

1 **Title:** Knowledge exchange enhances engagement in ecological restoration and rehabilitation
2 initiatives

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4 **Running head:** Knowledge exchange supports ecological restoration

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16

17 **Author contributions**

18 NF conceived, co-designed, implemented the research, wrote the manuscript; LS secured the funding,
19 provided research guidance, edited the manuscript; AD secured the funding, provided research
20 guidance, edited the manuscript; LK designed Figure 2.

21

22 **Abstract**

23 Effective knowledge sharing and community engagement can be major enablers in the pursuit of
24 socially relevant benefits from ecological restoration and rehabilitation. Focusing on two ecological
25 restoration and rehabilitation practitioner organizations and their workers, this paper evaluates
26 perceptions of the extent to which short-term knowledge exchange contributes to social goals in
27 ecological restoration and rehabilitation in South Africa through (i) stakeholder engagement and

28 awareness of community well-being, and (ii) knowledge enrichment. Data collected through impact
29 questionnaires, participatory site visits, practical work exchange, focus group discussions and a
30 workshop are analysed using thematic analysis framed by the International Principles and Standards
31 for the Practice of Ecological Restoration 1 and 2. We explore participants' perceptions of knowledge
32 exchange benefits and discuss implications for future collaboration in establishing long-term
33 knowledge exchange. Findings show that knowledge exchange is perceived to result in enhanced
34 teamwork engagement, and strengthened knowledge on restoration techniques through mutual
35 learning, inspiration and a strengthened sense of community. Findings suggest that sustained
36 knowledge exchange and engagement activities between different practitioner organizations is key to
37 realize and transform short-term perceived benefits into long-term applied socio-ecological impacts
38 across landscapes in dryland Africa. There is a need to progress from short-term, horizontal learning,
39 to long-term (horizontal and vertical) knowledge exchange, to inform restoration project design and
40 implementation.

41

42 **Keywords:** Africa, stakeholder engagement, capacity building, social learning

43

44 **Implications for Practice**

- 45 • Short-term and localized knowledge exchange grounded in practice is perceived to foster benefits
46 across multiple social dimensions through stakeholder engagement and knowledge enrichment;
- 47 • Combining different engagement approaches in knowledge exchange and advancing from short-
48 term to systemic and long-term knowledge exchange is essential to enhance different forms of
49 learning and deliver applied socio-ecological benefits;
- 50 • Professionally facilitated knowledge exchange processes help to raise visibility of best practices
51 and explain potential sources of future support;
- 52 • Systemic and long-term knowledge exchange will likely provide a useful collaborative tool for
53 facilitating knowledge aggregation to guide future activities of practitioner organizations.

54

55 **Introduction**

56 Global ecosystem degradation results in losses of socio-economic and ecological landscape
57 values, costing 10% of annual GDP and threatening the well-being of 3.2 billion people, predominantly
58 concentrated in drylands (IPBES 2018; Costanza et al. 2017). In addressing these challenges, ecological
59 restoration and rehabilitation are central. While international policy efforts such as the United Nations
60 Decade on Ecosystem Restoration, 2021–2030 (UN 2019) bring a global focus to restoration, they
61 acknowledge the importance of exchanging local knowledge and engaging stakeholders without
62 providing empirical insights. Limited theoretical, methodological or empirical grounding hampers the
63 capacity to engage local stakeholders and appreciate their knowledge of restoration practices (Gann
64 et al. 2019, Reed et al. 2014), while challenges persist in the integration of different knowledge types.
65 Expert guidance is needed in the use of multi-actor learning to inform best practices (Tisenkopfs et al.
66 2015).

67 We interpret knowledge integration and sharing as the process of Knowledge Exchange (KE)
68 that takes places across multiple groups (i.e. knowledge producers, intermediaries and users),
69 generating a range of impacts on policy and practice, classified as conceptual (awareness raising and
70 experience sharing), instrumental (policy or practice changes) and symbolic (advocating existing policy
71 or practice) (Reed et al. 2014). The extent to which KE affects ecological restoration practice has also
72 been questioned, given the limited capacity for short-term research to be translated into increased
73 long-term understanding of practitioner organizations as to how to implement successful restoration
74 (Francis & Goodman 2011). A further gap relates to the lack of analyses and engagement that could
75 stimulate learning between different restoration initiatives. This can take place through horizontal
76 knowledge sharing between practitioners (parallel organizations at the same spatial scale and without
77 leverage over each other), or vertical knowledge sharing across multiple governance levels; from
78 practitioners to national and international governmental and intergovernmental bodies (Cohen-
79 Shacham et al. 2019; Koontz 2021). A key bridging role in KE is played by knowledge brokers (such as
80 NGOs) that have access to local knowledge and are able to summarize it and transfer it to other actors
81 at different scales or locations (Reed et al. 2014).

82 While enabling more effective KE is recognized as key to mutual enrichment of multiple
83 knowledges, systematic appreciation of its applied practices remains contested (Phillipson et al. 2012).
84 This paper picks up these perspectives and considers how KE between different practitioner
85 organizations involved in ecological restoration can potentially better support engagement and
86 sharing of ecological restoration knowledge and efforts. We focus on two case studies from South
87 Africa, a country known as a continental leader in applying restoration to achieve societally relevant
88 goals (Carrick et al. 2015; Favretto et al. 2018). **This paper aims to investigate how KE in ecological
89 restoration can offer opportunities to enhance collaboration and knowledge sharing between
90 practitioner organizations involved with ecological restoration and their workers. It effectively
91 applies the International Principles and Standards for the Practice of Ecological Restoration #1 and
92 #2 to assess the extent to which short-term KE is perceived to address social goals in ecological
93 restoration and rehabilitation through (i) stakeholder engagement and awareness of community
94 well-being, and (ii) knowledge enrichment.** Findings allow consideration of the implications of KE in
95 informing future restoration and rehabilitation practices more widely (CBD and UNEP 2018; IPBES
96 2018).

97

98 **Methods**

99 Two case study practitioner organizations that pursue ecological restoration and rehabilitation were
100 selected for this study (Figure 1).

101 [Figure 1]

102 While they implement varied restoration practices, the two organizations (Table 1) have a
103 history of collaboration facilitated through a number of research and impact-acceleration projects led
104 and undertaken by the authors of this manuscript since 2016 (e.g. Favretto et al. 2018). The two cases
105 were selected to maximize added value and scope for KE across initiatives that pursue similar
106 overarching goals, building on a depth of knowledge and trusted interactions generated over time.

107 [Table 1]

108 KE activities involved two “learning journeys”, one in each site and a final workshop, with
109 perceptions of knowledge enrichment assessed through an impact questionnaire administered at the
110 beginning and end of the KE. The learning journeys were pursued through 1-day participatory site
111 visits, followed by a 1-day ‘work exchange’, where mixed teams from both practitioner organizations
112 undertook joint manual work in the field of *Portulacaria afra* (hereafter called Spekboom). This was
113 selected as joint practical task as planting Spekboom is the main overlap among the two organizations,
114 where shared learning can be maximized. Learning journeys concluded with reflective focus group
115 discussions guided by a similar set of questions as in the impact questionnaires detailed below. Results
116 were then summarized and consolidated in a final workshop for all who participated.

117 Matched baseline and impact questionnaires were administered to all 8 workers from Living
118 Lands (all those engaged in restoration at the Baviaanskloof Hartland site), 1 Living Lands manager, 6
119 workers from J4C (those available out of 24 active at this site) and 2 managers (total n=17) to assess
120 the perceived benefits of the KE. Sample selection aimed to involve the largest number of managers
121 and workers that operate in the field with both practitioner organizations.

122 Three questions aimed at testing initial knowledge of the activities carried out by the other
123 practitioner organization were addressed in a baseline questionnaire focused on participants’
124 knowledge of the restoration work, and achievements and challenges of the other practitioner
125 organization (Supplement S1). An extended impact questionnaire (with a total of nine questions, all
126 open except the first one using a Likert scale) was administered after the KE activities to assess the
127 perceived ‘knowledge enrichment’ impacts of the KE. Baseline and impact questionnaire responses
128 were compared to assess differences and identify whether changes to knowledge took place (as per
129 Marques et al. 2020). The additional questions addressed in the impact questionnaire focused on
130 aspects of mutual learning (i.e. what one practitioner organization can learn from the other) and the
131 potential for future replication of the identified best practices (see Supplement S1 for a more detailed
132 description of how the sets of questions were compared and expanded). The extended responses
133 were integrated in the pre-workshop qualitative thematic analysis (see below).

134 Professional facilitators (i.e. the paper authors) played a key role in the delivery of the learning
135 journeys, where the KE participants were guided through a mix of indoor meetings, which involved
136 presentation of the work of each practitioner organization, and field visits where participants gained
137 a practical overview of the breadth of work implemented. Facilitators guided the participants in taking
138 notes and drawing their own observations and comparisons focused on four key areas: (i) benefits of
139 KE, (ii) similarities and differences between practitioner organizations, (iii) best practices, and (iv)
140 future engagement opportunities (Guest et al. 2012). These themes were discussed and summarized
141 each day through a ‘wrapping up’ focus group.

142 Using qualitative thematic analysis, notes from the site visits, work exchanges, focus groups
143 and impact questionnaires were categorized according to emergent patterns focused on the themes
144 listed above. Data were discussed in a 1-day workshop, to share experiences across the themes
145 identified, particularly considering knowledge enrichment about best practices and engagement
146 implications for the practitioner organizations and their workers (see Supplement S2).

147 Following the workshop, the thematic analysis was refined and findings were regrouped
148 (qualitatively and using basic frequency counts) to assess the implications of KE activities for achieving
149 principles #1 and #2 of the International Principles and Standards for the Practice of Ecological
150 Restoration (Gann et al. 2019). Qualitative indicators adapted from the Society for Ecological
151 Restoration ‘social benefits wheel’ (*ibid*) were developed to guide the thematic discussion of our
152 findings (Figure 2). Stakeholder engagement and awareness of community wellbeing (principle #1) is
153 intended as the collaborative building dialogue between practitioner organizations and local
154 communities aimed at exchanging knowledge about ecological restoration and rehabilitation practices
155 (Gann et al. 2019). It was assessed through the following indicators: involvement strengthened,
156 capacity increased, improved inspiration, improved social bonding, and improved understanding of
157 welfare goals of restoration. ‘Knowledge enrichment’ (principle #2) is understood as the identification
158 of different knowledge sources that generate new knowledge with the potential to inform project
159 implementation, planning or monitoring (Gann et al. 2019), assessed through the following indicators:

160 integrated practitioner and local knowledge, and knowledge enhanced. Figure 2 details how the
161 original indicators from the social benefits wheel were adapted to the indicators listed above.

162 [Figure 2]

163

164 **Results**

165 Data from all the activities show that KE between the two practitioner organizations generated twelve
166 major perceived benefits, which have potential for longer-term impacts through ongoing KE activities
167 (Table 2).

168 [Table 2]

169

170 **Principle 1. Stakeholder engagement and awareness of community well-being**

171

172 *Involvement strengthened*

173 Social interaction through KE strengthened involvement in collaborative tasks of staff across both
174 practitioner organizations by sharing ideas, opportunities and tools used to seek common solutions
175 based on practice: '[The KE] gave the feel of what other working colleagues do, and the chance for
176 both groups to relate to each other' (manager, J4C, workshop). A process of future continued
177 engagement was considered a key pre-requisite to achieve joint benefits in the long-term: 'We need
178 to be primed, almost forced, to make time for this type of activity' (manager, Living Lands, workshop).

179 Through collaborative dialogue where multiple viewpoints were shared, the group
180 strengthened trust in one another, building on the history of collaboration through previous research
181 and KE activities. In turn, this stimulated further commitment. For applied benefits to be derived in
182 the long-term, workshop discussions called for continued KE, such as a system that enables exchanging
183 a constant flow of workers and groups between practitioners. This would help to extend these benefits
184 beyond the group involved. Practical examples identified included exchanging workers on a biweekly
185 basis to carry out joint work, organizing larger monthly exchanges, and planning regular learning
186 experiences with universities to enable shared field-based learning on erosion control and restoration

187 practices. These findings indicate that broader stakeholder engagement will maximize benefits from
188 targeted KE, which may otherwise remain limited.

189

190 *Capacity increased*

191 KE resulted in a perceived increase in capacity to understand the broader priorities and challenges
192 experienced by managers. For example, it was realized that project implementation is often hampered
193 by factors linked to politics or funder demands. New understanding increased appreciation for the
194 need to invest in KE as a long-term effort.

195

196 *Improved inspiration*

197 KE activities enabled participants to learn about other realities, familiarize themselves with peers from
198 other contexts, and gain a broader understanding of wider restoration efforts. By feeling part of a
199 broader 'family' that tackles degradation, participants perceived their inspiration to do more: 'It was
200 an opportunity for myself to see things in a different way [...] we are a family' (worker, Living Lands,
201 focus group). This was mirrored by managers, who stressed that KE provided all participants with the
202 opportunity to 'encourage each other, boost, empathize' (manager, Living Lands, focus group), and
203 identify common ground.

204

205 *Improved social bonding*

206 Social bonding was perceived to be strengthened through KE and teamwork in field based training:
207 'We are now all colleagues and we are reference points to our peers [...] we are leaders, and can
208 complement each other' (worker, Living Lands, focus group). This was mirrored in the impact
209 questionnaire, where all respondents stated that the two practitioner organizations will now work
210 together, despite questions on the financial and logistical feasibility of future collaboration.

211

212 *Improved understanding of welfare goals of restoration*

213 Improved understanding of the welfare goals of both practitioner organizations was perceived by all
214 participants. While the two practitioner organizations pursue similar community goals, the KE
215 showcased different approaches, with a view to replicating good practices. Workshop discussions
216 showed that while Living Lands' efforts focus on generating business opportunities (e.g. helping
217 farmers shift towards sustainable land uses), J4C focuses more on job creation and providing training
218 and support to school children in the context of restoration projects. This generated conversations
219 and awareness on how each practitioner could combine some of these approaches for greater long-
220 lasting benefits.

221

222 **Principle 2. Knowledge enrichment**

223

224 *Integrated practitioner and local knowledge*

225 Exchange of knowledge, practical tips and experiences between peers pursued through social
226 interactions during the practical restoration work enabled shared learning. Participants perceived this
227 learning could be used for wider dissemination and application across the respective communities.
228 Sharing practitioner knowledge based on restoration experiences of managers was key in helping
229 workers understand the rationale behind their practical work. For example, during workshop
230 discussions on the use of brush-packing (an anti-erosion technique used to protect top soil around
231 trees), workers' knowledge complemented explanations from managers about the implications for
232 topsoil temperature reduction and increased water infiltration. While all workers employed by both
233 organizations received training on these techniques, they found that integration of similar knowledge
234 across two different organizations and landscapes provided added-value as it generated more
235 comprehensive insights.

236

237 *Knowledge enhanced*

238 Drawing on impact questionnaires, Table 3 summarizes key questions and thematic areas in which KE
239 is perceived to have enhanced knowledge.

240

[Table 3]

241 Likert scale responses showed that all respondents perceived that they learnt 'a lot' from the
242 KE. The majority of respondents across both practitioner organizations, showed enhanced knowledge
243 in multiple answers (see S1). When asked to list the intended benefits sought by the other practitioner
244 organization, most respondents were able to provide between one and four new examples compared
245 to their baseline responses, noting community upliftment and job creation, Spekboom planting,
246 rehabilitation and erosion control pursued through multiple techniques, and carbon sequestration.
247 Only four respondents (from 17) perceived unchanged knowledge. When asked to provide practical
248 examples of the work implemented by the other practitioner organization, most respondents could
249 explain up to three new examples, and were able to identify one or two new similarities (mostly
250 focused on Spekboom planting).

251 Improved understanding of the carbon sequestration potential of Spekboom exemplifies the
252 new insights people perceived they gained. General statements about the capacity of Spekboom to
253 sequester carbon were raised in baseline questionnaires, but after the KE, a deeper understanding
254 was shown in workshop discussions, where workers noted: 'Spekboom captures [stores] atmospheric
255 carbon in the soil, and when there is more carbon, there is more water being stored', and as a result
256 'other plants will be able to better survive and grow in the enriched soil' (worker, Living Lands,
257 workshop).

258 Workshop discussions identified scope to transfer some practices in future engagement
259 among the two organizations, e.g.: 'Bacterial composting [for Spekboom nursery] would be cheap and
260 easy to replicate' (manager, J4C, workshop). However, it was noted that although the skills and
261 knowledge are transferable, improved enabling institutional and regulatory frameworks are needed
262 to support such engagement.

263

264 **4 Discussion**

265 KE based on the use of participatory site visits, focus groups and workshop discussions has potential
266 to raise awareness of benefits across the International Principles and Standards for the Practice of

267 Ecological Restoration #1 and #2. Mirroring experiences in using social learning processes in
268 environmental management planning (Marques et al. 2020), and drawing on wider lessons from
269 practice on stakeholder engagement in landscape management across the African continent (Favretto
270 et al. 2021), we found that bringing together practitioner organizations and their workers for KE can
271 result in perceived strengthening of trust, and learning. Focus on two organizations that operate
272 across a common and diverse landscape as knowledge brokers and landscape facilitators, has shown
273 that effective shared learning is feasible, and perceived as beneficial at the landscape scale (Cockburn
274 et al. 2020). Best practices stress the importance of sharing knowledge to empower those groups
275 tackling degradation in practice (Stringer et al. 2017). As noted in analysis of transdisciplinary projects
276 aimed at generating new knowledge and action in ecosystem management in South Africa, knowledge
277 sharing enables upscaling by promoting systems thinking grounded in practice (Sitas et al. 2016). This
278 research acknowledges that while short-term KE does not necessarily translate into long-term benefits
279 for complex problems, it can catalyze engagement and knowledge sharing that, if implemented in a
280 more systemic manner, will help to ground long-term system thinking in practice (Falayi et al. 2020).

281 South Africa is actively pursuing engagement aimed at fostering cross-sectoral transformation
282 for environmental conservation (Gelderblom et al. 2020). Combining different types of engagement
283 to maximize interaction and enable learning is a building block for transformation (Stringer & Dougill
284 2013). Expanding observations of Nicolletti et al. (2020), we show that local-level KE initiated and
285 facilitated by academics in cooperation with practitioner organizations can trigger social interaction
286 and bonding with a view to identifying practical opportunities and pursuing common solutions aligned
287 with the needs and perceptions of KE participants. The KE undertaken here built on existing
288 collaborations between researchers and case study practitioner organizations, helping a short-term
289 and workshop-based KE activity to generate tangible perceived impacts, while acknowledging that
290 collaborative outcomes are shaped by the social-ecological context under which they occur (Schoon
291 et al. 2021). However, for KE to be initiated and maintained, continued mutual engagement must be
292 enabled. Systemic KE is not commonly practiced due to its high organizational, time and financial
293 costs. Workshop discussions stressed the need for diversified funding streams to implement multiple

294 local and short-term projects. This mirrors project-based learning literature, which stresses how the
295 temporary nature, time urgency and limited incentive mechanisms of “project task” contexts limit the
296 willingness to exchange knowledge (Bakker et al. 2011). As identified by our KE participants, and
297 expanding observations on participatory process design in social-ecological systems in global
298 drylands (de Vente et al. 2016), the professionally facilitated processes that enabled this KE can play
299 a leading role in raising visibility and explaining potential sources of future support (i.e. by collating
300 and generating evidence on perceived benefits and impacts of KE focusing on the practical work of
301 case study partners). However, such professional facilitation and research also require adequate
302 resources to sustain long-term knowledge sharing.

303 KE was perceived to enable horizontal learning at the practitioner organization level and
304 integration of multiple forms of knowledge via interactions between the participants. This suggests
305 that KE can support multi-actor learning to inform best practices (Tisenkopfs et al., 2015). We stress
306 the need to progress from short and horizontal learning to long-term (both horizontal and vertical)
307 learning to translate the initial identification of perceived benefits and engagement into sustained
308 restoration and rehabilitation. As regards vertical learning, workshop discussions noted that while
309 skills and knowledge of best practices are transferable, a lack of adequate enabling legal and
310 regulatory systems hampers vertical mainstreaming of KE. For example, the capacity of the two
311 practitioner organizations to replicate the use of specific rehabilitation techniques is constrained by
312 multiple rules and laws (e.g. National Environmental Management Act, National Environmental
313 Management Biodiversity Act, National Forests Act, and South African Water Act). In some instances
314 topsoil removal through re-sloping is forbidden to avoid changes in soil composition, while in other
315 instances the use of restorative techniques requires environmental impact assessments prior to
316 project approval. Given that practitioner organizations operate under short timeframes imposed by
317 the available project funding, they are often unable to test and implement innovative techniques at a
318 small scale. Longer-term funding received from private foundations partially increases operational
319 flexibility, however going into longer-term projects remains a challenge. Research is required to assess
320 coherence and conflicts in regulatory frameworks, to enhance alignment and identify the changes

321 needed to facilitate identification and replication of best practices. KE focused on practical
322 implementation proves a useful collaborative tool to facilitate knowledge aggregation about these
323 themes and generate evidence aimed at informing funding and decision-making.

324 While this research has focused on learning journeys of just two organizations, it
325 demonstrates that localized KE should be considered as a starting point in fostering multidimensional
326 ecological restoration and rehabilitation more broadly. Short-term KE activities permit participation
327 of limited numbers of workers and managers due to financial constraints, time limitations and the
328 need for proximity to the workplace. The new (horizontal) knowledge generated across practitioner
329 organizations enhances a sense of shared purpose amongst KE participants and empowers them to
330 become reference points to their peers. This research emphasizes that well engaged local-level KE
331 participants are a building block in a knowledge sharing system grounded in practice. The novel
332 application of the International Principles and Standards for the Practice of Ecological Restoration #1
333 and #2 proved highly useful in guiding the best practice assessment and drawing key lessons, showing
334 that KE holds particular promise in identifying best practices and engaging participants in joint
335 activities and learning that can inform ecological restoration and rehabilitation practices across
336 dryland Africa (CBD and UNEP 2018; Gann et al. 2019; IPBES 2018).

337

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343 Lands' staff did not influence the analysis and presentation of the data grounded on the KE attended
344 by her field colleagues.

345

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445 **Illustrations**

446 **Tables**

447

448 **Table 1.** Key characteristics of case study practitioner organizations, South Africa

	Living Lands	Jobs 4 Carbon
Organization type	Not-for-profit company	Not-for-profit company, Gouritz Cluster Biosphere Reserve (GCBR)
Mission	Promoting social learning and fostering partnerships towards a 'living landscape'	Implementing restoration and rehabilitation through thicket planting that seeks carbon mitigation, community upliftment and job creation
Location	Baviaanskloof Hartland site, Eastern Cape	Vanwyksdorp, Western Cape
Years of operation	Since 2008	Since 2014
Vegetation types	Thicket, Fynbos, Nama-Karoo, Succulent Karoo, Grassland, Savannah and Forest	Fynbos, Succulent Karoo, Thicket and Maputoland-Tongoland-Albany
Land degradation types and drivers	Degradation of thicket vegetation, soil erosion, reduced water retention and creation of gullies. Driven by overgrazing and exacerbated by climate change, high rainfall unpredictability and extended droughts	Soil degradation, erosion, thicket loss. Driven by overgrazing under historical land use (goat farming), exacerbated by climate change and high rainfall variability
Type of activities implemented	Thicket restoration through Spekboom planting, rehabilitation of hillslopes through resloping and erosion prevention	Thicket through Spekboom restoration through Spekboom planting, job creation, erosion

	– i.e. installation of anti-erosion barriers and brush-packing to cover top soil, catchment management, awareness raising, business development for essential oil production	control through anti-erosion sausages and brush-packing, business development for production and sale of Spekboom cuttings, elementary school food gardening and environmental awareness raising
Land-tenure situation	Cluster of state-owned protected lands within a network of private and communal land	Cluster of private lands under a biosphere reserve
Socio-economic context	Population: 1,000. Economic activities focused on goats and sheep farming, cattle and ostriches, and production of vegetable seeds	Population: 800. Marginalized and vulnerable area with high unemployment and poverty levels. Limited economic activities focused on livestock farming, irrigated agriculture and some tourism
Funders	The Coca Cola Foundation, Rain Global Environment Facility 5, Nationale Postcode Lotterij Netherlands, Commonland	South African Government 'Extended Works Programme', European Union, Private Dutch foundations
Types of stakeholders	Not-for-profit company, project workers, private land owners, local community, church community, governmental agencies, international funders	Not-for-profit company, project workers, private land owners, local community, governmental agencies, Wildlife and Environment Society of South Africa, international funders

449 Sources: Living Lands (2021); GCBR (2021)

450

451 **Table 2.** Adapted Society for Ecological Restoration social benefits wheel indicators and perceived
 452 benefits to assess progress towards social goals in ecological restoration and rehabilitation framed
 453 across International Principles and Standards for the Practice of Ecological Restoration #1 and #2 for
 454 two South Africa practitioner organizations.

Principle 1: Stakeholder Engagement and Awareness of Community Wellbeing		
<i>Original Indicator (social benefits wheel)</i>	<i>Adapted Indicator</i>	<i>Perceived benefits</i>
Involvement attracted	★ Involvement strengthened	Enhanced engagement and partnership
Capacity increased	★ Capacity increased	Project management
-	★ Improved inspiration	Inspiration
Social bonding Improved	★ Improved social bonding	Teamwork
Health & welfare improved	★ Improved understanding of welfare benefits of restoration	Enhanced awareness of community building
Principle 2: Knowledge Enrichment		
<i>Original Indicator (social benefits wheel)</i>	<i>Adapted Indicator</i>	<i>Perceived benefits</i>
TEK reinforced; science drawn upon	★ Integrated practitioner and local knowledge	Mutual learning; enhanced mitigation knowledge; environmental conservation awareness
Knowledge improved	★ Knowledge enhanced and innovated	Erosion control; restoration and rehabilitation techniques; planting; transferable lessons

455 Source: adapted from Gann et al. (2019)

456

457 **Table 3.** Impact questionnaire responses showing knowledge enhancement from KE

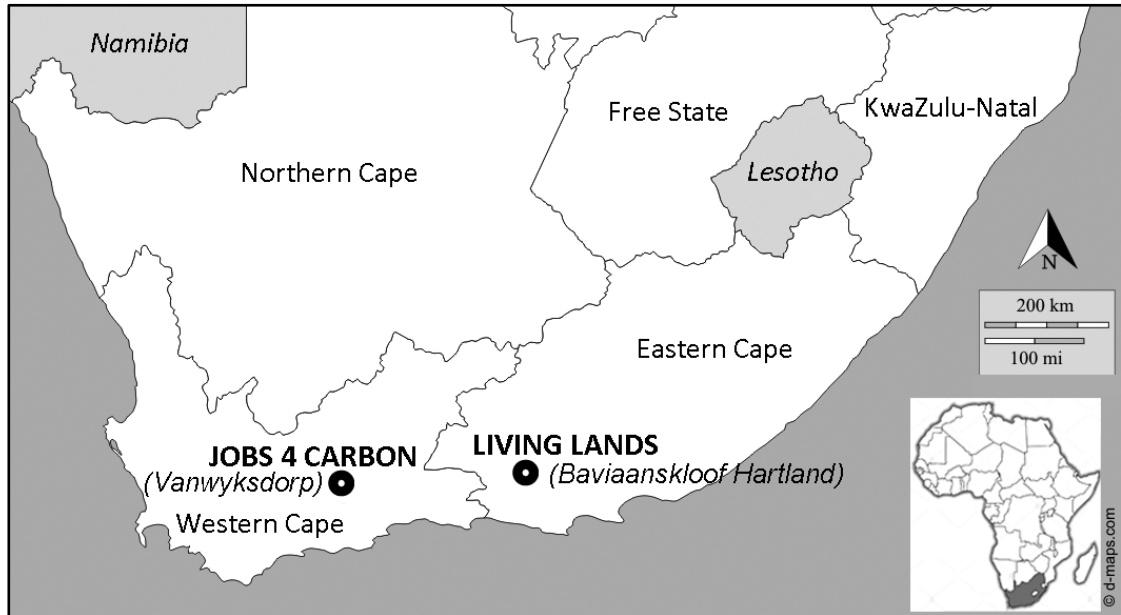
Questions	Response (total n=17)	Notes (with frequencies)
a. How much did you learn in this journey?	<ul style="list-style-type: none"> • A lot (in a 1 [nothing] – 3 [a lot] range of Likert scale) (17). 	<p>Themes learnt about (presented in decreasing frequency): knowledge of restoration and rehabilitation techniques (17), enhanced knowledge and inspiration through teamwork and mutual learning (9), enhanced engagement and partnership (8), environmental conservation awareness (7), community upliftment (3), project management (1)</p>
b. Describe 3 or more intended benefits sought by the other practitioner.	<ul style="list-style-type: none"> • 1 to 4 new benefits described (14); • Same as in baseline (3). 	<p>Benefits listed by decreasing frequency: community upliftment and job creation (17), Spekboom planting (9) rehabilitation and erosion control pursued through multiple techniques (5), and carbon sequestration (3).</p>
c. Give 3 practical examples of the work done by the other practitioner in the field.	<ul style="list-style-type: none"> • 1 to 4 new examples described (15) • Fewer examples described than in baseline (2) 	<p>Examples related to the following themes (by decreasing frequency): rehabilitation and erosion control techniques (17), Spekboom planting (14), carbon sequestration (2), and environmental awareness (1).</p>
d. Describe what J4C does SIMILAR to Living Lands.	<ul style="list-style-type: none"> • 1 to 2 new similarities described (16) • Fewer similarities described than in baseline (1) 	<p>Similarities described (by decreasing frequency): Spekboom planting and nursery (17), rehabilitation and erosion control techniques (12), community upliftment and job creation (8).</p>

459 **Figures**

460

461 **Figure 1.** Ecological restoration and rehabilitation case study practitioner organizations, Baviaanskloof

462 Hartland and Vanwyksdorp, South Africa. Source: adapted from Favretto et al. (2018).



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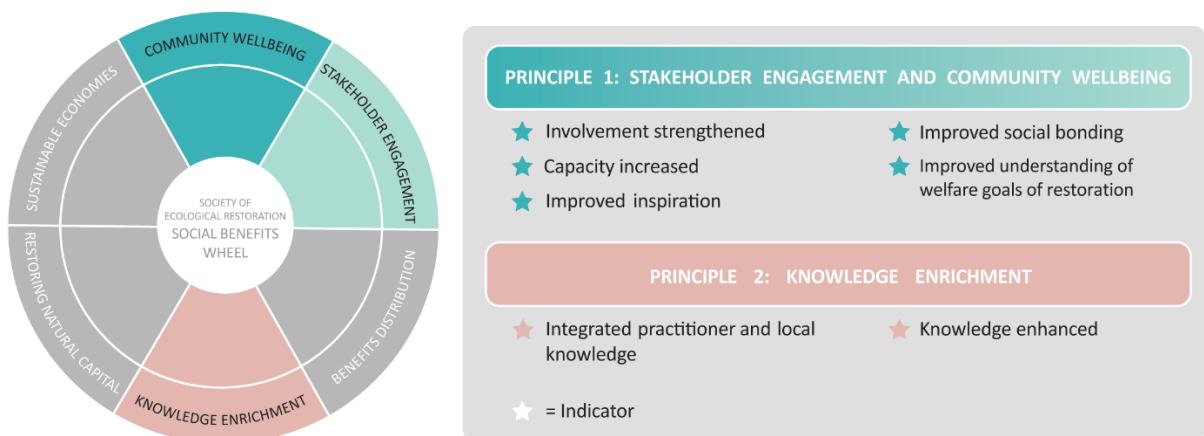
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465 **Figure 2.** Adapted qualitative indicators to assess perceptions of progress towards social goals in

466 ecological restoration and rehabilitation for two South Africa practitioner organizations, drawing on

467 the Society for Ecological Restoration social benefits wheel and grounded on International Principles

468 and Standards for the Practice of Ecological Restoration #1 and #2.



469

470 Source: adapted from Gann et al. (2019)

471

472 **Supporting Information**

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

474 **Supplement S1.** Baseline and impact questionnaires, with matched questions in Table 3 (example
475 given is for Living Lands. Same questions applied to J4C)

476 **Supplement S2.** Workshop agenda

477