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Supporting better forest landscape restoration by making investor funding for tree planting conditional on an adequate explanation of how tree seeds and seedlings will be sourced

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> The urgency of implementing large-scale tree planting is prompting the release of funding into inadequately assessed projects that will most likely have negligible sequestration benefits and cause potential human and ecological harm.
>
> – Stevens (2020)

Massive public and private investments in tree planting are being made in attempts to sequester carbon, support human livelihoods and conserve biodiversity (Mansourian et al. 2022). As the above quote attests, however, tree planting is often done poorly. From a social perspective, the requirements of the different institutions and actors involved, including especially the needs of local communities, are not always properly considered (Edwards et al. 2021). Meanwhile, from an ecological perspective, problems include the use of an insufficient diversity of tree species, which leads to monocultures and causes environmental damage, and the reliance upon genetically unadapted and physiologically poor seeds and seedlings, which means tree establishment is low and the growth of trees is slow (Graudal et al. 2021). This unsatisfactory state of affairs is despite knowledge being available on how to do things better, but the context for improving practice is often complex, and a number of measures are needed to bridge the knowledge–action gap. Here we discuss just one of the measures that we consider to be important for improvement, which is related to the 'sourcing' of tree planting material for planting projects. We suggest that in circumstances where potential planters of trees apply for funding from investors to undertake tree planting, they should have to explain clearly the trees they intend to plant and how they are going to source the necessary seeds and seedlings of these trees. Our view, supported by a survey of the global tree planting community, is that investors should make the receipt of funds for planting conditional on an adequate explanation on these points. Our contention is that doing so will help drive better tree seed and seedling sourcing practices widely, and that this will support further tree planting investments and, ultimately, greater impact.

Current efforts to improve tree seed and seedling sourcing are insufficient

Considerable efforts have been made in the last decade to develop knowledge resources that support good planting practices during landscape restoration, and these resources include specific guidance on how to go about effective seed and seedling sourcing (see, e.g., quality criteria as defined by Pedrini & Dixon 2020, Di Sacco et al. 2021). Some of our own work has been directed towards this end. We have, for example, developed online decision-support tools that advise on what trees to plant where, why and how (Kindt et al. 2021); we have shown how these decisions can cater for climate change (Kindt et al. 2023); and we have brought together guidelines for developing 'tree seed and seedling systems' (Lillesø et al. 2018, 2021, PATSPO 2023). While these efforts are necessary for improving access to high-quality tree planting material, they are clearly not in themselves sufficient, as most tree planting initiatives in their reporting continue to focus on the 'quantity' of trees planted rather than their 'quality', and the lack of planting of a diversity of well-adapted populations of native tree species in particular has been noted (Graudal et al. 2021). What, then, is still going wrong in the tree seed and seedling sourcing process? And how might current problems be addressed?

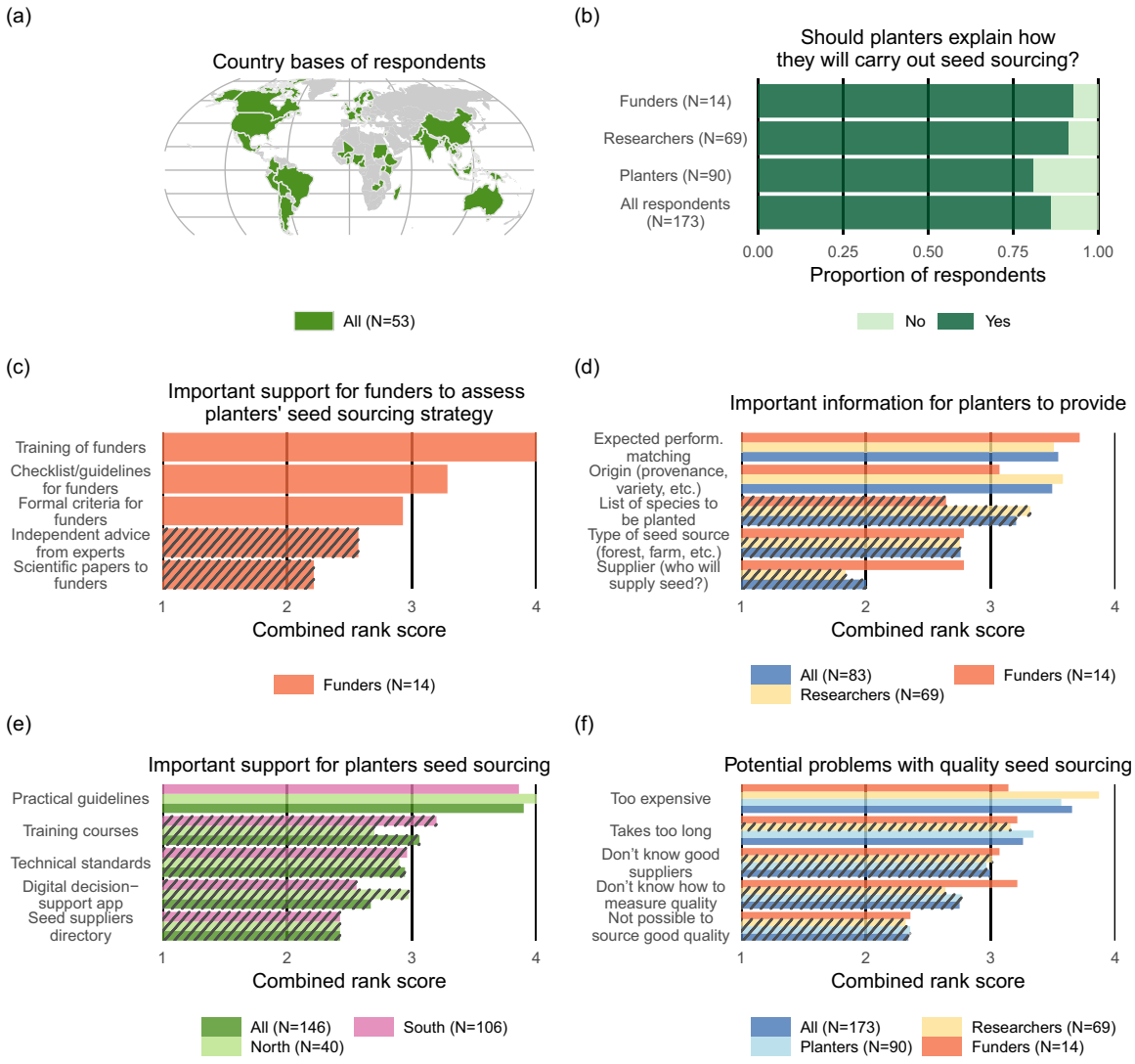

Figure 1. Results of a survey of the global tree planting community to explore attitudes to integrating mandatory questions on tree seed and seedling sourcing ('tree seed and seedling' abbreviated to 'tree seed' in this legend and figure) in tree planting project funding application templates. In the survey, each respondent was asked to self-identify as either a 'funder', 'researcher' or 'planter'. (a) Country bases of survey respondents. (b) Views of respondents on whether it is good in principle for prospective planters to be required to explain how they will carry out tree seed sourcing when they apply for funds to support tree planting. (c) The most important form of support needed by 'funders' to assess funding applicants' tree seed sourcing approach. (d) The most important information needed for 'funders' from prospective planters to assess whether a given tree seed sourcing approach would result in high-quality tree seed. (e) The most useful form of support to prospective tree 'planters' to help them develop a high-quality tree seed sourcing approach, considering all survey respondents combined and divided into whether the respondents work in the Global South or the Global North. (f) The perceived greatest potential problem in placing emphasis on high-quality tree seed sourcing in planting project funding application templates. The graphs in (c)–(f) are based on the ranking of five possible response options. Ranking results were converted into rank scores, where the top-ranked option had the highest score. To assess the statistical significance of the difference in ranking between response options for any particular respondent category, rank responses were modelled using the *PlackettLuce* package (version 0.4.0; https://cran.r-project.org/package=PlackettLuce) in the *R* statistical environment (version 4.0.2; https://www.R-project.org/). Whether the first-ranked option was ranked significantly higher than each of the four other options was estimated. Hatching indicates that the ranking is significantly different at $p < 0.05$. Note that in the case of 'funders' the statistical power for testing differences is limited by the small sample size of this category of respondent. Also note that in (e) the pool of respondents that could be analysed was a subset of the entire respondent set, because only respondents whose work was based either in the Global South or in the Global North were considered; respondents whose work was carried out in both zones were excluded. For interested readers, a full description of the methods of the survey and its findings are provided in Carsan et al. (2021).

An explanation of tree seed and seedling sourcing should be a fundamental element of tree planting project design

In our view, one of the persistent reasons why a diversity of tree species and genotypes well matched to planting sites is not used in tree planting is that public and private investors that fund planting do not provide sufficient incentives to planters to engage in better tree seed and seedling sourcing practices. To improve this situation, investors could target incentives to a number of points in the tree planting process, but in our opinion an obvious opportunity, not yet fully leveraged, is to incentivise good tree seed and seedling sourcing at the initial project proposal design stage. In cases where potential planters of trees apply for funding from investors through a project proposal application form, investors could ask for information in this form on how prospective tree planters are going to go about sourcing the tree seeds and seedlings that they are intending to plant, assuming that they are successful in achieving funding. A sufficient explanation would be a 'green light' to proceed through this step of the proposal evaluation (to move on to consider the merits or otherwise of the rest of the proposal), while an inadequate description would be a 'red light'

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that would preclude project funding or at least lead to further dialogue between the investor and the funding applicant on the sourcing process.

We initially discussed with relevant stakeholders whether this approach to condition tree planting funding would be implementable during a 2020 Global Landscapes Forum online event hosted by CIFOR-ICRAF called 'Can Tree Planting Save Our Planet?' (https://www.globallandscapesforum.org/publication/event-report-digital-forum-can-tree-planting-save-our-planet/). Based on initial positive indications from this event, we followed up with an online survey of the views of the global tree planting community. Some of our findings, published here formally for the first time, are provided in Fig. 1. In total, 173 respondents from 53 different nations completed our survey (Fig. 1a), of which 14 self-identified as 'funders' of tree planting, 69 as 'researchers' and 90 as 'planters'. Of these respondents, a substantial majority (>80%) considered it good in principle for planters to have to explain how they will carry out tree seed and seedling sourcing when they apply for funds to carry out tree planting (Fig. 1b). When 'funder' respondents were asked what support they would need to evaluate the sourcing approaches provided by prospective planters, they ranked training in what constitutes good sourcing practice, in specific circumstances, as most important (from among five possible response options; see Fig. 1c). In order to be able to effectively assess sourcing approaches, 'funder' and 'researcher' respondents ranked expected tree performance and/or expected matching to planting site (these together constituted a single possible response option) as the most important information on sourcing that prospective planters should provide (Fig. 1d). Survey respondents ranked practical guidelines on how to source tree seeds as the most useful support that could be provided to planting funding applicants to enable them to develop high-quality sourcing approaches (Fig. 1e). The most important 'downside' of asking funding applicants to focus on higher-quality tree seed and seedling sourcing was indicated by survey respondents to be the higher cost of such provision (Fig. 1f).

Moving forward to practice

The findings of our survey supported our initial view that asking prospective tree planters about how they plan to source tree seeds and seedlings in planting funding applications provides a potential pathway to improve tree seed and seedling sourcing for planting programmes. This should, by extension, provide an opportunity to increase the overall effectiveness of tree planting, so that the local custodians of trees in landscapes, who suffer most when tree seed and seedling sourcing is done poorly (Cernansky 2021), receive the greatest possible benefits. We therefore recommend that it should in general be mandatory for prospective planters to include planting material sourcing information in the initial funding application process.

Our survey also revealed important messages that need to be communicated to prospective tree planters when they are designing their tree seed and seedling sourcing approaches to be able to complete the proposed revised funding application template. Survey respondents indicated the increased cost of high-quality sourcing as a concern, so it is important to stress the great gains for livelihoods and the environment that can be achieved when more attention is given to sourcing; these gains are generally far greater than any extra costs involved (Pedercini et al. 2022).

Turning our concept into action will not be straightforward. It will require close work with tree planting investors whose funding application templates will need to be redesigned, as well as the training of funders in the evaluation of tree seed and seedling sourcing approaches, considering known problems and potential solutions in tree seed and seedling supply (Lillesø et al. 2021). To facilitate implementation of the approach, we suggest building a partnership platform between investors, planters and researchers to specifically monitor the costs involved and the benefits achieved for a series of case studies. We are currently working to this end.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/S0376892923000188

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Competing interests. The authors declare none.

Ethical standards. None.

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