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2 PERSPECTIVE

3 **Forest Landscape Restoration: Progress in the last decade and remaining challenges**

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5

6 **Abstract**

7 Forest landscape restoration (FLR) aims to return forests in a landscape in a way that meets
8 both human needs and ecological priorities. Although the term was first defined in 2000, it
9 has recently become popular and is being promoted as a solution to many of the
10 environmental and social problems associated with land degradation. We take a step back and
11 reflect on developments in FLR in the last twelve years, using as a framework 13 key issues
12 raised in 2005. A decade ago, when the term “forest landscape restoration” had only recently
13 been defined, we identified and documented several pre-requisites, tools, and approaches
14 necessary for its development, as well as outstanding issues. Today FLR is the subject of
15 significant government commitments, and has entered into the language of large multilateral
16 environmental agreements, notably the three so-called Rio Conventions. While FLR can
17 provide an important means of achieving multiple objectives in forested landscapes,
18 outstanding challenges to its effective and widespread application remain. Our analysis of
19 progress to date suggests that particular challenges for the effective implementation of FLR
20 concern implementation of truly large-scale restoration initiatives that have both ecological
21 and socio-economic objectives, tackling governance challenges, focusing on both quality and
22 quantity of restored landscapes, promoting the links between FLR and climate change, and
23 ensuring adequate and long-term monitoring. Given the significant advances in both

24 development and uptake of FLR, we hope this reappraisal of 2005 challenges will help
25 restoration practitioners and decision-makers to prioritize future interventions.

26 **Key words:** Bonn Challenge, forest quality, *Forest Restoration in Landscapes: Beyond*
27 *Planting Trees*, landscape governance, , stakeholder engagement

28 **RESTORATION RECAP:**

- 29 • Ten years ago, over 70 experts from around the globe contributed to the identification
30 and publication in a book of priorities for developing the concepts and practice of
31 forest landscape restoration (FLR).
- 32 • Progress can be seen in some areas, such as awareness amongst policy-makers,
33 integration into international programs and multi-lateral environmental agreements,
34 and an increase in funding.
- 35 • Significant shortfalls persist in five priority areas. Main challenges include: 1)
36 implementing FLR at scale and in an interdisciplinary fashion; 2) improving
37 governance; 3) ensuring an increase in both forest cover and forest quality; 4)
38 promoting the role of restoration in climate change responses; and 5) improving
39 methodologies for measuring long term impacts and their application.

40

41 Forest landscape restoration (FLR) aims to return forests in a landscape in a way that meets
42 both human needs and ecological priorities (Mansourian et al. 2005, Lamb 2014). This
43 concept emphasizes forest quality whilst recognizing the need for trade-offs in a landscape to
44 meet different needs (e.g., the need to restore habitat for an endangered species and the need
45 to restore the water protection function of riparian forests). As such, it does not seek to cover
46 a landscape entirely in forests, but rather to optimize the role of forests in the landscape. A
47 decade ago we edited a book entitled “Forest Restoration in Landscapes: Beyond Planting
48 Trees”, which brought together over 70 specialists from around the world to share concepts
49 of forest restoration in a landscape context (Mansourian et al. 2005). As far as we know, it
50 was the first comprehensive book on forest landscape restoration (FLR), a term defined by a
51 group of experts in 2000 as “*a planned process that aims to regain ecological integrity and
52 enhance human wellbeing in deforested or degraded landscapes*” (WWF and IUCN 2000,
53 Mansourian et al. 2005, Lamb et al. 2012).

54 Today, the term FLR is widely used and applied (e.g., Rietbergen-McCracken et al.
55 2007, Stanturf et al. 2012, Lamb 2014, Chazdon et al. 2017), and has evolved and been
56 interpreted in diverse ways, partly reflecting the diversity of issues worldwide. Much interest
57 has been generated (e.g., Alexander et al. 2011, Chazdon et al. 2017) and there is political
58 momentum behind increasing the scale and ambition of forest restoration. Many case studies
59 have been described, e.g., the Society for Ecological Restoration (SER)’s Global Restoration
60 Network (<http://www.globalrestorationnetwork.org/>) and the Global Partnership on Forest
61 and Landscape Restoration (GPFLR) database (<http://www.forestlandscaperestoration.org/>),
62 even though what is described as FLR may not always exactly match the original definition,
63 in particular with respect to scale, the diversity of approaches, and the combined social and
64 ecological dimensions.

65 Major mapping efforts have been undertaken to highlight potential areas for FLR
66 (WRI 2014) as well as for achieving the Convention on Biological Diversity's (CBD) Aichi
67 ecosystem restoration targets (e.g., for mapping ecosystem services in Europe, Maes et al.
68 2012) and some prioritization tools have been developed (IUCN and WRI 2014). There has
69 been a significant increase in funding, both in diversity of sources and in total amount (e.g.,
70 FAO funding mechanism, World Resources Institute (WRI), Global Environmental Facility
71 (GEF), German government funding.)

72 On the downside, there continues to be limited attention paid to FLR among
73 conservation organizations (with a few notable exceptions such as the International Union for
74 Conservation of Nature (IUCN) and the WRI), most FLR projects remain small scale and
75 methodological or policy orientated, and we still lack significant concrete progress in
76 restoring forest landscapes. There are few case studies that seek both to enhance ecological
77 integrity and improve human wellbeing by restoring forest functions in a landscape
78 (Mansourian and Vallauri 2014), resulting in continued misunderstanding about the key
79 elements of FLR (Newton and Tejedor 2011). Ultimately, forest loss continues to be a major
80 problem (Hansen et al. 2013, FAO 2015, Sloan 2016) and forest degradation, although harder
81 to assess (Ghazoul et al. 2015), affects large tracts of forests worldwide.

82 Climate change adds to the complexity of restoration efforts because it impacts on
83 forest ecosystems in many ways (and vice versa), notably by increasing their vulnerability to
84 threats, changing their composition and their range, and generally adding uncertainty about
85 their ability to fulfill their ecological and social functions in a landscape. The long-term
86 nature of forest restoration projects forces restorationists to better integrate medium to long
87 term ecological dynamics and to carefully take into consideration future human pressures and
88 disturbances. This means that climate adaptation options must be built clearly into their
89 modeling, planning and execution (Vallauri et al. 2002, Stanturf et al. 2015).

90 In 2005, we identified 13 priority areas of work for FLR to succeed (see Table 1)
91 (Mansourian et al. 2005). Progress in the last ten years on these priorities is discussed below.
92 A summary of progress against each of the 13 priority areas is given in Table 1. In some
93 cases, significant progress can be seen (e.g., a supportive political environment, funding,
94 etc.), but many others are still poorly developed (e.g., monitoring and evaluation). This paper
95 highlights key developments in FLR since 2005 in the context of these priority areas of work,
96 and recognizes outstanding and urgent gaps.

97

98 **Progress in 13 Priority Areas of Work for FLR Since 2005**

99 Many restoration projects fail because they do not pay sufficient attention to the pre-existing
100 context in terms of either the need for restoration or the reason that degradation happened in
101 the first place (Galatowitsch 2012). Two related issues were identified as important in 2005:
102 (i) understanding the impacts of both forest loss and restoration; and (ii) addressing
103 underlying causes of forest loss and degradation. Since then, there has been a major change in
104 perceptions about the importance of restoration, including restoration at large scale. To a
105 significant extent this is due to recognition of the relevance of forests in the climate change
106 debate. Forests have become an accepted contributor to climate mitigation and adaptation by
107 increasing carbon sequestration, regaining ecosystem services and recovering natural capital
108 (Parrotta et al. 2012, Stanturf et al. 2015). Forests themselves are and will continue to be
109 affected by climate change, and their vulnerability requires attention, which may in part be
110 met by integrating restoration and adaptive approaches into landscape-scale management
111 strategies (Clewell and Aronson 2013). However, although the underlying causes of
112 deforestation are now well understood, and linked most closely with favorable economic
113 returns from agriculture and pasture (Ferretti-Gallon and Busch 2014), less progress has been
114 made on addressing these drivers. Forest degradation (Ghazoul et al. 2015), or the linked

115 concept of forest quality, is still misunderstood and underutilized to develop FLR policies,
116 strategies or tactics. As a result, FLR concentrates very often only on the most barren
117 landscapes to restore.

118 Governance factors (which deal with decision-making) are often critical to success or
119 failure of forest restoration. In 2005, five issues were identified as requiring further work: (i)
120 the need for a supportive political environment; (ii) negotiation and prioritization; (iii)
121 empowerment and engagement; iv) implementation through multidisciplinary teams; and (v)
122 modeling and decision-support tools. The importance of governance is increasingly accepted
123 in the environmental field. Where there has been monitoring, lack of success in past
124 restoration projects can be attributed in part to governance failures (e.g., Newton and Tejedor
125 2011, Reed et al. 2016), particularly when projects are large scale. Analyzing restoration
126 projects in Colombia, Murcia et al. (2015) estimated that only about 2% truly involved all
127 stakeholders, which jeopardized their success.

128 The results of efforts to build a supportive political environment are uneven.
129 Significant progress has been witnessed in the discourse of governments related to forest
130 restoration and FLR over the last decade. Policy changes can be seen in the U.S for example,
131 with the enactment of the “Omnibus Public Land Management Act” of 2009 on FLR and the
132 subsequent funding released for the “Collaborative Forest Restoration Programme” (Schultz
133 et al. 2012). In Brazil’s Atlantic Forest, the Atlantic Forest Pact has mobilized over 250
134 stakeholders at all levels (Melo et al. 2013, Brancalion et al. 2016). On the other hand, in
135 most countries, supportive policies are still few and far between. A rapid overview of
136 intended national contributions (INDCs) under the UN Framework Convention on Climate
137 Change (UNFCCC) frequently brings up the words “reforestation” or “afforestation”
138 associated with tree planting on forested or non-forested lands which frequently provide
139 limited ecological or human wellbeing benefits to those living in the landscape. Incentives to

140 engage private landowners and companies in restoration are still lacking in many cases or are
141 simply not being effectively enforced. For example, in Paraguay, while conservation and
142 restoration is required by law in riverine forests in the country's Atlantic Forest, in practice,
143 poor enforcement means that landowners frequently fail to comply with this legal
144 requirement (Mansourian et al. 2014).

145 The need to negotiate trade-offs between different stakeholders, and to agree priorities
146 at site and landscape scales, are both central to the success of FLR (see chapters 8, 14, 21 or
147 40 in Mansourian et al. 2005). Both rely on effective governance. Yet in much of the world,
148 poor governance favors strong stakeholders at the expense of weaker communities even
149 though the latter are most dependent on forests, forested landscapes and the goods and
150 services that they provide (e.g., Sunderlin et al. 2005). Amongst the most important
151 governance issues are land tenure and use rights. These have been brought to the fore notably
152 because of the rise of payments for ecosystem services (PES) schemes and modalities under
153 REDD+ (Reducing Emissions from Deforestation and forest Degradation), and the role of
154 conservation, sustainable management of forests, and enhancement of forest carbon stocks;
155 Korhonen-Kurki et al. 2014) which require clarity of tenure and rights for their effective
156 implementation.

157 One important gap identified in 2005 was the lack of effective tools and approaches
158 to facilitate effective stakeholder engagement (see chapter 18 in Mansourian et al. 2005). To
159 date there are few good case studies where effective engagement and empowerment can be
160 seen in restoration, and in FLR in particular (Guariguata and Brancalion 2014). In Ghana, the
161 Community Resource Management Areas (CREMAs) provide an interesting case where
162 landscape stakeholders are being consulted through CREMA-led institutions in order to
163 promote restoration on community lands (Baruah et al. 2016).

164 Larger areas are essential to FLR success. The idea of “landscape governance” – the
165 social interactions and decision-making processes at a landscape level that help to solve
166 social and ecological problems - has recently been highlighted (see e.g. Görg 2007, Colfer
167 and Feintrenie 2011, van Oosten 2013). Inevitably larger areas usually have numerous
168 stakeholder groups and therefore, an increased need for collaborative institutional
169 arrangements and decision-making platforms to negotiate trade-offs. Where this is not
170 happening, the risk for poor decisions and/or opposition to restoration is greater. This is
171 particularly true for example, when restoring tree cover has implications for land ownership
172 or rights (e.g., Bruce et al. 1993, Phelps et al. 2010).

173 Modeling tools can help to support decisions related to alternative objectives within
174 landscapes (Lamb 2014), and several new tools have been developed in the last decade (e.g.,
175 IUCN and WRI 2014). Advances in geographical information systems (GIS) have enabled
176 detailed mapping of forest cover and the overlay of different scenarios (e.g., Schulz and
177 Schröder 2017). But given that societal choices are also involved, final decisions also usually
178 need to involve discussions between different groups and ground-truthing. Limiting efforts to
179 technological “fixes” may not be sufficient for effective stakeholder participation. Less
180 complex tools, such as for example three-dimensional *papier maché* models can help to bring
181 stakeholders around the table to discuss options for their landscape (e.g., Hardcastle et al.
182 2004).

183 One of the factors that most clearly distinguishes FLR from other restoration efforts is
184 the scale at which it operates, which requires a whole array of new tools and methods. Two
185 specific areas that were highlighted in 2005 as requiring further work in this context were: (i)
186 setting multiple objectives for restoration in the landscape; and (ii) working at multiple scales
187 of implementation. The landscape approach, as both an implementation and a conceptual
188 framework to tackling integrated forest, agriculture and other land use priorities, has risen in

189 importance during the last decade (e.g., Sayer et al. 2013). Within UNFCCC, a “Global
190 Landscape Forum” was launched as of 2013 in recognition of the importance of integrated
191 landscape work. Achieving acceptable outcomes for several stakeholder groups requires
192 agreement on multiple objectives and usually a degree of trade-offs. For example, in China,
193 where the government is promoting large-scale reforestation and afforestation, researchers
194 found that areas where the objectives were not only to expand tree cover but also to provide
195 incomes and food (e.g., by planting fruit trees) and to provide property rights to farmers,
196 generally had more successful restoration outcomes (Zheng and Wang 2014). Such multiple
197 objectives are critical within landscapes, where different stakeholder groups will have
198 different needs, both short term and long term (Sayer et al. 2015, Sunderland et al. 2015).

199 Given the scale, likely complexity of ownership patterns, multiple stakeholders and
200 many needs and wants, planning and implementing FLR projects will rely on excellent
201 facilitation; where the term refers to all the elements that aid implementation, particularly
202 related to finding resources and understanding what to do on a technical level. Specific issues
203 in this respect that were identified in Mansourian et al (2005) were: (i) sustainable financing;
204 (ii) capacity building and information exchange; and (iii) research. Some progress has been
205 made towards financing, although the size and security of available funds remains uncertain.
206 The UN, the GEF, the World Bank and several donor governments are active in promoting
207 the role of forests, including restoration, in addressing the climate change challenge. Funders
208 are also putting significant money into REDD+ projects, many of which are also potentially
209 aligned to FLR objectives (Stanturf et al. 2015). This renewed international attention on
210 climate and forests was stressed in the Paris Declaration at the UNFCCC Conference of
211 Parties in December 2015, which specifically mentions the role of forests. Challenges remain
212 however, to address the risk of the displacement of degradation or deforestation to other
213 countries, as seen in the past under the Clean Development Mechanism (CDM) with

214 “leakage” to other countries (e.g., Li et al. 2017). At the same time, other sources of finance
215 have started to emerge or reach greater prominence, including various payment for ecosystem
216 service schemes, such as the water funds operating in several Latin American countries and
217 now spreading further afield (Abell et al. 2017).

218 Ecological restoration has benefitted from significant research in the fields of forestry
219 and ecology (e.g., Aronson et al. 2007, Chazdon 2008, Lamb 2014). However, the human
220 dimension is far less well studied (Egan et al. 2011). Furthermore, the reduction of forest
221 carbon stocks through land use change or forest degradation is far less well known than the
222 direct impact of deforestation, even in Europe (Naudts et al. 2016). Also, the risk remains that
223 countries will set aside the complexity of implementation of FLR for meeting international
224 commitments through simple afforestation for carbon, often with exotic monocultures.

225 A final priority area identified was the need to measure changes in landscapes where
226 FLR was undertaken. Despite some attempts at developing monitoring systems for FLR,
227 effective and practical monitoring of ecosystem structure, function and composition, as well
228 as well-being aspects, remains lacking. Recent work by FAO has attempted to address this in
229 drylands (Berrahmouni et al. 2015) and CIFOR also recently produced a review of
230 participatory monitoring for forest restoration (Evans and Guariguata 2016). In practice,
231 projects however, frequently fail to integrate adequate monitoring, generally due to lack of
232 funds or capacity. Furthermore, monitoring the landscape should extend beyond the lifetime
233 of short term projects, which suggests integrating such practices in either government or local
234 institutions (or both), something which is rarely done.

235

236 **An Agenda for the Future**

237 We suggest that over the next 10 years, in addition to a general emphasis on research and
238 capacity building, a particularly strong emphasis on five key areas is needed.

239 First, implementation of real and effective landscape work is needed that brings
240 together multi-disciplinary teams to achieve multiple objectives for restoration (e.g., Schultz
241 et al. 2012). While this challenge was already identified in 2005, we see limited progress on
242 true multidisciplinary interventions, instead finding teams of foresters, ecologists,
243 development workers and social scientists all working largely in isolation from each other
244 (Wortley et al. 2013, Suding et al. 2015). Funding streams from both national governments
245 and donors tend to exacerbate these divisions, with agriculture, development or environment
246 aid, focusing on relatively narrow objectives. Stronger guidance, with real-life examples, is
247 needed to help project coordinators choose the optimal teams, identify the mixture of skills
248 necessary, and have an understanding of which local and regional institutions need to be
249 involved.

250 Second, governance as it relates to FLR continues to be a challenge in many countries
251 (Mansourian 2016). The type and quality of governance at all levels affects decision making
252 and empowerment and influences both the implementation of FLR and, importantly, its
253 sustainability. While some progress has been made with a marked recent increase in the
254 number of studies on this issue (e.g., van Oosten 2013, Guariguata and Brancalion 2014,
255 Wilson and Cagalanan 2016, Mansourian 2016), better understanding of the governance
256 environment for restoration, and of how to address specific challenges such as tenure or
257 stakeholder participation, remains a priority. Unclear or conflicting land tenure and rights
258 continue to hamper implementation of forest landscape restoration in much of the tropical
259 world. Governance frameworks recently developed in the forest sector (WRI 2009, FAO and
260 Profor 2011) provide some ideas of potential responses but these are not all specific to
261 restoration, or to landscape-scale interventions and further work is needed here.

262 Third, restoration is not just about increasing forest area, but also, importantly, about forest
263 and landscape quality. Restoration may need to move forward in a series of stages; for
264 example, first bringing back tree cover and essential services for communities, and later
265 focusing more on regaining long term natural dynamics. The role of FLR in restoring
266 degraded forest and deforested landscapes is underestimated. Degradation often occurs at the
267 scale of the landscape and therefore responses need to be planned and implemented at more
268 than site scale (Chazdon 2008). Reversing forest loss and degradation requires a common
269 understanding of what key forest qualities are, at landscape level, from an ecological and
270 social point of view (Dudley et al. 2006, Dudley 2012).

271 Competing land use is a reality in much of the tropics (Lambin and Meyfroidt 2011).
272 FLR can provide a means of improving overall landscape planning for both human and
273 ecological benefits, thereby minimizing competition with other land uses (Latawiec et al.
274 2015). The recent debate over land sparing - whereby some areas are intensely managed and
275 others kept for biodiversity conservation – and land sharing - where less intensive land use is
276 promoted and combined across the landscape – (also framed as sustainable intensification) as
277 a means of reducing the impact of agriculture on forests and biodiversity (e.g., Phalan et al.
278 2016, Phalan et al. 2011, Chandler et al. 2013, Latawiec et al. 2015) could provide new
279 opportunities for the role of FLR. In a context of land sparing, FLR can provide opportunities
280 for buffer zones, linkages and improvements in degraded areas. Equally, land sharing is an
281 option that could contribute to reducing fragmentation in the landscape for forest species and
282 support the overall landscape mosaic (e.g., by encouraging forms of agroforestry that also
283 enhance ecological benefits, such as restoring hedgerow networks to reconnect remaining
284 forest patches in the landscape).

285 Fourth, FLR is also an effective response to climate change by providing extra carbon
286 sequestration and ecosystem services (Parrotta et al. 2012, Stanturf et al. 2015), as long as

287 restoration maximizes the climate resilience of the restored forest itself (Seppälä et al. 2009).
288 Recognition of the importance of this role has grown rapidly since 2005; our book had only
289 one chapter on climate change whereas it has become absolutely central to the debate on
290 restoration in the years since. For example, large-scale restoration projects of thicket in the
291 South African Cape Floristic Region have been restoring 2000 hectares a year, with a
292 sequestration rate of 80 tons of carbon dioxide equivalent per hectare (Mills et al. 2015).
293 Forest landscape restoration has an important role to play in climate change mitigation and
294 adaptation strategies, as long as clear and multiple objectives are set, and all key stakeholders
295 are engaged in a fair way. To date many of the promised climate funds for restoration have
296 failed to materialize; ensuring that restoration remains in the mainstream of climate change
297 responses needs to be an important priority.

298 Fifth, measuring progress is necessary to learn from practice and to feed back into
299 implementation (Reed et al. 2016, Mansourian et al. 2017). This is all the more relevant when
300 multiple objectives are sought within a landscape. Further research is needed to identify
301 practical ways of measuring progress, wherever possible using methods simple enough to be
302 understood and implemented by a wide range of stakeholders. Long term monitoring is
303 required for FLR which is itself a long term process. Restoration plans should ensure that
304 they include a monitoring system that can be realistically implemented and the results of
305 which can be used in adaptive management (McDonald et al. 2016).

306

307 **Conclusion**

308 The long term nature of FLR, and restoration in general, is a particular challenge given its
309 reliance on political decisions, funding streams and implementing organizations, all of which

310 tend to have short planning and funding cycles. Embedding FLR in local practices and truly
311 engaging local stakeholders is a means to secure some continuity.

312 Forest landscape restoration is a bold idea, consciously integrating many disciplines
313 and different perspectives and thus acknowledging the need for trade-offs between competing
314 needs and wants. While the term has been widely accepted, and gained some political
315 momentum, development of the concept building on solid field experience probably requires
316 more than 15 years. Our assessment shows that some challenges already identified as
317 priorities in 2005 remain. Today, given the significant advances in both development and
318 uptake of FLR, we hope this reappraisal of 2005 challenges will help restorationists to
319 prioritize future interventions.

320

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324

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