewer resources, weaker governance structures, and where English is not the dominant language, awareness and uptake may be even lower. Our study was timed approximately 0 year after the publication of the document, and therefore represents an early assessment of awareness and use by practitioners. We also recognize that language may have been an additional barrier to awareness and consultation in certain regions, as the French version of the Principles and Standards only became available in 2021, well after our interviews concluded. However, the 2019 document builds upon a previous first edition of Principles and Standards (McDonald et al. 2016), which has been available for consultation in both English and French for a few years prior to our study. Although we cannot assume that availability of the previous version directly translates to consultation of this second edition, we

can expect that at least some practitioners would have been aware that SER was active in drafting this guidance. Perhaps more efforts should be deployed to assess how people engaging in ecological restoration respond to and process communication related to this field (Lewenstein 2003). Research into effective and concise messaging that is able to reach people engaged in both science and policy work (Goodrich et al. 2020) could help raise awareness of the document across local networks. Once the publication is in the hands of users, testimonials could be used to inspire other practitioners to embrace and apply the principles in their work (Cvitanovic et al. 2015; Fabian et al. 2019; Goodrich et al. 2020). These communication-oriented strategies would ultimately help increase the visibility of the document, and encourage its uptake within the community of restoration professionals.

From our interviews, we were able to identify four main issues that had an impact on the consultation of SER's Principles and Standards document.

(1) Participants commented that the complexity of the document may limit accessibility, and shut out or discourage the diverse body of volunteers who practice ecological restoration. Although this was not seen as a direct barrier to consultation for our interviewed professionals, it does nonetheless indicate that the publication may not be accessible for the diversity of people that engage in restoration activities who may lack advanced education or professional training in this field.
(2) The structure and format of the document works against easy adoption. The number of principles (eight), complicated concepts such as the recovery wheel, and the lack of a unified structure for ecological and cultural goals makes the document more difficult to apply.
(3) Efforts to encode standards creates at least the impression if not insistence that top-down and widespread prescription is the most effective way to direct improved and upscaled restoration activity. The Principles and Standards document encourages a commitment to a one-size-fits-all approach to restoration, which may be useful on a general basis, as for example when learning about key terminology related to restoration such as the notion of reference ecosystem. However, significant diversity of ecosystems and cultures of practice push toward greater flexibility (Higgs et al. 2018*a*, 2018*b*).
(4) The people we interviewed self-identified as restoration professionals who work in diverse settings ranging along the "restoration continuum" advanced in the Principles and Standards publication. For those who work in ecosystems already heavily transformed (e.g., open caste mines, industrial peat harvesting areas, urban centers), it may be demotivating to know that the highest achievement of restoration implied in the continuum may simply be out-of-reach; in the end, these professionals may opt for different forms of guidance.

These critical reflections point to ways in which the SER Principles and Standards might evolve. Separating out a general primer on restoration accessible for wider audiences would convey the essence of restoration for the widest possible audience. A more technical document including elements that bear more directly on the practice of restoration would be useful to those already beyond the introductory stages of restoration practice. It might also be useful to commission a series of technical ecosystem-focused standards that dig deeper. These documents would be more effective at dealing with sector-specific issues and target restoration efforts where they are most needed (Cliquet et al. 2022). Similarly, guidance on working with people—stakeholder engagement, integration of traditional knowledge—would be valuable. Research has shown that inclusive and clearly communicated guidance aimed at encouraging community-led restoration may often promote long-term success and local uptake of restoration projects (Lee & Hancock 2011; Kramer et al. 2018). Indeed, so much of successful restoration depends on understanding public opinion, securing long-term finance, ensuring political support at many levels, and monitoring not only ecological performance but social factors, too (Martin & Lyons 2018). More attention should be given, perhaps even primary attention, to these dimensions of restoration.

We encourage a simplification of principles. The development of eight principles in SER's Principles and Standards is already difficult to sort out, but this has been amplified by the ten principles advanced by the UN Decade (FAO, IUCN, CEM, & SER 2021). In Canada, it may be that over a decade of experience with the "Canadian principles" (effective, efficient, and engaging) developed in 2008 and widely adopted for practice across Canada's protected areas network, predisposed our participants to want simpler, more open, and more adaptable guidance (Parks Canada and Canadian Parks Council 2008). This points out toward the importance of parsimony in how people take up restoration. The "Canadian principles" are recently undergoing an appropriate extension to include a fourth "E:" "equitable" (Wong et al. 2022). This new principle acknowledges the critical importance of social justice and reconciliation with Indigenous peoples, and constitutes an important advance. These four principles can be easily understood and adopted by a wide audience of practitioners to grasp the entirety of what is important about good restoration, and to deploy these adaptively to meet diverse circumstances.

Finally, we suggest revisiting the idea of a restoration continuum. It is understandable that good practice ought to encourage people toward excellence. However, the journey toward restoration in highly degraded ecosystems for which reclamation or rehabilitation are the best of limited options should not be portrayed as restoration lite. The continuum also leaves out practices such as rewilding and forest landscape restoration that take a different if allied approach to restoration (Mansourian 2018; Perino et al. 2019). Instead, we recommend establishing restoration as a big tent that embraces the multiple forms of practice that aim to reverse degradation. If rooted in easy-to-grasp principles, then it is the degree of attainment within each of the principles that matters, and the combination of attainment across these principles that defines it as

restoration. This approach is exemplified in the model developed in Suding et al. (2015); the principles used were loosely based on the Canadian principles, but can easily be adapted to meet the diverse international needs of SER.

Our findings reveal opportunities for improvements in SER's Principles and Standards to ensure they are more fully embraced by the restoration community. Our analysis showed that for a majority of our sample of Canadian practitioners, the SER Principles and Standards had not yet been adopted into practice. We recognize that there are some limitations to our survey, particularly with regards to sample size and representation, with approximately a third of our participants originating from British Columbia. Although our sample size is deemed adequate from the perspective of content analysis research (McIntosh & Morse 2015; Boddy 2016), our numbers do not allow us to make the type of generalizations that are prevalent in quantitative studies. Nonetheless, the type of data collected from this qualitative analysis can help draw idiographic conclusions which remain valuable in providing rich and detailed information pertaining to our study questions (Sandelowski 1995). With regards to our British Columbian respondents, it may be that their higher representation within our study sample introduced some bias toward awareness and use of the SER document pertaining to that particular province. Further investigation of restoration guidance in Canada should attempt to have more proportional representation of practitioners across different regions in the country. Finally, we acknowledge that most our interviewees were practitioners with professional experience in restoration policy or practice. As the SER Principles and Standards document aims to be adopted by a vast audience of people that engage in restoration activities (see "Executive Summary" in Gann et al. 2019) further studies examining the uptake of this publication should be inclusive of these intended users and incorporate other stakeholders such as volunteers, youth, and community groups. Although early in the uptake of the document, we see barriers to widespread adoption and opportunities for significant improvement. We offer our analysis in the hope that SER continues consultation with restoration scientists, practitioners, policy specialists, and community members to advance the urgent work of restoration in an era of rapid climate change.

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Supporting Information

The following information may be found in the online version of this article:

Supplement S1: Letter of information for implied consent
Supplement S2: Interview guide

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