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1                                   **Which of the plethora of tree growing projects to support?**

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8  
9   **Summary:** The vast sums of money being spent to plant trees have the potential to transform  
10   landscapes and slow global warming, but will accomplish little if trees do not survive and grow.  
11   We discuss nine key questions to decide which of the numerous tree growing projects are most  
12   likely to succeed.

13  
14   **Key-words:** climate change mitigation, forest restoration, natural climate solutions,  
15   reforestation, tree planting

16 **The promise and pitfalls of the tree planting frenzy**

17           Given the growing interest in the ecosystem services provided by trees, particularly their  
18 potential as a carbon sink, the amount of money being spent on tree planting has increased  
19 dramatically in the past few years and continues to grow rapidly. This trend is fueled by the  
20 implementation of the U.N. Decade on Ecosystem Restoration, the Bonn Challenge, and the  
21 multiple billion and trillion tree planting campaigns,<sup>1</sup> combined with the boom in investments  
22 aimed at improving environmental, social, and governance responsibility. Funders range from  
23 billionaires, such as Amazon founder Jeff Bezos who has pledged US\$2 billion to restore forests,  
24 to millions of individuals who contribute US\$10-1,000 to tree planting organizations.  
25 Increasingly both individuals and large corporations look to tree planting projects to offset their  
26 carbon emissions. For instance, Mercado Libre, a Latin American e-commerce company, raised  
27 US\$400 million in sustainable bonds in 2021 to invest in forest restoration across the region to  
28 reduce its carbon footprint, and other companies such as Microsoft, Nestlé, and Shell have  
29 followed suit.

30           These efforts to increase tree cover are largely motivated by good intentions, such as  
31 improving human livelihoods, conserving biodiversity, and enhancing water quality and supply.<sup>2</sup>  
32 Yet most projects set ambitious targets for the number of trees to plant or the area to be restored  
33 without following up to evaluate whether the projects were successful in achieving their goals,  
34 something that is inconceivable in most business supply chains. For instance, the Ethiopian  
35 government garnered a great deal of attention for planting a world record 350 million trees in a  
36 day, but there are no publicly available data on where those trees were planted or whether they  
37 survived and grew. When projects have been evaluated over time, the evidence suggests that tree  
38 planting projects have frequently failed to achieve the desired outcomes.<sup>2,3</sup> For example, costly,  
39 large-scale tree planting programs in India over the past several decades have not increased  
40 forest cover or improved peoples' livelihoods.<sup>3</sup>

41           Whereas trees can provide many benefits, poorly-planned tree planting can have  
42 numerous unintended negative consequences, such as reducing water supply when rapidly  
43 growing trees transpire large amounts of water in arid systems, destroying biodiverse grasslands  
44 and savannas, and increasing social conflicts and income inequity when trees are planted on land  
45 without including landowners in the decision-making process (Figure 1).<sup>1,4</sup> Moreover, if  
46 landholders are displaced from their land to plant trees, they may clear forest elsewhere.<sup>2</sup> The

47 risk is that tree planting projects may have net negative effects and even increase forest loss. For  
48 example, remote sensing data suggest that a Mexican government program that pays farmers to  
49 plant trees has actually incentivized many farmers to clear existing forest to create open land for  
50 tree planting.<sup>5</sup>

51 The drive to scale up tree growing efforts has led to a complex suite of actors at the  
52 global, regional, and local scales involved in funding and implementing projects.<sup>1,6</sup> Some  
53 landowners grow trees on their own lands for variety of reasons, including compliance with laws  
54 (Figure 2). The majority of funding, however, comes from governments, businesses, and  
55 individuals who support tree growing on others' land, so it critical to ensure this funding goes to  
56 the right projects to avoid negative consequences. Here, we focus on funding from either  
57 philanthropic donors or for-profit businesses who invest in tree growing and expect a return on  
58 investment (Figure 2, arrow 3), although most of our questions are relevant to other funders.<sup>6</sup>  
59 Private funders primarily support international intermediary organizations (e.g., Conservation  
60 International, World Wildlife Fund, WeForest) who select which local projects to support,  
61 although in some cases funders directly support local groups (e.g., non-governmental  
62 organizations (NGOs), communities, farmers, private companies, Figure 2) who implement the  
63 projects. For example, the NGO SOS Mata Atlântica in Brazil hires local restoration companies  
64 to establish their restoration projects, which are funded by a mix of donations, marketing  
65 payments from private companies, and biodiversity offsetting funds.

66 The deluge of funding has led to the explosion of new tree growing organizations, many  
67 of which have minimal past experience. This combined with the common lack of information  
68 regarding past project outcomes, means that the risks of investing in projects that do not succeed  
69 or that do more harm than good have never been so high. In short, funders need guidance on how  
70 to select amongst the myriad tree growing projects so their money is not wasted on failed  
71 projects, or even worse, that it has the opposite outcome of what they hope to achieve (Figure 1).

72

### 73 **Questions funders should ask**

74 Here, we discuss nine key questions that funders should ask of intermediary  
75 organizations, and that intermediary organizations in turn should use in selecting which local tree  
76 growing projects to support. These questions are based on guidance from several recent papers  
77 on how to improve tree growing efforts,<sup>1,7,8</sup> as well as our personal experience as scientists who

78 study forest restoration and advise numerous non-profit and investment groups on tree growing.  
79 Critical questions include why the funder wants to grow trees (Q1-2); whether local landowners  
80 and communities have been meaningfully engaged in the project and whether the overall benefits  
81 outweigh the risks (Q3-5); how likely the project is to achieve the stated goals over the long-term  
82 (Q6-7); and the qualifications of and funding allocation among the organizations involved in the  
83 project (Q8-9). We use the term tree “growing” rather than tree “planting” for two reasons. First,  
84 planting trees is not enough; trees need to survive and grow over decades to develop a functional  
85 forest that achieves targeted benefits. Second, trees often regenerate naturally without being  
86 planted.

87

88 **1. What do you hope to achieve by growing trees? 2. Do the proposed tree growing**  
89 **strategies match those goals?** Both funders and tree growing organizations alike often have  
90 lofty ambitions of simultaneously sequestering carbon, restoring a biodiverse forest,  
91 improving the well-being of local landholders, and more. However, there are tradeoffs  
92 among those goals and the most effective strategy to achieve each one.<sup>1</sup> For example, most  
93 projects plant one or a few species of trees that benefit landholders by producing food,  
94 timber, or firewood,<sup>9</sup> but those may not be the same species that maximize biodiversity or  
95 return-on-investment in carbon markets. Allowing forest to regenerate naturally without  
96 planting trees is often the most cost-effective strategy to recover biodiversity, yet typically  
97 does not result in the establishment of tree species that are most economically-valuable to  
98 landowners. Therefore, it is essential that project funders, intermediary organizations, and  
99 local stakeholders ensure their goals are aligned and that the selected tree growing strategies  
100 and species are consistent with those goals.<sup>1</sup>

101

102 **3. How have the initial drivers of deforestation and forest degradation been assessed and**  
103 **resolved?** The most cost-effective way to minimize carbon emissions and biodiversity loss  
104 from forests and to achieve other desired benefits of trees is to keep existing forest standing  
105 and healthy.<sup>1,7,10</sup> Deforestation is caused by a complex suite of drivers that operate at global  
106 (e.g., demand for agricultural and forest products), regional (e.g., government incentives for  
107 land conversion), and local (e.g., firewood harvesting, subsistence agriculture) scales, that  
108 vary in importance geographically.<sup>11</sup> If pressures to clear forest remain and landholders do

109 not perceive financial or other benefits to maintaining and protecting new tree cover (Q5),  
110 the land will likely be cleared or degraded again, and the investments in tree growing  
111 partially or completely wasted. Thus, it is critical that implementing groups have addressed  
112 the initial cause of forest loss and ensured that protections and/or incentives are in place to  
113 minimize the likelihood of future deforestation and degradation.

114  
115 **4. How are local stakeholders involved in the project and what benefits will they receive?**

116 Although global mapping efforts often suggest that extensive land is available for growing  
117 trees,<sup>12,13</sup> people live on and earn their income from a large portion of these lands through  
118 agricultural and pastoral activities.<sup>14</sup> As a result, the single most important factor that  
119 consistently determines project success or failure is whether local stakeholders (individuals,  
120 communities, and organizations) benefit from the project and are included meaningfully from  
121 the planning stage through the project life cycle (goal setting/visioning, planning,  
122 implementation, maintenance, monitoring, and adaptive management).<sup>1,4,7,15</sup> Ideally, projects  
123 should be led by local stakeholders and draw on local knowledge, in order to provide income  
124 for those involved in implementation and maintenance and dramatically increase the  
125 likelihood of ongoing project buy-in and success (Figure 1). If landholders depend on income  
126 from the current land use (e.g., agriculture, timber) then this income must be replaced, either  
127 through alternative job opportunities or payments for ecosystem services throughout the  
128 lifetime of the project. Otherwise, landholders are likely to clear trees, either from replanted  
129 or remnant forest, when the initial financial support for tree growing ceases (Figure 1). A  
130 large-scale forest corridor restoration project in the Pontal do Paranapanema region of Brazil  
131 provides an excellent example of how meaningful stakeholder inclusion can lead to long-  
132 term success.<sup>16</sup> The project has engaged small farmers from rural settlements, cattle ranchers,  
133 and sugarcane mills to support local livelihoods and enhance forest connectivity across the  
134 landscape.

135  
136 **5. How will potential negative consequences of the project be minimized?** Given the  
137 various, well-documented potential negative consequences of tree growing discussed  
138 previously (Figure 1) and elsewhere,<sup>2,4,8</sup> it is crucial that implementing organizations draw on  
139 lessons from past project successes and failures, and collaborate with stakeholders to

140 evaluate and minimize the potential harmful outcomes for the most vulnerable social groups,  
141 ecosystem services, or species of a given region. This information should be shared with  
142 intermediary organizations and funders. If the negative biophysical and social effects  
143 outweigh the positives, the project should not go forward.

144  
145 **6. How will the project be maintained and supported after the first few years?** The  
146 common tree planting goals of sequestering carbon and conserving biodiversity require that  
147 trees survive and grow for many years, making it critical to determine at the outset who is  
148 responsible for paying for and doing maintenance and monitoring (Q7) activities over the  
149 long-term. Whereas the “one dollar, one tree” slogan often used in online advertisements is  
150 catchy, costs vary greatly depending on the location and tree growing strategy used. In nearly  
151 all cases the actual cost is much higher to ensure that trees are maintained over time and that  
152 landowners are compensated for lost income, so the trees are not cut within a few years  
153 (Figure 1).<sup>17,18</sup> We recommend that funders ask what an organizations’ targets are for the  
154 number of trees that are alive in 3, 10, or 20 years, rather than how many trees they will  
155 plant.

156  
157 **7. How will the outcomes of the project be monitored and guide adaptive**  
158 **management?** As noted previously, information on the success or failure of tree growing  
159 efforts is often lacking. When tree survival and growth are monitored, typically it is only for  
160 one to two years<sup>18</sup> rather than long enough to determine whether project goals have been  
161 achieved (e.g., a certain amount of carbon sequestered). Rarely are other project goals  
162 monitored, such as improving water quality or local livelihoods.<sup>9</sup> Monitoring plans must be  
163 closely aligned to ensure they evaluate whether project goals have been achieved over a  
164 sufficiently long time period. Monitoring is also important to identify problems and take  
165 corrective actions to improve project success. The ambitious tree growing programs planned  
166 for the coming years will be implemented in a sequential manner with the scale of  
167 interventions increasing dramatically over time, so adaptive management approaches are  
168 important to learn from initial mistakes and increase success from a learning-by-doing  
169 process.<sup>7</sup>

171 **8. What are the outcomes of prior tree growing efforts overseen by this organization?**

172 With the global fixation on trees as a way to counteract climate change, the number of new  
173 funders, intermediary organizations, and local implementing groups is growing every week.  
174 The experience and expertise of these organizations varies greatly. Funders should look at the  
175 past track record of the intermediary and implementing organizations and how well they have  
176 addressed the prior questions. If the organization is not able to provide this information and  
177 data on the outcomes from prior projects, step back. Or start by giving them some pilot  
178 funding and assess the results. Lack of transparency and accountability is a recurring problem  
179 with current tree growing initiatives. In deciding where to spend your money, look carefully  
180 at their proposal, websites, and annual reports using the lens proposed by our key questions  
181 to draw your own conclusions. In particular, based on monitoring results, how successful has  
182 the organization been in achieving their original goals.

183  
184 **9. How will the funding be allocated across organizational scales?** Most intermediary

185 organizations are based in the global north, but select and acquire funding for tree growing  
186 projects in the global south. Whereas international intermediary organizations play a valuable  
187 role in publicizing and connecting local projects with funders and providing project  
188 management and reporting expertise, they often retain a disproportionate share of the funding  
189 and compromise the financing of those implementing and maintaining the project (Figure 1).  
190 Funders should ask for a breakdown of how money will be divided across administrative  
191 staff and those directly involved in implementing, maintaining, and monitoring the project to  
192 ensure that local stakeholders are sufficiently compensated.

193  
194 **Conclusions**

195 Investments in sustainable development are often influenced by fads, with tree growing  
196 being one of the most emblematic “must-do” activities. If tree growing programs are not planned  
197 for the long-term, the risk is high of establishing a boom and collapse cycle, with a large share of  
198 initial investments wasted on failed projects that do not achieve expected benefits. It is  
199 impossible to guarantee success, but we are confident that asking intermediary and implementing  
200 organizations to answer the questions discussed above will greatly increase the likelihood of  
201 successful outcomes. We urge tree growing organizations to provide this information in



202 proposals and on their websites. Answering these questions will require staff time, but doing so  
203 is critical to ensure the most effective use of future investments in tree growing to realize the  
204 potential to contribute to a more livable planet.

205  
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208  
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267

## Figures

### SUCCESSFUL PROJECTS



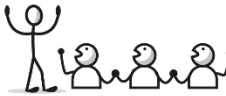
Seedlings healthy and growing



Restoration of a biodiverse forest



Enhanced carbon and water storage



Stakeholder engagement



Long-term forest protection coexisting with agro-pastoral land uses



Equitable distribution of the funding across organizational scales

### FAILED PROJECTS



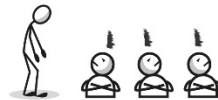
Seedlings die and resources wasted



Destruction of native grasslands



Water yield reduced



Social conflicts

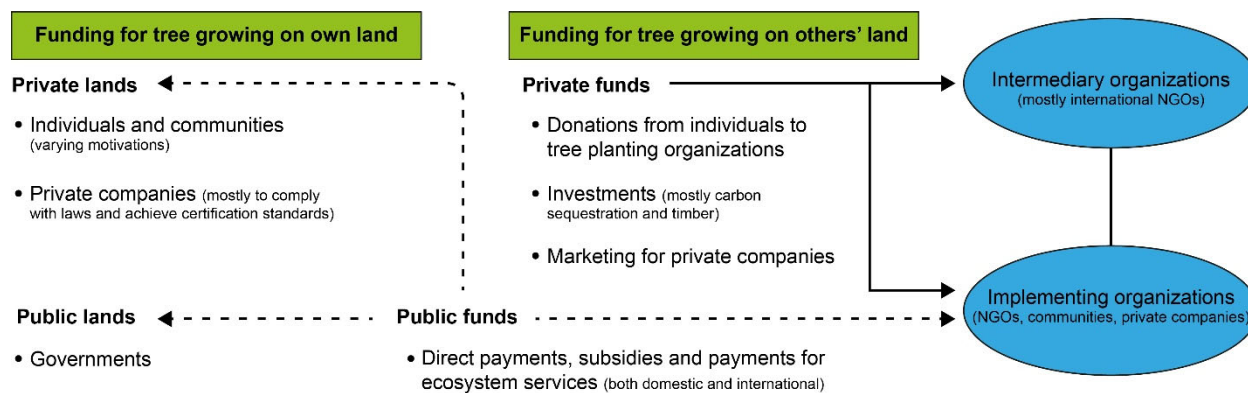


Forest reclearing for expanding agro-pastoral land uses



Disproportionate share of funding goes to intermediary organizations

**Figure 1.** Potential beneficial outcomes and unintended negative effects of tree growing, the balance of which depends on how well projects are planned, implemented, and maintained over the long-term. Figure modified from Brancalion and Holl (2020).<sup>1</sup>



**Figure 2.** Funding flows for tree growing. This paper focuses on arrow 3, the case when private funding supports tree growing on land that is not owned by the funders.